Oklahoma State-Owned "Rolling Pipeline" Development Project
Sayre, Oklahoma

TIGER III Grant Application
Benefit Cost Analysis Technical Memo

November 2, 2011

The formal benefit-cost analysis (BCA) was conducted for this project using best practices for BCA in transportation planning, and reflecting all TIGER III grant application guidelines. As noted in the application, it is important to note 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 other sections of the application, particularly section IV.A.ii Economic Competitiveness.

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: specifically, reduced maintenance costs to the rail line as well as reduced wear and tear on pavement due to the relatively long-distance truck trips that will need to be made to carry oil out of the Anadarko Basin if the project is not built.
- Economic Competitiveness: specifically, the reduction of shipping costs for crude oil moving between the Anadarko Basin and refineries.
- Environmental Sustainability: the project will result in a major shift of freight movements to and from 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: Changes in projected truck and rail accidents resulting from the project.

Given the caveats, the computed benefit-cost ratio for the Farmrail project is 56.8 to 1.0 using a seven percent discount rate. The BCA compares the capital construction costs to the quantifiable benefits of the project for 25 years following construction. After 25 years, the railroad will need to again be rehabilitated, so no residual project value was assumed past 2037.

The quantified project benefits are:

1. Rail maintenance cost savings
2. Reduced pavement damage to highways
3. Reduced cost of oil shipments
4. Emissions reductions
5. Safety benefits (reduced crashes)

Discount Rates
Federal TIGER guidance recommends that applicants discount future benefits and costs to 2011 present values using a real discount rate of seven percent to represent the opportunity cost of money in the private sector[1]. TIGER guidance also allows for an alternate present value analysis using a three percent discount rate when the funds currently dedicated to the project would be other public expenditures. This is largely the case for this project, which is 9.5% privately funded. The BCA ratio at 3% is 87.3 to 1.0.

Cost Benefit Results
Table BCA-1 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 is valued at $7.8 million. The benefits have an estimated present value of $445.2 million over the 25-year period, yielding the 56.8 BCA ratio.

Table BCA-1: Benefit Cost Analysis Summary
Figures in thousands of 2011$, discounted to 2011

Category	**Present Value at 7%**	**Present Value at 3%**
Construction Cost	**$7,840**	**$8,181**
Evaluated Benefits		
Rail Maintenance Cost Savings	$220	($320)
Reduced Damage to Roadway	$60,279	$96,182
Reduced Cost of Oil Shipments	$310,858	$498,623
Emissions Savings	$27,447	$44,532
Net Safety Benefits	$46,664	$74,458
Total Evaluated Benefits	**$445,248**	**$713,795**
NET PRESENT VALUE	**$437,409**	**$705,614**
BENEFIT/COST RATIO	**56.79**	**87.25**

Benefit Calculation Assumptions
The benefits of the project are derived by comparing conditions under a Build and No Build scenario. These two scenarios are defined as follows:

[1] Source: TIGER Notice of Funding Availability (Federal Register/Vol 76. No. 156, 8/12/2011):
Applicants should discount future benefits and costs to present values using a real discount rate (i.e., a discount rate that reflects the opportunity cost of money net of the rate of inflation) of 7 percent, following guidance provided by OMB in Circulars A–4 and A– 94 (http://www.whitehouse.gov/omb/ circulars_default/). Applicants may also provide an alternative analysis using a real discount rate of 3 percent. The latter approach should be used when the alternative use of funds currently dedicated to the project would be other public expenditures, rather than private investment.

No Build
Under the No Build, rail traffic between Sayre and Clinton is limited due to poor track conditions. It is estimated that at most 105 carloads of oil per week could be shipped by Farmrail without the project. This is built on the assumption that five cars at a time take four hours to move from Sayre to Elk City (two hours at 10mph from Sayre to Elk City – a distance of 17 miles, and then another two hours for the locomotives to return to get more carloads of oil).

Because of crew costs and safety concerns on the poor quality track, trains are generally not run during nighttime hours. In an average 12-hour day, therefore, three roundtrips with five carloads of oil can be shipped. Fifteen per day times 7 is 105 railcars per year.

Build
With the project, the capacity is much greater. Farmrail estimates that practical capacity is a maximum of 560 railcars per week. Theoretical capacity is much higher, as there is technically no limit on the length of a rail car on Class 2 track. However, there are other constraints – meeting other customers' needs, return of empty oilcars, the number of engines needed to pull the train, etc.

Table BCA-2: Weekly Carload and Crude Oil Carrying Capacity Build vs. No Build

Year	No Build		Build		Difference	
	Maximum Carloads	Maximum Capacity (barrels)	Maximum Carloads	Maximum Capacity (barrels)	Added Carloads	Added Capacity (barrels)
2013 (2nd half)	105	68,250	320	208,000	215	139,750
2014	105	68,250	410	266,500	305	198,250
2015-2037	105	68,250	560	364,000	455	295,750

Note on Updated Railcar and Tanker Truck Capacity Calculations
Railcars that are designed to transport crude oil have a holding capacity of 30,000 gallons (714 barrels). Tanker trucks vary in size, but the typical truck used to transport crude oil in southwestern Oklahoma holds 7,800 gallons (185 barrels).

The grant application and the BCA were originally developed using these assumptions.

Shortly before the TIGER grant was due, staff from Farmrail reviewed the application and informed Oklahoma Department of Transportation (ODOT) staff that when transporting oil, room must be left in the vehicles (both railcar and truck) for product expansion and movement. The practical capacity of railcars is therefore 650 barrels and for tanker trucks it is 170 barrels.

The BCA was revised to reflect this new information, but in one or two instances the text of the grant application does not reflect this (specifically, references to the specific dollar per barrel cost of rail shipments, the oil demand calculations and some of the numbers in Exhibit 17.) The analysis itself (that is, the assessed benefits and the BCA ratio) as described in this memo and as presented in the text does include these changes and is correct.

Verification of Demand
The scenarios above assume that as much oil will be moved by rail as there is rail capacity available. To ensure that the analysis did not project that more oil would be shipped by Farmrail than was likely to be produced, a short analysis was performed as a check.

The Oklahoma State Department of Energy and Chesapeake Energy forecast that 200,000 barrels of crude oil per day will be produced from the Anadarko field by 2015[2]. Assuming 650 barrels per rail carload this is equivalent to 300 daily rail carloads, or about 2,150 carloads per week. The Anadarko field is large, and Sayre is centrally located within it, so it was estimated that only 30% of the oil would go to Sayre, with the remainder headed north to railheads in Kansas or south to railheads in the Texas panhandle.

Thirty percent of 2,150 carloads is 650, indicating that there will be demand from producers to use all of Farmrail's 560 railcar/week capacity. The 200,000 barrels per day production level will not be reached until 2015, so a gradual increase from today's 50 rail cars per week was assumed (as shown in **Table BCA-2**). After 2015, to be conservative, it is assumed that there will be no increase in oil production.

To calculate the benefits of the project, the additional amount of oil that would be shipped by rail with the project vs. without was calculated (right-most column). The various benefits of the project are largely calculated by assuming that the amount of oil that would NOT be moved by rail if the project were NOT built would instead be moved by truck to Cushing, Oklahoma (where there is a pipeline head).

As shown in **Table BCA-2**, in the No Build, there are 295,850 barrels of oil that would need to be shipped by truck from Sayre to Cushing, Oklahoma in 2015. The oil would then be shipped by pipeline to refineries on the Gulf Coast. In the Build, this same 295,850 barrels of oil is assumed to be shipped by rail from Sayre to Lake Charles, Louisiana via Farmrail and BNSF railroads. Lake Charles is currently a common crude oil destination from Sayre.

Rail Maintenance
Rail maintenance schedules were developed using data from Farmrail staff (**Table BCA-3**). The maintenance schedules for the two segments of rail are quite different. The western (Sayre to Elk City) segment is currently in very poor condition, so-called Excepted Track, and maintenance would actually be higher in the Build to account for the many hundreds of additional railcars being carried each week.

There is savings for the Elk City to Clinton (eastern) part of the improvement project, although the present value of the savings is negative when using the 3% discount rate. This segment of rail is currently classified as marginal Class 2 status, and it is due for major maintenance in 2017 if the project is not built in the near future. For six years after construction (and also after major maintenance, which is done in approximately ten year cycles if funding is available) annual maintenance costs are substantially lower.

[2] Source: September 22, 2011 e-mail from Jay Albert, Deputy Secretary of Energy, State of Oklahoma, referencing information from Chesapeake Energy.

TABLE BCA-3: Maintenance Cost Schedule for Rail

Year	Sayre to Elk City		Elk City to Clinton		SAVINGS
	NO BUILD	BUILD	NO BUILD	BUILD	(Extra Costs)
2013	$115,770		$364,800		$480,570
2014	$115,770	$193,800	$364,800	$255,360	$31,410
2015	$115,770	$193,800	$364,800	$273,600	$13,170
2016	$115,770	$193,800	$364,800	$291,840	$(5,070)
2017	$115,770	$193,800	$2,819,560	$310,080	$2,431,450
2018	$115,770	$193,800	$255,360	$328,320	$(150,990)
2019	$115,770	$193,800	$273,600	$346,560	$(150,990)
2020	$115,770	$193,800	$291,840	$364,800	$(150,990)
2021	$115,770	$193,800	$310,080	$364,800	$(132,750)
2022	$115,770	$193,800	$328,320	$364,800	$(114,510)
2023	$115,770	$1,497,891	$346,560	$ 2,819,560	$(3,855,121)
2024	$115,770	$135,660	$364,800	$255,360	$89,550
2025	$115,770	$145,350	$364,800	$273,600	$61,620
2026	$115,770	$155,040	$364,800	$291,840	$33,690
2027	$115,770	$164,730	$2,819,560	$310,080	$2,460,520
2027	$115,770	$174,420	$255,360	$328,320	$(131,610)
2028	$115,770	$184,110	$273,600	$346,560	$(141,300)
2029	$115,770	$193,800	$291,840	$364,800	$(150,990)
2030	$115,770	$193,800	$310,080	$364,800	$(132,750)
2031	$115,770	$193,800	$328,320	$364,800	$(114,510)
2032	$115,770	$1,497,891	$346,560	$ 2,819,560	$(3,855,121)
2033	$115,770	$135,660	$364,800	$255,360	$89,550
2034	$115,770	$145,350	$364,800	$273,600	$61,620
2035	$115,770	$155,040	$364,800	$291,840	$33,690
2036	$115,770	$164,730	$2,819,560	$310,080	$2,460,520
2037	$115,770	$174,420	$255,360	$328,320	$(131,610)
TOTAL	**$3,010,020**	**$7,055,893**	**$15,973,560**	**$12,898,640**	**-$970,953**

Overall, using a discount rate of 7%, the project results in a rather minimal maintenance savings of $220,000 over the life of the project. Using a three percent discount rate, the impact is a loss of $320,000. The difference is due to the seven percent discount rate placing a high value on the reduced maintenance cost of the eastern segment in 2017, while placing lower values on the maintenance cost savings in the out years.

Reduced Pavement Damage to Highways

The other side of assessing the "State of Good Repair" impacts is the reduced wear and tear on the roadways that is a result of removing trucks from the highway under the Build scenario.

Between Sayre and the pipeline heads in Cushing is a 200-mile trip, largely along I-40. Crude oil tank trucks need to be driven back empty, leading to high costs, as a trucker's day consists of one 400-mile round trip to carry one tanker truck of oil.

With 170 barrels of oil per truck[3], and 400 miles per truck trip (round trip), this rail project is estimated to take over 36.2 million truck miles off of Oklahoma highways every year starting in 2015:

> 2015 excess railcars = 455 x 650 barrels per railcar. Additional capacity is 295,750 barrels/week.
> An average truck holds 170 barrels, so (295,750/170) = 1,740 trucks per week.
> Multiplied by 52 weeks/year = 90,465 truck trips per year.
> Multiplied by 400 miles per trip = 36,186,000 additional truck miles annually in the No Build.

To evaluate the cost of truck pavement damage, the following data from FHWA (http://www.fhwa.dot.gov/policy/hcas/addendum.htm) was used. Although some of the miles between Sayre and Cushing are in urban areas, the figure for rural pavement damage was used, as most of the miles would be made on rural sections of I-40. The $0.127 per VMT cost figure from this source was provided in 2000 dollars. To update the cost to 2011 dollars the CPI was used, taking the factor from the BLS online inflation calculator[4]. The resulting cost figure was $0.167 per mile traveled in 2011$.

Table BCA-4: Source data for truck pavement damage.

Type of Truck	Per VMT Cost in 2000$
Autos/Rural Interstate	0
Autos/Urban Interstate	0.0001
40 kip 4-axle S.U. Truck/Rural Interstate	0.01
40 kip 4-axle S.U. Truck/Urban Interstate	0.031
60 kip 4-axle S.U. Truck/Rural Interstate	0.056
60 kip 4-axle S.U. Truck/Urban Interstate	0.181
60 kip 5-axle Comb/Rural Interstate	0.033
60 kip 5-axle Comb/Urban Interstate	0.105
80 kip 5-axle Comb/Rural Interstate	**0.127**
80 kip 5-axle Comb/Urban Interstate	0.409

Source: According to the "Addendum to the 1997 Federal Highway Cost Allocation Study final Report" FHWA, May 2000.

[3] Crude oil tanker trucks vary, although those most commonly used in the area have a theoretical capacity of 7,800 gallons. However, as with rail tanker cars, space must be left in the tank for product expansion and movement, and the typical capacity of a truck is 7,140 gallons, or about 170 barrels.
[4] http://www.bls.gov/data/inflation_calculator.htm

The annual value (in 2015) of $6.06 million was arrived at by multiplying 36.2 million miles per year by $0.167. Using a seven percent discount rate over the 2013-2037 analysis period, the total pavement benefits are valued at $60.3 million.

Reduced Cost of Oil Shipments
As noted in the application, reduced costs of shipping oil from Sayre to the refineries is a result of a number of factors:

1. Reduced costs to Farmrail of shipping the oil (reflected in a price reduction of $50 per carload)
2. Reduced cost of tank car rental due to faster railcar turnaround times
3. The cost differential between truck-plus-pipeline shipping costs and rail shipping costs

To calculate the per-barrel cost of shipping crude oil by rail, the following assumptions were used. Sources are listed below, with the resulting calculations presented in **Table BCA-5**.

- Farmrail's current price is $350 to bring a rail car to BNSF and back. This price would likely be lowered to $300 per carload if the project were built and if rail traffic on the line grows as projected. (Source: Farmrail)
- BNSF's current price to bring a railcar from Farmrail to Lake Charles Louisiana and back is $2,904, plus a $729 fuel surcharge. (Source: Farmrail)
- The cost to rent a rail tanker car is $1,000 a month ($33 per day) (Source: Farmrail)
- The turnaround time for a rail car (to travel from Sayre to a refinery and then return empty to be loaded with more oil) will be reduced by two days. Current estimates are 22 days without the project and 20 days with the project[5].

Table BCA-5: 2015 Rail Shipper Cost Savings Calculations

	No Build	Build
Farmrail Cost	$350.00	$300.00
BNSF Cost (with fuel surcharge)	$3,633.00	$3,633.00
Tank Car Cost	$ 733.33	$ 666.67
Total Cost per carload	$4,716.00	$4,600.00
Per barrel cost to ship by rail	$7.26	$7.08

These costs were then compared to the costs of shipping by truck and pipeline, using the following assumptions:

- Truck cost - $8 per barrel (the Oklahoma Department of Energy stated that current truck transportation costs are $6-$10 per barrel shipped)
- Pipeline cost -$1 per barrel (the Oklahoma Department of Energy stated that current pipeline costs are $1 to $2 per barrel. New-construction pipeline is forecast to cost $3 per barrel to bring oil to the gulf coast).

[5] With only 15 cars per day traveling between Sayre and Elk City in the No Build, it will take 2-3 days to put together a (cost efficient) 40-car train at Elk City to be brought to BNSF. In the Build scenario, 40 cars could be connected into a single train at Sayre, and head out for BNSF the same day.

The difference of $9.00 minus the rail costs per barrel (Build and No Build) shown in **Table BCA-5**, when multiplied by the "additional capacity" from **Table BCA-2**, leads to an annual savings of $30.2 million per year beginning in 2015. Present value for the 2013-2037 period is $310.9 million.

Emissions Reductions
The 36.2 million truck miles removed from the road each year would remove a substantial volume of pollutants from the air as well, an estimated 47,000 tons of CO, CO_2 , NO_x, SO_x, volatile organic chemicals and particulate matter (PM_{10}). Over the 25-year life of the project, total truck pollutant reductions are an estimated 1.1 million tons. The emissions were calculated using the California Life-Cycle Benefit-Cost Analysis Calculator (CAL B/C)[6] for trucks traveling 60 mph. Factors vary by year, and are presented in **Table BCA-6** (in grams per VMT).

Table BCA-6: Emissions Factors for Trucks Traveling 60 Miles per Hour

Year	Grams of pollutant emitted per VMT (source CAL B/C)					
	CO	CO_2	NO_X	PM_{10}	SO_X	VOC
2012	3.406324	1263.598	8.155018	0.337364	0.012174	0.641098
2013	3.207335	1265.537	7.499747	0.3178	0.012189	0.601309
2014	3.019971	1267.478	6.897128	0.299371	0.012204	0.563989
2015	2.843552	1269.423	6.34293	0.282011	0.012219	0.528985
2016	2.677439	1271.37	5.833264	0.265657	0.012234	0.496154
2017	2.52103	1273.32	5.36455	0.250252	0.012249	0.465361
2018	2.373758	1275.274	4.933498	0.23574	0.012264	0.436478
2019	2.235089	1277.23	4.537082	0.222069	0.012279	0.409389
2020	2.104521	1279.19	4.172519	0.209192	0.012294	0.38398
2021	1.98158	1281.152	3.837249	0.197061	0.012309	0.360149
2022	1.865822	1283.118	3.528919	0.185633	0.012324	0.337796
2023	1.756825	1285.086	3.245363	0.174868	0.012339	0.316831
2024	1.654196	1287.057	2.984592	0.164728	0.012355	0.297167
2025	1.557562	1289.032	2.744774	0.155175	0.01237	0.278724
2026	1.466573	1291.009	2.524226	0.146177	0.012385	0.261425
2027	1.3809	1292.99	2.3214	0.1377	0.0124	0.2452
2028	1.300231	1294.974	2.134871	0.129715	0.012415	0.229982
2029	1.224275	1296.96	1.96333	0.122193	0.01243	0.215708
2030	1.152756	1298.95	1.805573	0.115107	0.012446	0.20232
2031	1.085415	1300.943	1.660491	0.108432	0.012461	0.189764
2032	1.022008	1302.938	1.527068	0.102144	0.012476	0.177986
2033	0.962305	1304.937	1.404365	0.096221	0.012491	0.166939
2034	0.90609	1306.939	1.291522	0.090641	0.012507	0.156578
2035	0.853158	1308.944	1.187745	0.085385	0.012522	0.146861
2036	0.803319	1310.952	1.092308	0.080433	0.012537	0.137746
2037	0.756391	1312.963	1.004539	0.075769	0.012553	0.129197

[6] California Department of Transportation. (2009). California Life-cycle Benefit/Cost Analysis Model, Technical Supplement to User's Guide (Vol. 3). Sacramento: California Department of Transportation.

Values were assigned to the emissions levels using guidance from the TIGER website (http://www.dot.gov/tiger/application-resources.html).

Project emissions impacts also have to account for increased rail emissions. While rail produces a fraction of the emissions per ton-mile as truck travel, the 200-mile Sayre-to-Cushing truck trip used in this analysis must be compared to the much longer 600-mile rail trip between Sayre and Lake Charles, Louisiana. It is assumed that pipeline travel (the other part of the truck trip) produces a negligible level of emissions.

Data on rail emissions was limited, so the most conservative of the following sources was used to assume that rail emissions are 30% of truck emissions per ton-mile.

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

It was assumed that due to the efficiency of rail, the transport of empty railcars returning to Sayre would have very low emissions. Whatever emissions are produced from the return trip should be accounted for by the use of the most conservative of the above figures rather than the average.

Calculation of rail emissions required calculating the emissions that would be produced by the trucks that would be required to transport the oil between Sayre and Lake Charles Louisiana. For 2015, the 295,750 barrels of "additional capacity" would require 1,800 trucks per week, or 96,000 trucks per year. Multiplied by 600 miles yields 57.8 million truck miles traveled. Applying the emissions factors in **Table BCA-6** yields approximately 75,000 tons of emissions annually. Applying the assumed 30% emissions savings from rail travel, rail emissions would then be in the range of 22,000 tons per year.

Cumulative additional (Build vs. No Build) rail emissions over the 25-year analysis period are shown in **Table BCA-7**.

Table BCA-7: Rail Emissions Calculations (2013-2037 Totals) in Tons*

Pollutant	CO (metric tons)	CO_2 (long tons)	NO_X (metric tons)	PM_{10} (metric tons)	SO_X (metric tons)	VOC (metric tons)	TOTAL
Truck-equivalent	2,238	1,786,113	4,209	223	17	404	1,793,205
Rail	672	535,834	1,263	67	5	121	537,961

* All figures are in metric tons except for CO_2 which is in long tons.

The net emissions reduction (Truck minus Rail, or Build minus No Build) is thus in the range of 25,000 tons per year. Using TIGER guidance to evaluate emissions reductions, the total reduction over the total analysis period is presented in **Table BCA-8**. The present value of the net emissions reductions over the life of the project is $27.4 million. The net emissions savings is shown in **Table BCA-8**.

Table BCA-8: New Emissions Reductions (2013-2037 Totals)

Pollutant	CO	CO_2	NO_X	PM_{10}	SO_X	VOC	TOTAL
Truck Emissions (No Build) tons*	1,400	1,117,363	2,633	139	11	253	1,121,799
Rail Emissions (Build) tons*	672	535,834	1,263	67	5	121	537,961
Net Savings, tons*	729	581,529	1,370	73	5	132	583,838
Value per ton	*$ 0*	*varies*	*$ 4,370*	*$ 183,560*	*$ 17,482*	*$ 1,857*	
Value (in thousands of 2011$)	$ 0	$48,446	$5,989	$13,314	$96	$244	$68,089

* All pollutant emissions are in metric tons except for CO_2 which is in long tons.

Safety Benefits

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

Reduced Truck Accidents

The reduced truck miles traveled 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 is $129,540 in 2011 dollars, as shown in **Table BCA-9**.

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 Notice of Funding Availability (NOFA). The MAIS values are also from the NOFA, which cites the original source as *Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses – 2011 Revisions* (http://ostpxweb.dot.gov/policy).

Table BCA-9: Calculation of Safety Costs per Million Vehicle Miles Traveled (VMT)

	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	$5,129	$42,009	$81,036	$296,628	$6,200,000	
Cost of accidents per million VMT	$4,807	$10,870	$15,502	$18,371	$79,990	**$129,540**

* 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 truck VMT removed from the roadway, the annual savings for the analysis years is shown in **Table BCA-10**. The present value of the truck related safety benefits is calculated to be $46.7 million using a 7% discount rate.

As noted in the grant application, the true accident costs might be larger, as these trucks are filled with hazardous crude oil.

Rail Safety Impact

An attempt was made to calculate increased rail accidents expected from the substantial growth in rail freight volumes expected to result from the project. Currently, the accident rate for Farmrail, on all of its lines in this part of Oklahoma, is very low – two accidents in the past six years, during which over 31,000 carloads were shipped, mostly on 25mph track. Both of these accidents were property damage only (no injuries or deaths) and fault was placed on 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 railcar traffic.

Interestingly, while carload traffic is set to grow substantially with the project in place, train traffic will not grow much, and will actually decrease between Sayre and Elk City. For example, in 2015, with 560 rail cars shipped each week, at 40 cars per train, the rail traffic is just 14 trains per week—about two trains per day. Once the railcars are added to BNSF or other Class I trains, which are often 100 railcars long, the increase is less than one additional train per day.

In the No Build, the 105 railcars per week require 21 trains per week (three per day) between Sayre and Elk City. There is a speed differential that might increase the potential severity of accidents in the Build (25 mph vs. today’s 10 mph train speed), but with the improved safety equipment at three of the grade crossings that are included in the project (in addition to the reduced number of trains per day), it was assumed that overall there would be no increase in rail accident costs resulting from the project.

Table BCA-10: Calculation of Safety Benefits

Year	Truck VMT Removed from Roadway	Millions of Truck VMT	Value of Accident Reduction	Present Value DR = 3% in 2011 $	Present Value DR = 7% in 2011 $
2012	-	-	-	$0	$0
2013	8,549,412	8.5	$1,107,488	$1,043,914	$967,323
2014	24,256,471	24.3	$3,142,176	$2,875,536	$2,564,951
2015	36,185,882	36.2	$4,687,508	$4,164,790	$3,576,078
2016	36,185,882	36.2	$4,687,508	$4,043,486	$3,342,129
2017	36,185,882	36.2	$4,687,508	$3,925,714	$3,123,485
2018	36,185,882	36.2	$4,687,508	$3,811,373	$2,919,145
2019	36,185,882	36.2	$4,687,508	$3,700,362	$2,728,172
2020	36,185,882	36.2	$4,687,508	$3,592,585	$2,549,694
2021	36,185,882	36.2	$4,687,508	$3,487,946	$2,382,892
2022	36,185,882	36.2	$4,687,508	$3,386,356	$2,227,001
2023	36,185,882	36.2	$4,687,508	$3,287,724	$2,081,310
2024	36,185,882	36.2	$4,687,508	$3,191,965	$1,945,149
2025	36,185,882	36.2	$4,687,508	$3,098,995	$1,817,897
2026	36,185,882	36.2	$4,687,508	$3,008,733	$1,698,969
2027	36,185,882	36.2	$4,687,508	$2,921,100	$1,587,821
2028	36,185,882	36.2	$4,687,508	$2,836,020	$1,483,945
2029	36,185,882	36.2	$4,687,508	$2,753,417	$1,386,865
2030	36,185,882	36.2	$4,687,508	$2,673,220	$1,296,135
2031	36,185,882	36.2	$4,687,508	$2,595,360	$1,211,341
2032	36,185,882	36.2	$4,687,508	$2,519,767	$1,132,095
2033	36,185,882	36.2	$4,687,508	$2,446,375	$1,058,032
2034	36,185,882	36.2	$4,687,508	$2,375,122	$988,815
2035	36,185,882	36.2	$4,687,508	$2,305,943	$924,126
2036	36,185,882	36.2	$4,687,508	$2,238,780	$863,670
2037	36,185,882	36.2	$4,687,508	$2,173,573	$807,168
TOTAL	**865,081,176**	**865**	**$112,062,354**	**$74,458,157**	**$46,664,207**

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 shippers. While the benefits of reduced Farmrail costs for crude oil shippers is accounted for in the BCA, the impact of this cost reduction for other shippers, such as the county's 1,000+ farms and other businesses was not. While existing agricultural shipping is minimal – a dozen or so railcars per year – there is likely to be massive growth in the shipment of fracking sands and other oil extraction supplies, based on the construction of a fracking sand intermodal facility at Elk City. Further, agricultural shipments may increase once rail transportation costs drop.

  Freight transportation cost savings would improve the cost efficiency of all existing and future businesses, allowing them to be more competitive and make their products cheaper for a wider domestic or international market. Rail is already being used to ship oil extraction supplies into Beckham County, and could be used to ship oil drilling equipment and possibly wind turbine components, which are difficult to ship by truck.

- As stressed 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 105 carloads per week, 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 were in place. These benefits are not just the jobs of those drilling and monitoring the wells, but jobs at restaurants and grocery stores that will serve these new employees, the teachers that educate their children, the builders who construct their homes, etc.

- The project, by increasing the number of cars that each train can pull (as well as increasing train speeds) will reduce Farmrail labor and fuel costs per carload. It will also enable the operation to become profitable, as annual operating and maintenance costs will be divided by hundreds of cars per week instead of about 50 today. The exact benefit is difficult to calculate, so in the above analysis it was assumed that reduced costs to Farmrail would be reflected in a $50 reduction in the current price to move a railcar from Sayre to Clinton. However, the true operating cost savings to Farmrail will exceed that $50 per carload assumption.

  The reason it is difficult to calculate is that the Sayre-to-Clinton line is part of an integrated regional rail network both within Farmrail Corporation (which operates state-owned rail lines), and with Grainbelt Corporation, which owns and operates more profitable lines in the area. Farmrail and Grainbelt are owned by the same holding company. A rough cost estimate showed cost savings of as much as $112 per rail car shipped on the network based on more efficient operations and higher traffic densities on their rail lines, but this figure was considered too unreliable to use in the BCA, and savings for just the Sayre-to-Clinton segment could not be isolated.

- The Sayre-to-Elk City segment of the rail system has been subsidized by other segments because of its very low usage. Once it becomes profitable, the revenues remaining after cost reductions will be used to improve maintenance on other Farmrail and Grainbelt lines. The portion of the revenue that is forwarded to ODOT (which owns the Sayre-to-

Clinton segment) will similarly be used to improve the condition of other rail lines in the state, thus strengthening the entire state rail network.

Public Benefits
As noted in the application, much of the value of this project will accrue to businesses involved in the oil extraction industries (shipping, drilling, fracking chemical suppliers). For this reason, a separate analysis was done to show that the purely public benefits of this project greatly exceed the project costs on their own.

The benefits of the reduced pavement damage to highways, reduced emissions, and avoided accidents each individually exceed the project cost within four years of project completion. Taken together, the Present Value of these three benefit categories on their own provide a benefit cost ratio of 17.1 to 1.0 at a seven percent discount rate.

The years shown in Exhibit 18 in the grant application were obtained by adding a cumulative total column of the benefits before present value calculations were applied. The year where this total exceeded the $8,456,580 undiscounted project cost was the year entered into the table. The 17.1 benefit cost ratio was calculated as per **Table BCA-8.**

This analysis was done to highlight the public benefits of this project, or perhaps better stated, to highlight the cost in pavement damage, air pollution and traveler safety should this project *not* be implemented.

Table BCA-11: PUBLIC SECTOR BCA

Category	**Present Value at 7%**	**Present Value at 3%**
Construction Cost	**$7,840**	**$8,181**
Evaluated Benefits		
Rail Maintenance Cost Savings		
Reduced Cost of Oil Shipments		
Reduced Damage to Roadway	$60,279	$96,182
Emissions Savings	$27,447	$44,532
Net Safety Benefits	$46,664	$74,458
Total Evaluated Benefits	**$134,390**	**$215,172**
NET PRESENT VALUE	**$126,550**	**$206,991**
BENEFIT/COST RATIO	**17.14**	**26.30**