Erick-to-Sayre Freight Rail Rehabilitation
Erick, Beckham County, Oklahoma

2013 TIGER Grant Application
Benefit Cost Analysis Technical Memo

June 3, 2013

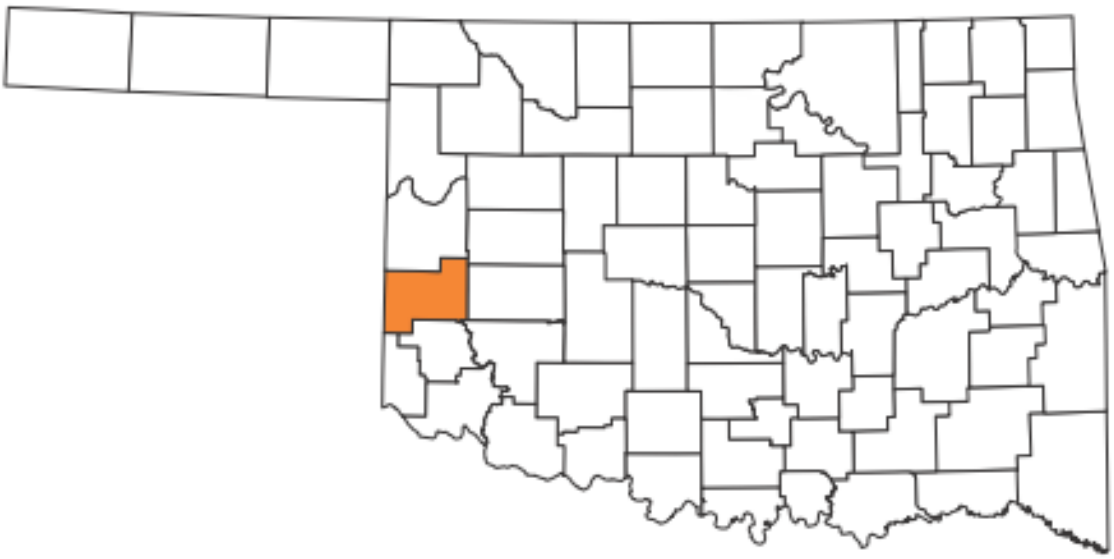

Table of Contents

Contents

Project Summary

The Erick-to-Sayre Freight Rail Rehabilitation Project (the Project) involves the rehabilitation of a currently unused 15-mile rail corridor in Beckham County in western Oklahoma. The rehabilitation is intended to increase rail capacity and economic competitiveness in western Oklahoma and the nearby eastern Texas panhandle to help relieve the very high demand for truck travel, as well as the capacity constraints on pipelines and other rail facilities, due to energy extraction activities taking place in the Anadarko Basin.

The project that the TIGER funds are being requested for includes the cost of (1) rehabilitation of the track to a "Class 1" condition (2) construction of an industrial siding on the western end to facilitate connection to businesses. Funds are not required for the purchase of right-of-way, as all needed land is owned by the State of Oklahoma. The improvement to "Class 1" status will enable the line to carry up to unit-sized (120-car) trains, and to safely transport hazardous cargo such as crude oil at 10 mph speeds. These improvements will allow for long-term heavy industrial use with very low maintenance needs over the next ten years.

Anticipated benefits resulting from the Erick-to-Sayre project are summarized in the project matrix, **Table BCA-1**, on the following page.

.

Table BCA-1: Project Matrix

Current Status/Baseline & Problem to be Addressed	Change to Baseline	Type of Impact	Population Affected by Impacts	Economic Benefits and Summary of Results (Present Value at 7% discount rate)	Page Reference in BCA Tech Memo
Large volume of crude oil being transported out of western Oklahoma and the eastern Texas panhandle by truck due to limited rail capacity.	Rehabilitated tracks will carry an estimated 26,000 barrels of oil per week, resulting in a reduction of 153 truck trips/week (238,600 truck VMT annually). (Actual capacity may be higher depending on private sector demand.)	Reduced truck VMT leading to: • Reduced pavement damage • Reduced emissions • Safety benefits (reduced accidents) • Reduced fuel usage	• Pavement damage – highway agencies (taxpayers) • Reduced emissions – state and local residents • Safety benefits – state and local residents and other drivers on Oklahoma roads (safer roads, plus lower auto insurance costs)	• Pavement damage reduction of $136,000 • Net emissions reductions valued at $76,000 • Accident reduction $482,000	• Pavement damage, p 9 • Emissions reductions, p 10 • Safety benefits, p 13 • Reduced fuel usage, p 10
Lengthy truck trips required to bring materials such as frac sands from existing railheads to well locations in the field.	Rehabilitated tracks will carry an estimated 12 railcars of frac sands per week to Erick, resulting in a reduction of 46 truck trips (adding up to 153,100 truck VMT annually). (Actual capacity may be higher depending on private sector demand and investment in loading facilities at Erick.)				
High cost of truck transportation due to high demand/labor shortage	Bringing rail service closer to the oil wells in the fields in western Oklahoma and the eastern Texas panhandle, will reduce the demand for truck VMT. Rail transportation is also cheaper than truck transportation.	• Reduced shipping costs • Slight reduction in labor demand for truck drivers • Increase in rail traffic on existing lines will reduce per-railcar shipping costs for these rail lines and for other customers all along the route.	• Oil shippers • Rail companies	• Reduced cost to oil and frac sands shippers using the Erick-to-Sayre railroad ($10.9 million) • Benefits to the railroads and to their other customers (not quantified in the BCA) • Benefits to users of truck shipping (not quantified in the BCA.)	• Cost savings to shippers, page 15 • Other benefits are included in the “Non-Quantifiable Benefits” discussion on page 16.
Limitations on pipeline capacity	This project will enable more oil to be shipped out of the region by rail	• Expansion of rail capacity will ensure that the high cost of truck shipment and the limitations on pipeline capacity and on existing rail capacity do not reduce economic development potential in this low-income, high-poverty area.	• Residents of Erick, OK, as well as the area’s commuter-shed • National interests	• Residents of area will benefit from the economic growth created by having truck-to-rail transloading facilities operating in the area (not quantified in the BCA) • By reducing the cost of bringing domestic energy supplies to market, as well as reducing the fuel used to bring it to market, this project will assist in reducing the nation’s dependence on foreign oil (not quantified in the BCA).	• These benefits are included in the “Non-Quantifiable Benefits” discussion on page 16.

VMT = Vehicle Miles Traveled

A Note on Independent Utility

While it is true that the success of the project requires a private sector investment in transloading facilities, it is important to understand that there is already interest by four private companies in developing transloading facilities at Erick.

This project is similar to a 2011 TIGER grant used by Oklahoma DOT to improve the rail corridor from Elk City to Sayre, described in the box on the following page. This project improved the connection to Sayre, and restored the yard there. The project is scheduled for full completion in June of this year, but already all the land in the yard is built-out, and trucks are currently loading oil onto rail cars 24 hours a day. There is no room to expand at Clinton or at Elk City, leading to the interest in new capacity at Erick. Erick also has the benefit of being located 15 miles closer to the oilfields in western Oklahoma and the Texas panhandle.

Further, to ensure that the analysis did not overpredict demand, an analysis was done to see if it was reasonable to assume that another 40 railcars of crude oil per week would be shipped (from Erick) along the Sayre-to-Clinton rail line in 2016. While Farmrail[1] reports 40% growth in the past two years on the Sayre-to-Elk City line, the assumed additional 40 railcars of crude oil per week coming from Erick would represent an additional 24% increase above today's levels.

This analysis was based on the 200,000 barrel per day production estimate from the State Energy Department for 2015, which was broken down into railcarloads. Railcars hold 27,300 gallons or about 650 barrels of oil. Daily production of 200,000 barrels would fill 307 railcars per day, or about 2,149 per week. The Anadarko field is large, and Sayre and Erick are centrally located within it, so it was estimated that only 30% of the oil would be in Erick's likely service area. Thirty percent of 2,149 carloads is 644 railcars per week, indicating that there should be more than enough demand from producers to maintain the current level of crude oil shipment by rail (160 cars per week) as well as the additional expected 40 rail cars per week, and quite possibly more.

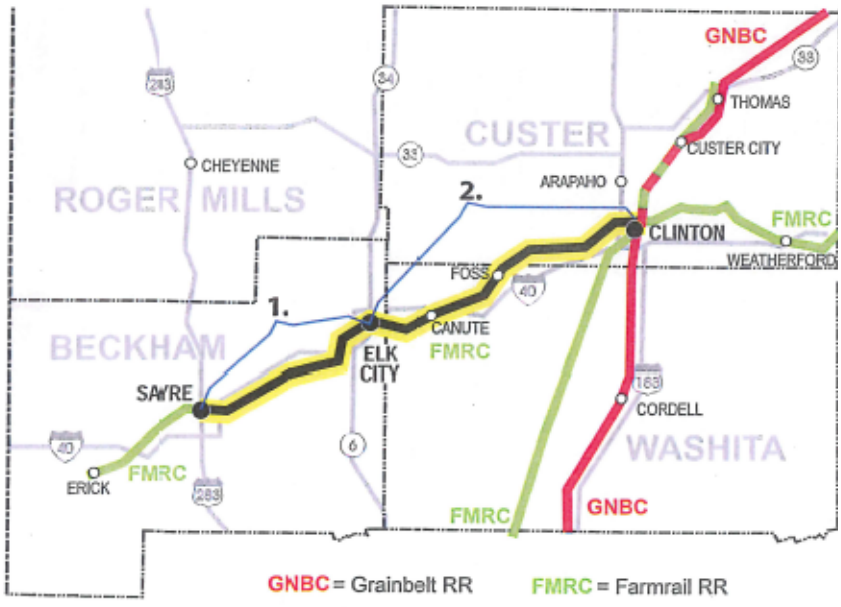

Figure BCA-1: Farmrail Line from Erick to Clinton

[1] Farmrail is the name of the railroad that operates and maintains the state-owned freight rail lines under agreement.

Excerpt from TIGER grant application:
Benefits and Impact of the 2011 TIGER Grant for Sayre, Oklahoma

Oklahoma DOT won a $6.8 million TIGER grant in 2011 to repair the rail yard in Sayre and improve the rail corridor between Elk City and Sayre. In 2010 and 2011, with oil production volumes rising, oil tanker trucks were clogging roads headed to oil transloading facilities in Elk City and Clinton (45 miles east of Sayre), or traveling even further east to Cushing, Oklahoma, where pipelines provided a connection to refineries in other states. At the time, there were severe capacity constraints at the rail facilities in Clinton and Elk City, and pipeline capacity out of Cushing was also unable to handle the growth.

With the TIGER 2011 grant, Oklahoma DOT was able to upgrade the 49 miles of track between Sayre and Clinton (through Elk City), allowing much larger volumes of crude oil from western Oklahoma to be loaded onto railcars and brought safely and cost-effectively to Gulf Coast oil refineries via rail service. Oil transloading activity along this line went from 50 carloads per week in 2010 (before the project) to more than triple that today (160 carloads per week so far in 2013).

The tracks could handle more railcars, but the recently-improved railyard in Sayre is already – in less than two years – operating at near capacity. Transloading facilities built there since 2011 are now loading oil onto railcars 24 hours a day, and the area surrounding the yard tracks in Sayre is nearing complete build-out. Crude oil comes to Sayre primarily from the north and west, from oil fields in Oklahoma, Texas, and even as far away as Colorado.

While demand exists for additional shipments, the railyard site at Sayre is limited, both in width and length, and no new large-scale loading facilities can be added there. With the addition of loading capacity at Erick, the 60-car trains currently running out of Sayre could be connected to 40-car trains arriving from Erick, and assembled into 100-car "unit" trains, lowering shipping costs further. In general, the more railcars on a train, the lower the per-railcar shipping cost, both for the rail company, and the owner of the goods being shipped.

Benefit Cost Analysis

A formal benefit-cost analysis (BCA) was conducted for this project using best practices for BCA in transportation planning, and reflecting all current TIGER grant application guidelines. As noted in the application, it is important to understand that a formal BCA is not a comprehensive measure of a project's total economic impact, as many benefits cannot be readily quantified or occur under conditions of uncertainty. This broader set of economic benefits and impacts on local and regional economic well-being and competitiveness are described in various sections of the application, particularly **Section IV.A.ii. Economic Competitiveness**.

However, to the maximum extent possible given available data, the formal BCA prepared in connection with this TIGER grant application reflects quantifiable economic benefits. It covers four of the five primary long-term impact areas identified in the TIGER grant application guidelines:

- **State of Good Repair:** The project funds will be spent on rehabilitating the track on the 15-mile state-owned rail corridor between Sayre and Erick. The track between Sayre and Elk City is currently in poor condition (Excepted Track), which has restricted the speed and carrying capacity of this stretch of railroad to the point where it has fallen into disuse.

One this track is rehabilitated, it is estimated that it will handle 52 rail cars a week, replacing 391,000 truck-miles of travel annually, primarily on I-40.

- **Economic Competitiveness:** This project will have an impact on local, regional, and national economic competitiveness by reducing rail shipping costs for oil shippers, farmers, and industry, allowing them to improve their logistics practices and expand markets for both domestic and international shipments. This will improve the competitive position of local agricultural and business enterprises, while reducing, somewhat, our nation's dependence on foreign oil sources. This BCA only calculates the cost savings for the 52 weekly railcars forecasted to be shipped each week, but the rail line could be used for other types of freight, including the wheat and other agricultural products produced in the area.

  The availability of this rail service will provide competition in freight services available in the area (truck and rail instead of only truck). In addition, the fact that this project will provide local shippers with access to two Class I railroads (UPRR and BNSF) will help to keep rail prices competitive for all shippers.

- **Environmental Sustainability:** The project will result in a major shift of freight movements within the Beckham County area, from trucks to rail. Rail is much more fuel efficient, and produces anywhere from 30% to as little as 8% of the emissions of trucks per ton-mile carried.
- **Safety:** By shifting freight movements of crude oil, a hazardous material, from truck to rail, this project will reduce the number of vehicle accidents and spills. Trucks transporting hazardous materials have nearly 16 times more hazmat releases than railroads[2].

Given the caveats, the computed benefit-cost ratio for this project is 4.5 using a 7% discount rate. The BCA compares the capital construction costs to the quantifiable benefits of the project for 10 years following construction. After 10 years of use, the railroad will need to again be rehabilitated, so no residual project value was assumed past 2024.
The quantified project benefits are:

1. Reduced cost of expected crude oil shipments
2. Reduced cost of expected frac sands shipments
3. Reduced pavement damage to highways
4. Emissions reductions
5. Safety benefits (reduced crashes)

Table BCA-2 summarizes the cost and the quantifiable benefits of the project in terms of Present Value. As shown in the table, the present value of the project's capital cost (at 7%) is valued at $2.45 million. The benefits have an estimated present value (after subtracting out the ongoing

[2] nationalatlas.gov/articles/transportation/a_freightrr.html

operations and maintenance costs) of $11.0 million over the 10-year period, yielding the 4.5 BCA ratio.

Table BCA-2: Benefit Cost Analysis Summary

Figures in thousands of 2012$, discounted to 2013

Category	Present Value at 7%	Present Value at 3%
Construction Cost	**$2,450**	**$2,545**
Evaluated Benefits		
Rail Maintenance Costs	($671)	($846)
Reduced Cost of Oil Shipments	$10,945	$14,028
Reduced Damage to Roadway	$136	$172
Emissions Savings	$76	$96
Net Safety Benefits	$482	$608
Total Evaluated Benefits	**$10,969**	**$14,058**
NET PRESENT VALUE	**$8,519**	**$11,512**
BENEFIT/COST RATIO	**4.5**	**5.5**

Benefit Calculation Assumptions

Discount Rates

Federal TIGER guidance recommends that applicants discount future benefits and costs to 2013 present values using a real discount rate of 7% to represent the opportunity cost of money in the private sector. TIGER guidance also allows for present value analysis using a 3% discount rate when the funds currently dedicated to the project would be other public expenditures. This is the case for this project, where the entire 30% will come from state funds. The BCA ratio at 3% is 5.5 to 1.0.

The project benefits are generally presented below using the more conservative 7% discount rate to demonstrate that the project's long term benefits clearly outweigh the project's costs.

Length of Analysis

The BCA compares the capital construction costs to the quantifiable benefits of the project for 10 years following construction (that is, through the end of 2024). After 10 years, the railroad will need to again be rehabilitated, so no residual project value was assumed past 2024.

Project Schedule

The Erick-to-Sayre project, if funded, will be constructed in 2014, and will be operable by the middle of that year.

Year 2012 Dollars

This analysis was computed in 2012 dollars. Where benefit values were developed in terms of previous year dollars, the values were converted to 2012 dollars using the Bureau of Labor Statistics CPI Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm).

Build/No Build Assumptions

The BCA was developed by comparing a Build case to a No Build case.

For the Build case, it is assumed that a TIGER grant is received in the Fall of this year, allowing project construction to be completed by July 1, 2014. A conservative demand forecast was made, projecting 40 railcars (one train) of crude oil per week headed from Erick to refineries (via Farmrail to Grainbelt, to BNSF, as shown **in Figure BCA-1**), and 12 railcars of frac sands headed from BNSF to Erick for trucking to well sites further west in Oklahoma and Texas.

Railcar vs. Tanker Truck Capacity

One barrel is equal to 42 gallons. Railcars that are designed to transport crude oil have a practically holding capacity of 27,300 gallons (650 barrels). Tanker trucks vary in size, but the typical truck used to transport crude oil in southwestern Oklahoma holds 7,140 gallons (170 barrels). By weight, a gallon of crude oil is 7 pounds, so the weight (cargo only) of a crude oil tanker truck is 25 tons. The weight of a loaded railcar of crude oil is 95.5 tons (130 tons if the car itself is included).

Under the No Build, it is assumed that the Erick-to-Sayre rail corridor is left in its currently unusable condition (see **Figure BCA-2**), and that trucks continue to be used to ship oil out of the Anadarko basin, and to bring in materials used for oil extraction in the areas west of Erick. To be conservative, it is assumed that the crude oil from this area, like today, would be transloaded to rail at Sayre, and that the frac sands needed in this area would continue to be loaded onto trucks in Elk City where these material suppliers are currently based.

A comparison between these two scenarios provides the following reductions in truck vehicle miles traveled (VMT):

- A shortening of each crude oil truck trip by 30 miles (round trip), as trucks could unload at Erick and turn around to head back to an oil well, instead of having to drive 15 miles further to Sayre before turning around to head back west to the well.
- A shortening of each frac sands truck trip by 64 miles, as trucks would not be needed to drive the extra 32 miles between Erick and Elk City.

In reality, with rail currently operating near capacity in Sayre and Elk City, it is possible that some of the oil would be trucked further east to other railheads, or even to pipeline heads in Cushing, so the actual truck mileage reduction (and the pavement damage, emissions, and safety benefits that are derived from it) might be **much greater than that calculated in this analysis**.

Figure BCA-2: Current Condition of Erick-to-Sayre Rail Corridor

Freight Shipping Assumptions

To be conservative, a gradual increase in train shipments was assumed between the project completion in Summer 2014 and full operation levels starting in 2016 (see **Table BCA-3**).

Table BCA-3: Forecasted Weekly Railcar Shipments Between Erick and Sayre

Year	Crude Oil Shipments	Frac Sands
2014*	10 cars/week	3 cars/week
2015	28 cars/week	8 cars/week
2016–2024	40 cars/week	12 cars/week

* To make calculations easier, an average of 13 cars per week was used in 2014. In reality, there would be no rail traffic in the first half of 2014 (the construction period), and an assumed 26 cars/week in the second half of the year.

With this gradual shift from truck to rail, the specific number of railcars and truckloads assumed each year is shown in **Table BCA-4**. Note that due to the capacity differential between trucks and railcars, with one railcar holding as much freight as 3.8 trucks, 40 railcarloads of materials equates to 153 truckloads, and 12 railcarloads equates to 46 truckloads.

Table BCA-4: Comparison of Weekly Rail and Truck Shipments With and Without the Project

Year	NO BUILD		BUILD	
	Crude Oil Shipments (to Sayre)	Frac Sands Shipments (from Elk City)	Crude Oil Shipments (to Erick)	Frac Sands Shipments (from Erick)
2014 (2nd half)	153 truckloads (no railcars)	46 truckloads (no railcars)	10 rail cars & 115 truckloads	3 rail cars & 34 truckloads
2015	153 truckloads (no railcars)	46 truckloads (no railcars)	28 rail cars & 46 truckloads	8 rail cars & 15 truckloads
2016–2024	153 truckloads (no railcars)	46 truckloads (no railcars)	40 rail cars (no truckload)s	12 rail cars (no truckloads)

The difference shown in Table BCA-4 between the numbers of truck trips in the Build vs. the No Build equates to a specific amount of truck VMT saved (30 miles for each crude oil truck trip, and 64 miles for each frac sands truck trip). The resulting truck-mile reduction is shown weekly and annually in Table BCA-5.

Table BCA-5: Weekly and Annual Truck VMT Savings with the Project

Year	Change in Truck VMT (Weekly)		Change in Total ANNUAL Truck VMT
	Crude Oil Shipments	Frac Sands Shipments	
2014 (2nd half)	-1,138 miles	-760 miles	-98,733 miles
2015	-3,208 miles	-1,976 miles	-269,605 miles
2016–2024	-4,588 miles	-2,936 miles	-391,285 miles

Project Costs

The capital cost of the project is estimated at $2,621,700 in 2012 dollars. The project is ready to go and will only take six months to construct, after two months for procurement. It was therefore assumed for the BCA that all of these funds would be spent in 2014.

Rail maintenance schedules were developed using data from Farmrail staff that assumed average annual costs of $6,810 per mile ($102,150 for the entire 15 mile length).

Using a 7% discount rate, the present value of the capital cost is $2,450,187, and the present value of the ongoing maintenance costs is $670,522.

Project Benefits

The benefits described in detail below were all derived from comparing the cost and impacts of moving the assumed 52 weekly railcarloads of oil and frac sands by rail between Erick ad Sayre (or Elk City) in the Build, to the costs and impacts of moving this freight by truck as indicated above for the No Build.

Reduced Pavement Damage to Highways

One of the "State of Good Repair" benefits of this project is the reduced wear and tear on the roadways that would result from removing truck travel from roads in Beckham county (primarily I-40) under the Build scenario.

According to the "Addendum to the 1997 Federal Highway Cost Allocation Study Final Report" (FHWA, May 2000) it is estimated that trucks weighing 60,000 pounds cause $0.044 dollars of damage (in 2012$) for every mile traveled on a rural interstate highway. Trucks weighing 80,000 pounds cause $0.169 dollars of damage on these roads. These two figures were averaged (to $0.107 dollars per mile) for the assumed weight of the truck movements that are part of this analysis.

Crude oil tanker trucks are driven round trip for each delivery to the rail and pipeline heads, and the return trip is always empty. The same is true for the frac sands shipments. Empty truck cause much less pavement damage than loaded trucks. Because half of the truck VMT are "empties," only the loaded portion of the trip is counted in this analysis of pavement damage.

In 2016, the 10.7 cents of damage caused per each of the 195,600 fully-loaded truck VMT under the No Build, would add up to $20,868 in pavement damage each year (Table BCA-6). The present value of these project benefits for the 2014-2024 analysis period are thus $136,150.

Table BCA-6: Reduced Pavement Damage Costs

(In 2012 $)

Year	Annual VMT Saved with Project	Fully Loaded VMT	Cost of Pavement Damage (at $0.1067 cents/mile)
2014	97,821	48,911	$ 5,217
2015	268,809	134,405	$ 14,336
2016 (and all other years through 2024)	391,285	195,642$	$ 20,868
TOTAL 2014-2024	**3,888,193**	**1,944,096**	**$ 207,365**
Present Value			***$136,150***

Reduced Fuel Use

Moving freight by rail is more fuel efficient by rail compared to truck. An assumption was made that trucks average 6.7 miles per gallon of diesel fuel. Applying this to the VMT savings results in a total savings over the 2014-2024 period of 582,580 gallons.

To account for the additional fuel that would be used by rail, it was assumed that rail would use 30% of the diesel fuel required for trucks (per ton-mile carried), thus reducing the net fuel savings of the project to 40,9887 gallons annually, or 407,283 gallons of diesel fuel over the life of the project.

Emissions Reductions

The 391,285 truck miles removed from the road each year would remove a substantial volume of pollutants from the air, an estimated 241 tons annually of CO, CO_2, NO_x, SO_x, volatile organic chemicals (VOC) and particulate matter (PM_{10}). The vast majority of these pollutants by weight consist of CO_2. Over the 10-year life of the project, total truck pollutant reductions add up to an estimated 2,395 tons.

Project emissions impacts also have to account for increased rail emissions between Erick and Sayre. While research turned up a range of rail emissions information, a conservative estimate of 30% of truck emissions per ton-mile was used.

The rail emissions added up to 72 tons of rail emissions annually, yielding a net emissions reduction of 169 tons per year. Using TIGER guidance to place a dollar value on the emissions reductions, the present value of the net emissions reductions over the life of the project is $76,371[3].

[3] The figure given in the text of the grant application is "$76.4 million" which conflicts with the $76,371 figure shown in Table 3 of the application. The correct number is $76,371.

Assumptions Used

Truck Emissions

Per-mile emissions rates were taken from the PRISM model for trucks traveling at 65 miles per hour (since most travel will be done along I-40). These factors are shown in **Table BCA-7**.

Table BCA-7: Emissions Factors for Trucks Traveling at 65 mph

Year	Grams of pollutant emitted per Truck-Mile Traveled					
	CO	CO2	NOX	PM10	SOX	VOC
2013	2.5177	610.7553	1.1272	0.0541	0.0064	0.2002
2014	2.3500	611.0387	1.0515	0.0539	0.0064	0.1938
2015	2.1934	611.3221	0.9808	0.0538	0.0064	0.1875
2016	2.0473	611.6055	0.9150	0.0537	0.0064	0.1815
2017	1.9109	611.8889	0.8535	0.0536	0.0064	0.1756
2018	1.7836	612.1723	0.7962	0.0535	0.0064	0.1700
2019	1.6648	612.4557	0.7427	0.0534	0.0064	0.1645
2020	1.5539	612.7391	0.6928	0.0533	0.0064	0.1592
2021	1.4504	613.0225	0.6462	0.0531	0.0064	0.1541
2022	1.3537	613.3059	0.6028	0.0530	0.0064	0.1491
2023	1.2636	613.5893	0.5623	0.0529	0.0064	0.1443
2024	1.1794	613.8727	0.5246	0.0528	0.0064	0.1396

Source: PRISM and Parsons Brinckerhoff.

Rail Emissions

Data on rail emissions was limited, so the most conservative of the three data sources listed below was used. Rail emissions are therefore assumed to be 30% of truck emissions per ton-mile.

The conservative estimate is probably the most accurate for this project, as the diesel locomotives being used here are old, the train is relatively short, and the length of trip (15 miles between start-up and stop) is also short.

- Trucks emit 6 to 12 times more pollutants per ton-mile than trains, and 3 times more NO_x and PM. Source: (http://nationalatlas.gov/articles/transportation/a_freightrr.html)
- Rail produces 70% less CO_2 than trucks per ton-mile. Source: http://www.freightonrail.org.uk/FactsFigures-environmental.htm
- Moving freight by rail reduces greenhouse gas emissions by 75%. Source: http://www.aar.org/~/media/aar/Background-Papers/Freight-RR-Help-Reduce-Emissions.ashx

Net reductions in emissions are shown in **Table BCA-8**.

Table BCA-8: Emissions Reductions by Year

Year	Annual Tons Emitted Annually by Truck							Rail Emissions (Annual Tons)	Net Emissions Impactof Project
	CO (metric tons)	CO2 (long tons)	NOX (metric tons)	PM10 (metric tons)	SOX (metric tons)	VOC (metric tons)	Total Impact of removed Truck VMT		
2014	0.23	59.84	0.1014	0.0052	0.0006	0.0187	60.19	18.06	42.13
2015	0.58	164.52	0.2598	0.0143	0.0017	0.0497	165.42	49.63	115.80
2016	0.79	239.58	0.3528	0.0207	0.0025	0.0700	240.82	72.25	168.57
2017	0.74	239.69	0.3291	0.0207	0.0025	0.0677	240.85	72.26	168.60
2018	0.69	239.81	0.3070	0.0206	0.0025	0.0655	240.89	72.27	168.62
2019	0.64	239.92	0.2864	0.0206	0.0025	0.0634	240.93	72.28	168.65
2020	0.60	240.03	0.2671	0.0205	0.0025	0.0614	240.98	72.29	168.69
2021	0.56	240.14	0.2492	0.0205	0.0025	0.0594	241.03	72.31	168.72
2022	0.52	240.25	0.2325	0.0204	0.0025	0.0575	241.08	72.33	168.76
2023	0.49	240.36	0.2168	0.0204	0.0025	0.0556	241.14	72.34	168.80
2024	0.45	240.47	0.2023	0.0204	0.0025	0.0538	241.21	72.36	168.84
TOTAL	**6.29**	**2,384.61**	**2.80**	**0.20**	**0.02**	**0.62**	**2,394.55**	**718.36**	**1,676.18**

Value of Emissions Benefits

Values were assigned to the emissions levels using current TIGER guidance as shown in **Table BCA-9** and **BCA-10**.

Table BCA-9: Value of Non-CO_2 Emissions Per Metric Ton

Pollutant	CO	NO_X	PM_{10}	SO_X	VOC
Value (in $2010)	$ 0	$ 7,385	$ 337,858	$ 43,651	$ 1,874
Value (in $2012)	$ 0	$ 7,776	$355,731	$ 45,960	$ 1,973

Source: 2013 TIGER BCA Resource Guide

The resulting monetized value of the net emissions reductions that are expected to result from the project are shown in Table BCA-11 for the entire 2014-2024 analysis period.

Table BCA-10: Value of Reduced CO_2 Emissions

Year	Value of CO2 $2012/ton
2013	$25.25
2014	$25.80
2015	$26.35
2016	$26.91
2017	$27.46
2018	$28.02
2019	$28.57
2020	$29.12
2021	$29.90
2022	$30.56
2023	$31.34
2024	$32.00

Source: PRISM; Parsons Brinckerhoff

Table BCA-11: Value of Reduced CO_2 Emissions

Pollutant	Value (in 2012$)
CO	$ 0
CO_2	$ 48,455
NOx	$ 15,264
PM_{10}	$ 50,867
SOx	$ 789
VOC	$ 860
TOTAL	**$ 116,236**
Present Value	***$ 76,371***

Safety Benefits

As with emissions, safety benefits were evaluated separately for rail and truck travel.

Reduced Truck Accidents

The reduced truck miles traveled in both directions (loaded and unloaded) will have a direct impact on reducing highway crashes. Using state crash data from 2010, along with accident cost values provided in the TIGER guidance, the cost of crashes per million miles traveled in Oklahoma was evaluated at $188,763 in 2012 dollars.

The crash rate per mile travelled was calculated from statewide Oklahoma crash data from 2010 (shown in the first two rows of **Table BCA-12**). The table also shows accident cost values derived from the TIGER guidance. The value for each crash type is derived from the Maximum

Abbreviated Injury Scale (MAIS) scale using the KABCO-to-MAIS conversion table in the TIGER BCA Guidance.

Table BCA-12: Calculation of Safety Costs per Million VMT

(In 2012 $)

	1 Non-injury	2 Possible Injury (minor injury)	3 Non-Incapacitating Injury	4 Incapacitating Injury	5 Fatal Injury	TOTAL
2010 crashes, statewide	44,746	12,354	9,134	2,957	616	69,807
2010 crash rate, statewide, (accidents per million VMT*)	0.94	0.26	0.19	0.06	0.01	1.46
Value of accident type	$ 6,190	$ 61,320	$ 118,819	$ 435,324	$ 9,100,000	
Cost of accidents per million VMT	$ 5,801	$ 15,866	$ 22,731	$ 26,960	$ 117,405	**$ 188,763**

* Total statewide VMT was 47.7 billion in 2010.

Source: Data on Oklahoma Accidents and VMT is from "2010 Oklahoma Crash Facts," Oklahoma Department of Public Safety, August 2011.

Using the 391,285 truck miles removed from the roadway, the annual value of reduced accidents is estimated at $73,860. The present value of the truck related safety benefits over the 2014-2024 analysis period is therefore $481,890.

True accident costs might be higher, as these trucks are filled with hazardous crude oil, which can lead to higher levels of damage, as well as clean-up costs. This cost effect was not estimated for the BCA, except to the extent it is included in the insurance component of the No Build truck shipping costs.

Rail Safety Impacts

An attempt was made to calculate increased rail accidents that might be expected from the project's growth in rail travel. However, it approaches zero. Currently, the accident rate for Farmrail-operated tracks in this part of Oklahoma is very low – two accidents in the past six years, during which over 31,000 carloads were shipped, most on 25mph track. Both of these accidents were property damage only (no injuries or deaths) and fault was attributed to automobile drivers.

Because most rail-vehicle accidents occur on a per train basis (cars rarely hit the back or middle cars of a long train), the rail accident analysis looked at growth in train traffic, as opposed to growth in railcar traffic. Interestingly, while the impact of this project on truck travel will be substantial – 199 fewer roundtrips weekly, and 391,285 truck-miles removed annually, train traffic will not grow much. Even at full build in 2016, with an additional 52 rail cars shipped each week, at 40 cars per train, the growth is just one or two additional trains per week. Once these railcars are added to 60-car trains at Sayre, there may not be any increase in train traffic – it

would typically be the same number of trains traveling per week, but each would be 40 cars longer.

Further, at the speeds expected along the Erick-to-Sayre route (10 mph), it is unlikely that any increase in rail accidents resulting from this project would noticeably reduce the safety benefits of the removed truck VMT.

Reduced Cost of Oil Shipments

The costs charged to customers for shipping oil via rail are cheaper than the costs charged to ship by truck. This is not surprising given the cost-efficiency of rail in moving products that are heavy, and that are not particularly time-sensitive. Crude oil can be particularly expensive to ship by truck, as it is carried in oil tanker trucks which need to be driven back empty, leading to high costs, particularly given the demand for truck driver labor.

As noted elsewhere, a single 100-car train can carry the same amount of oil as 382 tanker trucks, and only requires three operators.

Reduced costs of shipping oil from Erick vs. Sayre or Elk City was calculated using the following cost assumptions:

- The cost of driving a crude oil truck 30 miles round trip between Erick and Sayre would be $131
- The cost of driving a frac materials truck 64 miles round trip between Erick and Elk City would be $279
- The cost of shipping one railcar from Erick to Sayre is $50
- The cost of shipping one railcar from Erick to Elk City is $50

Following the above assumptions, with the truck and rail traffic levels shown in **Table BCA-4**, the total annual cost savings for shippers would total $1.6 million beginning in 2016, as shown in **Table BCA-13**. Present value of the shipper savings for the 2014–2024 period is $11.0 million.

Table BCA-13: Calculation of Shipper Savings for 2016

(in 2012 $)

Scenario	Crude Oil Shipments		Fracking Sands Shipments		TOTAL SHIPPING CHARGES
	Number	Shipping Cost	Number	Shipping Cost	
No Build	153 trucks	$ 20,012	46 trucks	$ 12,836	$ 32,848
Build	40 railcars	$ 2,000	12 railcars	$ 600	$ 2,600
				Savings per Week	$ 30,248
				Annual Savings	**$ 1,572,908**

NOTE: Per-truck-mile shipping costs in this area are believed to be $4.36, so a 30-mile round trip crude oil truck trip between Erick and Sayre would cost $130.80. Similarly, a 64-mile roundtrip for a frac sands truck between Elk City and Erick would cost $2789.04.

Other Non-Quantifiable Costs and Benefits

There are a number of other project benefits as well as costs that could not be reasonably quantified for the benefit-cost analysis. Among these are:

- **Benefits to other freight shippers -** While the benefits of reduced costs for shippers of crude oil and frac materials is accounted for in this BCA, the impact of this cost reduction for other potential shippers, such as the region's 2,000+ farms and other businesses was not. Without high demand levels, it is not efficient to run freight rail service, which is why the Erick-to-Sayre line fell into disrepair. However, with trains running on this line, it would again be open to small shippers (in other words, today it would cost too much to ship two cars of wheat by rail from Erick, but with the project in place, it would cost less than truck shipping to add two railcars of wheat to a train carrying 38 cars of crude oil). As an example, the recently improved, TIGER-funded Sayre-Clinton line was built assuming that it would be used exclusively for traffic related to the energy extraction industry. However, this rail segment has already handled over 1,100 rail carloads of non-crude oil materials just since January of this year, including agricultural products, and refined oil products.

  Even for shippers that continue to use trucks, the fact that this project would provide some competition for truck drivers in Beckham County should help reduce the upward pressure on trucking costs.

  Freight transportation cost savings would improve the cost efficiency of all existing businesses, allowing them to be more competitive and make their products cheaper for a wider domestic or international market. The availability of low-cost rail shipping could even attract new businesses to this area.

- **Benefit to Regional Rail** – This project would enable Farmrail and its sister company Grainbelt to take on new business (i.e., the 52 additional weekly railcars). Because adding additional railcars to existing freight trains would lower cost-per-railcar while increasing revenues, there are two potential effects. First, Farmrail and Grainbelt would be able to lower costs for customers throughout their service area. Alternately, Farmrail and Grainbelt could use the additional profit to improve and better maintain their existing rail infrastructure, providing improved service in this generally low-income part of the state of Oklahoma.

- **Economic Development Potential –** As noted in the grant application, the project is critical in making it possible to fully exploit the region's resources and maximize economic development potential for the region. The dampening effect of limiting rail traffic to current levels, while the truck driver labor shortage and the limitations on pipeline capacity make non-rail transportation more difficult, could greatly reduce the potential number of jobs and other benefits that would be possible if the project was in

place. These benefits are not just the jobs of those drilling and monitoring the wells, or driving the oil to the railheads, but the jobs at restaurants and grocery stores that will serve these new energy-industry employees, the builders who would construct their homes, etc.