Freight Rail Improvements – Oklahoma City to Shawnee
TIGER Grant Application

Benefit Cost Analysis Technical Memo

October 2009

Introduction

The formal benefit cost analysis has been conducted using best practices for benefit cost analysis in transportation planning, and reflects all TIGER grant application guidelines. It is important to note that a formal benefit cost analysis is not a comprehensive measure of a project's total economic impact, as many benefits cannot be readily quantified and occur under conditions of uncertainty. The broader set of long term economic benefits and impacts on local and regional economic well being and competitiveness are described in the TIGER grant application.

However, to the maximum extent possible given available data, the formal benefit cost analysis prepared in connection with this TIGER grant application, and reported below, reflects quantifiable economic benefits in all five major long term impact areas identified in the TIGER grant application guidelines. These include:

- State of Good Repair – accomplishment of the urgently-needed improvements to the track, track-bed, and eroded river banks will allow substantial reductions in train hours, operating costs, and maintenance of track and right of way. Life-cycle costs will be reduced; these will include reduced delays, slow orders, derailments, and temporary closures for emergency repairs and during summer temperature conditions.
- Long Term Economic Competitiveness – reducing rail freight rail delays and the higher costs associated with diversion of freight from rail to trucks will allow industries and agricultural enterprises to reduce transportation costs, improve their logistics practices, and expand markets for both domestic and international shipments. This will help retain and create permanent jobs and improve the competitive position of domestic manufacturers and agricultural enterprises.
- Sustainability – reducing emissions by making rail more efficient and avoiding diversion of freight from rail to truck will enhance sustainability in the region, and reduce Greenhouse Gas Emissions.
- Livability – the corridor generally and the city of Shawnee in particular will benefit greatly from less delay-prone freight rail operation, and from the avoidance of noise, accident, and health effects of truck traffic that would result from rail closure.
- Safety – avoiding increased truck traffic in the Oklahoma City – Shawnee corridor, which will result from freight rail discontinuation that will result if the project is not carried out, will yield measurable safety benefits in terms of reduced fatalities and other accidents.

Given the caveats above, the computed benefit-cost ratio for the Shawnee freight rail project, described in detail in the *Benefit-Cost Results* section of this report, is 4.5, calculated using a discount rate of seven percent, and 6.4 at a discount rate of three percent.

A Note on the Discount Rates

As required by the Federal Register guidelines for TIGER grant applications, a seven percent discount rate has been applied uniformly to all project costs and benefits to arrive at the discounted benefit cost ratio and net present value. As an alternative, and again in keeping with the Federal Register guidelines, benefits and costs have also been valued using a three percent discount rate. Sources for these rates are OMB circulars A-4 and A-94, where seven percent is represented as the average expected return on private capital and three percent represents the social rate of time preference. The higher rate is intended to provide a private sector investment benchmark for assessing government projects, while the lower rate is an estimate of the social rate of time preference for households and individuals. The former might be more appropriately applied to benefit streams that accrue to private firms, while the latter might be more appropriately applied to long term benefits that accrue strictly to current households and subsequent generations, and even more particularly where these benefits accrue to lower income households for whom long term wealth accumulation or future social benefits will be more highly valued.

No specific attempt has been made in the benefit cost analysis presented in this application to apply different discount rates to different benefit or cost streams. However, as projects will typically benefit a mixture of private and public stakeholders, as well as different income or social groups, the B/C ratios would undoubtedly fall somewhere between those computed at seven percent and three percent had this been done.

The Project and the Alternative (No Build)

The project consists of rehabilitation of the track, active warning devices and subgrade of the A-OK Shawnee line to support operating speeds up to 25 miles per hour. Also included are track and crossing improvements on a BNSF track extending to the north of Shawnee from the eastern end of the A-OK Shawnee line.

The track between Oklahoma City and Shawnee has deteriorated to Exempted Class, which by regulation may only operate at a maximum speed of 10 MPH. Poor track conditions lead to higher operating costs and slimmer margins of net revenue available to correct the situation. A flood event could easily undermine the trackbed at more than one location and render reconstruction beyond the financial means of the line. In this case, the line would be embargoed and rail service to A-OK and BNSF customers in Shawnee and between Oklahoma City and Shawnee would cease.

Consequently it is concluded in this analysis of benefits and costs that withdrawal of freight rail service is imminent. In the “No Build” scenario (absence of the project), freight service in the corridor served by the current rail operations is assumed to cease within two years, to be replaced by truck freight service during the remaining 20 years of the analysis period. The products shipped by the A-OK and BNSF customers are commodities requiring single-mode origin-to-destination service. As a result, the change from rail to truck would apply to the entire origin-to-destination length of the shipments. Based on information provided by specific Shawnee-area customers, the national average trip length for car-load freight is adopted as applicable to this analysis.

Cessation of service is assumed not to affect the automotive train service provided by A-OK. This service occurs within the western portion of the A-OK and would not be affected by a flood event closing the line. This service can be maintained with or without the rehabilitation project

Benefits of the Project

The primary direct benefits of the project result from avoidance of the loss of freight rail service currently provided by the A-OK in the Oklahoma City – Shawnee corridor, including the access it provides to the nine-mile BNSF line extending northward from Shawnee. BNSF access to their line is dependent on trackage rights over the A-OK from Oklahoma City. In the absence of freight rail service, customers in and near Shawnee would be forced to discontinue or relocate their businesses, or rely instead on freight movement by truck. This transfer from rail to truck would have a number of quantifiable economic costs, affecting freight customers and the area population at large. Based upon currently available data, the initial magnitude of this transfer of freight movement from rail to truck would be as described in **Table 1**. The A-OK has identified market growth over the next five years for specific customers, raising total annual freight cars per year from the current level, 1,927 to 2,892 (both excluding the automotive business close to Oklahoma City). In the table, allowance is made for delay in realizing that growth, because of the current track condition and the period of construction; the identified growth is shown to have occurred by the year 2015, six years from the present and three years after completion of construction.

Table 1: Rail Freight Movement, Oklahoma City – Shawnee Area

Annual Data	2012	2015	2029
Freight Cars per Year	1,927	2,892	3,816
Typical Freight Tons per Car	90	90	90
Freight Tons Carried per Year	173,430	260,280	343,434
Typical Miles Hauled	538	538	538
Freight Ton Miles per Year	93,305,340	140,030,640	184,767,456
Typical Freight Tons per Truck	21	21	21
Truck Trips Required if No Rail	8,259	12,394	16,354
Truck Miles (VMT) if No Rail	4,443,111	6,668,126	8,798,450

Source: Compiled from A-OK and BNSF Customer Data and AASHTO statistics
Note: Rail freight data unless otherwise specified.

Although the project is compared with replacement of rail freight service with truck freight in the analysis of benefits and costs, the project will in fact bring immediate benefits to rail freight operations and customers. Railroad operating costs will benefit from reduced train hours as a result of higher operating speeds. Rail freight customers will benefit from improved predictability of rail car deliveries, which at present are subject to significant delays as a result of excessive train travel times, which sometimes prevent completion of operations as scheduled. This is a problem especially during summer months, when high temperatures cause track deformation with consequent slow orders and line closing.

Economic benefits of the project have been estimated at year 2009 price levels. The benefits include:

(1) Fuel savings, quantified

Failure to implement the project is assumed to result in withdrawal of rail service after two years, as noted in the introduction to this Section. The No Build scenario would result in all freight otherwise shipped by rail having to be shipped by truck. The consequent increase in trucking will result in greater use of motor fuels, because of the relative inefficiency of diesel or gasoline-fueled trucks compared with diesel-electric rail locomotives.

Assuming all trucks would be diesel-fueled, the excess fuel use if the current level of rail freight service were to be withdrawn would be 653 thousand gallons in 2012, growing to 1.293 million gallons in the year 2029. The value associated with these fuel cost savings has been accounted for in the corresponding shipping cost estimates, which are summarized for selected years in **Table 4** later in this report.

(2) Customer (Shipper) cost savings, quantified

The project will result in small reductions in rail Operating & Maintenance (O&M) costs, which are not assumed to be passed on to customers. Because failure to implement the project will result in withdrawal of rail service within the project area after an assumed two years, the No Build alternative would result in freight otherwise shipped by rail having to be shipped by truck. Trucking is more expensive than shipping by rail; benefits accrue to customers as a result of lower shipping costs via rail. The project, by preserving and improving rail freight service, would save customers an estimated value of $9.7 million in 2012, compared with the cost of shipping by truck. This amount is projected to grow to $14.5 million annually by 2015 and to $18.9 million annually by 2029.

(3) Greenhouse gas emissions (reduced), quantified

The increase in trucking in the No Build alternative will result in increased emissions of greenhouse gases. Diesel or gasoline-fueled trucks are relatively inefficient compared with diesel-electric locomotives and the lower energy per ton-mile required when moving freight via rail. Greenhouse gas (measured by CO_2) reductions are projected to be 26.7 thousand tons in 2012, rising to 52.8 thousand tons by 2029. The benefit at $7.00 per metric ton grows from $187 thousand to $370 thousand per year, between 2012 and 2029.

(4) Public health benefits

As discussed, the No Build alternative would see all freight otherwise shipped by rail having to be shipped by truck. The consequent increase in trucking will have an adverse effect on air quality within the corridor, and may also result in localized noise increases. The economic benefit of air quality improvements (measured by HC, NOx, and PM10) of the project gradually declines from $174 thousand in 2012 to $12 thousand in 2029, as more stringent regulations result in cleaner diesel exhaust**.**

(5) Other costs and benefits related to vehicle miles of travel

The project will result in road traffic vehicle-miles-of travel (VMT) reductions as compared to the No Build alternative. There would be consequent savings in road maintenance and operating costs that would result from avoided road deterioration. Also, there would be improved traffic safety, producing reduced accident costs. Road maintenance expenditures anticipated to be eliminated by the project amount to $1.2 million in 2012 and $2.3 million by 2029. Accident costs are projected to be reduced by $2.9 million in 2012 and $5.8 million in 2029, assuming no changes in accident rates over this period.

Costs of the Project

The project entails the design and construction of capital improvements including river bank stabilization, track reconstruction, and rail-highway grade crossing improvements. Track reconstruction and rail-highway grade crossing improvements are included for both the A-OK and BNSF portions of the project.

Capital Costs

These costs include not only construction costs, but also design and project management costs. The estimated cost of the first phase of the project, including design and construction, is $32,105,949. Construction would be initiated in the second quarter of 2010 and would be completed in 2011, with approximately $20.8 million expended in 2010, and $11.3 million in 2011. The drawdown of funds is tabulated in **Table 2**.

Table 2: Capital Cost Drawdown Schedule

Capital Cost	Totals	Quarters, 2010				Quarters, 2011			
		1	2	3	4	1	2	3	4
River Bank Restoration MP447.8 to MP483.0	$ 8,487,625		50% $ 4,243,813	50% $ 4,243,813					
Crosstie Renewals	$ 9,615,375		50% $ 4,807,688	50% $ 4,807,688					
Rebuild 12 Grade Crossings	$ 446,850						100% $ 446,850		
Rebuild Canadian River Approach Spans BR 455.33	$ 538,250						100% $ 538,250		
Repair 457.54 and 478.91 Bridges	$ 640,500						100% $ 640,500		
QUARTERLY EXPENDITURES			$ 9,051,500	$ 9,051,500	$ -	$ -	$ 1,625,600	$ -	$ -
Contingency	15%		$ 1,357,725	$ 1,357,725	$ -	$ -	$ 243,840	$ -	$ -
QUARTERLY TOTALS	$ 22,687,890		$ 10,409,225	$ 10,409,225	$ -	$ -	$ 1,869,440	$ -	$ -
Additional Grade Crossings Improvements	$ 5,452,000						$ 5,452,000		
BNSF Improvements							$ 3,966,059		
		2010				2011			
SHAWNEE PROJECT TOTAL	$ 32,105,949	$ 20,818,450				$ 11,287,499			

Benefit-Cost Results

The analysis of benefits and costs finds that the Net Present Value (NPV) of the project benefits is:

$130.5 million at a seven percent discount rate

$198.5 million at a three percent discount rate.

These benefits compare with present values of the project cost, which are:

$29.3 million at a seven percent discount rate

$30.9 million at a three percent discount rates

The resulting Benefit/Cost (B/C) ratio is:

$130.5 M/$29.3M or 4.5 at the seven percent discount rate, and

$198.5M/$30.9M or 6.4 at the three percent discount rate.

In either case, benefits will exceed costs within six years.

Table 3 provides the basic factors and unit costs used in the analysis, which compares the cost of freight shipment by truck, if the project is not built, with the cost of freight shipment by rail upon completion of reconstruction of the line.

Cost/Benefit Summary

Table 4 summarizes the costs and the quantifiable benefits of the project that are discussed above. The table shows estimates for years 2010, 2012, 2015, and 2029, and the project's net present value and benefit/cost ratio, using both the three percent and the seven percent discount rates suggested in the TIGER guidance. Table 5 provides the entire 20-year forecast, for the years 2010-2029.

Other Non-Quantifiable Benefits

The true measure of all of this project's benefits is not summarized in the table, as many benefits cannot readily be quantified. The regional economic benefit in terms of population and employment growth resulting from having a fully operational railroad link between Oklahoma City and Shawnee and vicinity will include support for growth of existing rail freight customers' businesses as well as attraction of additional companies to be started or to relocate to the area. The consequences to the community at large will be major and enduring.

Table 3: Factors for Calculation of Economic Costs

Performance or Cost Item	Value 2010	Value 2020	Units or Rates 2020 values continue through 2029	Unit Cost	Units
Average tons per rail car	90	90	tons (typical value)		
Average tons per truck	21	21	tons (AASHTO)		
Average origin-destination length of haul	538	538	miles (AASHTO national avg. value, car-load freight, yr. 2000)		
Average shipper cost per ton-mile, rail	$ 0.024	$ 0.024	AASHTO report		
Average shipper cost per ton-mile, truck	$ 0.080	$ 0.080	AASHTO report		
Average ton miles per gallon diesel, rail	396	396	AASHTO report		
Average ton miles per gallon diesel, truck	105	105	assumption, PB		
Rail air pollutants, HC	9.20	8.00	grams per locomotive mile (linear change, 2010-2020)	$ 0.0017	per gram
Rail air pollutants, CO	27.40	27.40	grams per locomotive mile	$ -	per gram
Rail air pollutants, NOx	163.70	140.80	grams per locomotive mile (linear change, 2010-2020)	$ 0.0040	per gram
Rail air pollutants, PM10	5.70	4.90	grams per locomotive mile (linear change, 2010-2020)	$ 0.1680	per gram
Ton miles per rail locomotive mile	3,600	3,600	assumption		
Rail CO2 emissions	0.024	0.024	kg per freight ton-mile	$ 0.0070	per kg
Truck air pollutants, VOC	0.28	0.20	grams per truck mile (linear change, 2010-2020)	$ 0.0017	per gram
Truck air pollutants, CO	1.14	0.25	grams per truck mile (linear change, 2010-2020)	$ -	per gram
Truck air pollutants, NOx	8.38	1.28	grams per truck mile (linear change, 2010-2020)	$ 0.0040	per gram
Truck air pollutants, PM10	0.17	0.07	grams per truck mile (linear change, 2010-2020)	$ 0.1680	per gram
Truck CO2 emissions	0.310	0.310	kg per freight ton-mile	$ 0.0070	per kg
Rail accident costs per train mile	$ 6.570	$ 6.570	derived from AAR and FRA data and TIGER guidelines		
Highway accident cost per truck mile	$ 0.700	$ 0.700	derived from FHWA (USDOT) data and TIGER guidelines		
Highway maintenance cost per truck mile	$ 0.265	$ 0.265			
Rail freight growth rate after year 2014	2%	2%	growth rate - approx. nat'l avg. (AASHTO) for carload freight		

AASHTO source is "Transportation - Invest in America: Freight-Rail Bottom Line Report"

Table 4: Summary Economic Forecast, Selected Years

Present Values			20-year evaluation, selected years only			
at 7%	at 3%		2010	2012	2015	2029
		RAIL, Build Scenario				
$ 34,546,759	$ 50,699,988	Shipper cost, estimated total	$ 2,239,328	$ 2,239,328	$ 3,360,735	$ 4,434,419
$ 241,827	$ 354,900	Greenhouse gas emissions (CO2)	$ 15,675	$ 15,675	$ 23,525	$ 31,041
$ 589,205	$ 855,978	Public health (air quality measures)	$ 42,196	$ 41,014	$ 58,891	$ 71,854
$ 2,626,993	$ 3,855,312	Accidents	$ 170,282	$ 170,282	$ 255,556	$ 337,201
$ -	$ -	Highway maintenance cost (null case)	$ -	$ -	$ -	$ -
$ 38,004,784	**$ 55,766,177**	**Total Economic Cost, Rail**	**$ 2,467,481**	**$ 2,466,299**	**$ 3,698,708**	**$ 4,874,514**
		TRUCK (Rail in 2010 & 2011), No Build Scenario				
$ 105,708,790	$ 159,001,891	Shipper cost, estimated total	$ 2,239,328	$ 7,464,427	$ 11,202,451	$ 14,781,396
$ 2,785,870	$ 4,226,693	Greenhouse gas emissions (CO2)	$ 15,675	$ 202,473	$ 303,866	$ 400,945
$ 1,353,801	$ 1,820,762	Public health (air quality measures)	$ 42,196	$ 1,994	$ 2,721	$ 2,991
$ 42,666,225	$ 64,791,248	Accidents	$ 170,282	$ -	$ -	$ -
$ 16,035,662	$ 24,404,766	Highway maintenance cost (null case)	$ -	$ 207,810	$ 216,431	$ 75,681
$ 168,550,347	**$ 254,245,359**	**Total Economic Cost, Truck**	**$ 2,467,481**	**$ 12,169,429**	**$ 18,166,413**	**$ 23,756,436**
		COST SAVINGS (Economic Benefit, No Build minus Build)				
$ 71,162,030	$ 108,301,903	Shipper cost, estimated total	$ -	$ 5,225,099	$ 7,841,716	$ 10,346,978
$ 2,544,043	$ 3,871,793	Greenhouse gas emissions (CO2)	$ -	$ 186,797	$ 280,341	$ 369,904
$ 764,597	$ 964,784	Public health (air quality measures)	$ -	$ (39,020)	$ (56,171)	$ (68,863)
$ 40,039,232	$ 60,935,937	Accidents	$ -	$ (170,282)	$ (255,556)	$ (337,201)
$ 16,035,662	$ 24,404,766	Highway maintenance cost (null case)	$ -	$ 207,810	$ 216,431	$ 75,681
$ 130,545,563	**$ 198,479,182**	**Benefit of the Project (Truck minus Rail)**	**$ -**	**$ 9,703,129**	**$ 14,467,706**	**$ 18,881,921**
$ 29,315,434	**$ 30,851,638**	**PROJECT COST (2011 not shown)**	**$ 20,818,450**			
4.45	**6.43**	**B/C Ratio**				
$ 101,230,129	**$ 167,627,544**	**Net Present Value of Project**				
6	**6**	**Years to Break-Even**				

Table 5: Annual Economic Costs, Present Values, Project Net Present Values, and Benefit/Cost Ratios

Present Values			20-year evaluation																			
at 7%	at 3%		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
		RAIL																				
		Annual rail cars hauled	1,927	1,927	1,927	2,249	2,571	2,892	2,950	3,009	3,069	3,130	3,193	3,257	3,322	3,388	3,456	3,525	3,596	3,668	3,741	3,816
		Annual commodity tons carried	173,430	173,430	173,430	202,410	231,390	260,280	265,486	270,795	276,211	281,735	287,370	293,118	298,980	304,960	311,059	317,280	323,625	330,098	336,700	343,434
		Annual ton-miles carried	93,305,340	93,305,340	93,305,340	108,896,580	124,487,820	140,030,640	142,831,253	145,687,878	148,601,635	151,573,668	154,605,141	157,697,244	160,851,189	164,068,213	167,349,577	170,696,569	174,110,500	177,592,710	181,144,564	184,767,456
		Fuel consumed	235,620	235,620	235,620	274,991	314,363	353,613	360,685	367,899	375,257	382,762	390,417	398,225	406,190	414,314	422,600	431,052	439,673	448,466	457,436	466,584
		Locomotive miles	25,918	25,918	25,918	30,249	34,580	38,897	39,675	40,469	41,278	42,104	42,946	43,805	44,681	45,575	46,486	47,416	48,364	49,331	50,318	51,324
$ 34,546,759	$ 50,699,988	Shipper cost	$ 2,239,328	$ 2,239,328	$ 2,239,328	$ 2,613,518	$ 2,987,708	$ 3,360,735	$ 3,427,950	$ 3,496,509	$ 3,566,439	$ 3,637,768	$ 3,710,523	$ 3,784,734	$ 3,860,429	$ 3,937,637	$ 4,016,390	$ 4,096,718	$ 4,178,652	$ 4,262,225	$ 4,347,470	$ 4,434,419
$ 241,827	$ 354,900	Cost, CO2	$ 15,675	$ 15,675	$ 15,675	$ 18,295	$ 20,914	$ 23,525	$ 23,996	$ 24,476	$ 24,965	$ 25,464	$ 25,974	$ 26,493	$ 27,023	$ 27,563	$ 28,115	$ 28,677	$ 29,251	$ 29,836	$ 30,432	$ 31,041
$ 5,701	$ 8,289	Cost, HC	$ 405	$ 400	$ 395	$ 455	$ 513	$ 569	$ 572	$ 575	$ 578	$ 581	$ 584	$ 596	$ 608	$ 620	$ 632	$ 645	$ 658	$ 671	$ 684	$ 698
$ -	$ -	Cost, CO	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 237,011	$ 344,327	Cost, NOx	$ 16,971	$ 16,734	$ 16,496	$ 18,976	$ 21,376	$ 23,689	$ 23,799	$ 23,904	$ 24,004	$ 24,099	$ 24,187	$ 24,671	$ 25,164	$ 25,668	$ 26,181	$ 26,705	$ 27,239	$ 27,783	$ 28,339	$ 28,906
$ 346,493	$ 503,362	Cost PM10	$ 24,819	$ 24,471	$ 24,123	$ 27,747	$ 31,255	$ 34,634	$ 34,794	$ 34,946	$ 35,090	$ 35,226	$ 35,353	$ 36,060	$ 36,781	$ 37,517	$ 38,267	$ 39,033	$ 39,813	$ 40,610	$ 41,422	$ 42,250
$ 2,626,993	$ 3,855,312	Cost, accidents	$ 170,282	$ 170,282	$ 170,282	$ 198,736	$ 227,190	$ 255,556	$ 260,667	$ 265,880	$ 271,198	$ 276,622	$ 282,154	$ 287,797	$ 293,553	$ 299,424	$ 305,413	$ 311,521	$ 317,752	$ 324,107	$ 330,589	$ 337,201
$ 38,004,784	**$ 55,766,177**	**Total Economic Cost, Rail**	**$ 2,467,481**	**$ 2,466,890**	**$ 2,466,299**	**$ 2,877,726**	**$ 3,288,955**	**$ 3,698,708**	**$ 3,771,777**	**$ 3,846,290**	**$ 3,922,274**	**$ 3,999,760**	**$ 4,078,776**	**$ 4,160,351**	**$ 4,243,558**	**$ 4,328,429**	**$ 4,414,998**	**$ 4,503,298**	**$ 4,593,364**	**$ 4,685,231**	**$ 4,778,936**	**$ 4,874,514**
		TRUCK (RAIL IN 2010 AND 2011)																				
		Annual commodity tons carried	173,430	173,430	173,430	202,410	231,390	260,280	265,486	270,795	276,211	281,735	287,370	293,118	298,980	304,960	311,059	317,280	323,625	330,098	336,700	343,434
		Annual ton-miles carried	93,305,340	93,305,340	93,305,340	108,896,580	124,487,820	140,030,640	142,831,253	145,687,878	148,601,635	151,573,668	154,605,141	157,697,244	160,851,189	164,068,213	167,349,577	170,696,569	174,110,500	177,592,710	181,144,564	184,767,456
		Annual truck trips			8,259	9,639	11,019	12,394	12,642	12,895	13,153	13,416	13,684	13,958	14,237	14,522	14,812	15,109	15,411	15,719	16,033	16,354
		Annual truck vehicle miles			4,443,111	5,185,551	5,927,991	6,668,126	6,801,488	6,937,518	7,076,268	7,217,794	7,362,150	7,509,393	7,659,580	7,812,772	7,969,027	8,128,408	8,290,976	8,456,796	8,625,932	8,798,450
		Fuel consumed	235,620	235,620	888,622	1,037,110	1,185,598	1,333,625	1,360,298	1,387,504	1,415,254	1,443,559	1,472,430	1,501,879	1,531,916	1,562,554	1,593,805	1,625,682	1,658,195	1,691,359	1,725,186	1,759,690
$ 105,708,790	$ 159,001,891	Shipper cost	$ 2,239,328	$ 2,239,328	$ 7,464,427	$ 8,711,726	$ 9,959,026	$ 11,202,451	$ 11,426,500	$ 11,655,030	$ 11,888,131	$ 12,125,893	$ 12,368,411	$ 12,615,780	$ 12,868,095	$ 13,125,457	$ 13,387,966	$ 13,655,726	$ 13,928,840	$ 14,207,417	$ 14,491,565	$ 14,781,396
$ 2,785,870	$ 4,226,693	Cost, CO2	$ 15,675	$ 15,675	$ 202,473	$ 236,306	$ 270,139	$ 303,866	$ 309,944	$ 316,143	$ 322,466	$ 328,915	$ 335,493	$ 342,203	$ 349,047	$ 356,028	$ 363,149	$ 370,412	$ 377,820	$ 385,376	$ 393,084	$ 400,945
$ 23,270	$ 34,505	Cost, VOC	$ 405	$ 400	$ 1,994	$ 2,257	$ 2,499	$ 2,721	$ 2,683	$ 2,642	$ 2,598	$ 2,552	$ 2,503	$ 2,553	$ 2,604	$ 2,656	$ 2,709	$ 2,764	$ 2,819	$ 2,875	$ 2,933	$ 2,991
$ -	$ -	Cost, CO	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 1,241,397	$ 1,674,396	Cost, NOx	$ 16,971	$ 16,734	$ 207,810	$ 217,793	$ 220,692	$ 216,431	$ 188,309	$ 158,975	$ 128,392	$ 96,522	$ 63,326	$ 64,593	$ 65,885	$ 67,202	$ 68,546	$ 69,917	$ 71,316	$ 72,742	$ 74,197	$ 75,681
$ 89,134	$ 111,860	Cost PM10	$ 24,819	$ 24,471	$ 5,123	$ 5,594	$ 5,954	$ 6,203	$ 5,821	$ 5,423	$ 5,006	$ 4,570	$ 4,114	$ 4,197	$ 4,281	$ 4,366	$ 4,454	$ 4,543	$ 4,634	$ 4,726	$ 4,821	$ 4,917
$ 42,666,225	$ 64,791,248	Cost, accidents	$ 170,282	$ 170,282	$ 3,110,178	$ 3,629,886	$ 4,149,594	$ 4,667,688	$ 4,761,042	$ 4,856,263	$ 4,953,388	$ 5,052,456	$ 5,153,505	$ 5,256,575	$ 5,361,706	$ 5,468,940	$ 5,578,319	$ 5,689,886	$ 5,803,683	$ 5,919,757	$ 6,038,152	$ 6,158,915
$ 16,035,662	$ 24,404,766	Highway maintenance cost	$ -	$ -	$ 1,177,425	$ 1,374,171	$ 1,570,918	$ 1,767,053	$ 1,802,394	$ 1,838,442	$ 1,875,211	$ 1,912,715	$ 1,950,970	$ 1,989,989	$ 2,029,789	$ 2,070,385	$ 2,111,792	$ 2,154,028	$ 2,197,109	$ 2,241,051	$ 2,285,872	$ 2,331,589
$ 168,550,347	**$ 254,245,359**	**Total Economic Cost, Truck**	**$ 2,467,481**	**$ 2,466,890**	**$ 12,169,429**	**$ 14,177,733**	**$ 16,178,821**	**$ 18,166,413**	**$ 18,496,693**	**$ 18,832,917**	**$ 19,175,191**	**$ 19,523,623**	**$ 19,878,323**	**$ 20,275,889**	**$ 20,681,407**	**$ 21,095,035**	**$ 21,516,936**	**$ 21,947,275**	**$ 22,386,220**	**$ 22,833,944**	**$ 23,290,623**	**$ 23,756,436**
$ 130,545,563	**$ 198,479,182**	**Benefit of the Project (Truck minus Rail)**	**$ -**	**$ -**	**$ 9,703,129**	**$ 11,300,007**	**$ 12,889,866**	**$ 14,467,706**	**$ 14,724,916**	**$ 14,986,627**	**$ 15,252,917**	**$ 15,523,864**	**$ 15,799,547**	**$ 16,115,538**	**$ 16,437,849**	**$ 16,766,606**	**$ 17,101,938**	**$ 17,443,977**	**$ 17,792,856**	**$ 18,148,713**	**$ 18,511,688**	**$ 18,881,921**
$ 29,315,434	**$ 30,851,638**	**PROJECT COST**	**$ 20,818,450**	**$ 11,287,499**																		
		this assumes same on-going O&M cost as at present -- fewer problems but higher level of track maintenance																				
4.45	**6.43**	**B/C Ratio**																				
$ 101,230,129	**$ 167,627,544**	**Net Present Value of Project**																				
6	**6**	**Years to Break-Even**																				