

OKLAHOMA
Freight Railway Grade Separation Project
Claremore, Oklahoma

TIGER II Grant Application
Benefit Cost Analysis Technical Memo
August 20, 2010

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 economic benefits and impacts on local and regional economic well being and competitiveness are described in **Section IV** of the 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 four of the five major long term impact areas identified in the TIGER grant application guidelines. These include:

- Safety – eliminating at grade railroad crossings in downtown Claremore, a relatively high traffic area, will yield measurable safety benefits in terms of reduced fatalities, injuries, and other collisions.
- Long Term Economic Competitiveness – reducing rail freight rail delays for two major Class I railroads serving the Tulsa metropolitan area, northeastern Oklahoma and the wider Oklahoma, Arkansas, Kansas and Missouri regions 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 retain and create permanent jobs and improve the competitive position of domestic manufacturers and agricultural enterprises. The rail improvement will make the proposed transmodal facility in north Claremore more efficient, and will improve freight rail efficiency at the Claremore North Business Park as well, if that development proceeds to add rail access as planned.
- Sustainability – reducing idling at public railroad crossings will reduce fuel consumption and vehicle emissions at the crossings.
- Livability – the City of Claremore, an important tourism and employment center in the Tulsa metropolitan area, will benefit greatly from fewer and less lengthy traffic back-ups within the central core of the city, better emergency response times, and elimination of a major development barrier within the city itself.

Given the caveats above, the computed benefit-cost ratio for the Claremore Freight Railway Grade Separation Project is 2.80 using a three percent discount rate, and 2.03 using a discount rate of seven percent. The cost-benefit analysis, summarized in **Table 1**, compares

the project's capital construction and maintenance costs to the quantifiable benefits of the project including:

- a. Maintenance cost savings
- b. Travel delay savings for vehicles
- c. Fuel cost savings for vehicles
- d. Travel delay savings for rail traffic
- e. Safety benefits
- f. Emissions reduction benefits from reduced vehicle idling at rail crossings
- g. Savings resulting from avoiding more expensive capital projects needed to provide alternatives to traveling on delay-afflicted roads through Claremore.

**Table 1: Calculation of Benefit Cost Ratio and Net Present Value
(in thousands of \$2010)**

Category	Present Value at 3%	Present Value at 7%
Costs		
Construction Cost	\$60,209	\$54,764
Maintenance Costs	\$1,080	\$714
TOTAL COSTS	\$61,288	\$55,479
Evaluated Benefits		
Maintenance Costs Avoided (for existing BNSF grade crossings)	\$2,032	\$1,342
Vehicle Travel Time Savings	\$11,164	\$7,289
Vehicle Fuel Cost Savings	\$2,004	\$1,294
Rail Travel Time Savings	\$8,084	\$5,228
Safety Benefits	\$16,290	\$10,695
Emissions Savings	\$314	\$205
Avoided Construction Costs of SH 20 Bypass	\$131,809	\$86,790
TOTAL EVALUATED BENEFITS	\$171,697	\$112,843
NET PRESENT VALUE	\$110,409	\$57,365
BENEFIT/COST RATIO	2.80	2.03

Discount Rates

As required by the Federal Register guidelines for TIGER II 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 benefit cost ratios would undoubtedly fall somewhere between those computed at seven percent and three percent had this been done.

Project Costs

The project is expected to cost \$64.8 million, the bulk of which will be spent in 2012 and 2013. NEPA is scheduled for completion in mid-March 2011, and final design will commence immediately thereafter.

Because the bulk of the construction work will occur in 2012 and 2013, the project construction costs have a present value in 2010 dollars of \$60.2 million using a three percent discount rate and a present value of \$54.8 million using a seven percent discount rate.

Table 2: Project Capital Costs

Uses of Funds (in thousands of 2010\$)	Calendar Year				Total
	2010	2011	2012	2013	
Engineering & Environmental Studies	\$ 904	\$ 503	\$ 0	\$ 0	\$ 1,407
Final Design		\$ 675	\$ 215	\$ 0	\$ 890
Easement Acquisition and Utilities Relocation		\$ 1,695	\$ 288	\$ 0	\$ 1,983
Construction Management			\$ 1,605	\$ 1,403	\$ 3,007
Construction			\$ 21,300	\$ 36,244	\$ 57,544
TOTAL	\$ 904	\$ 2,873	\$ 23,408	\$ 37,647	\$ 64,831

Source: ODOT

Maintenance Cost Savings

The annual operating and maintenance cost for the new overpass structure will be less than the annual upkeep on the existing crossings.

Maintenance Costs for Current Crossings

To ensure safety, the existing at-grade vehicular crossings require maintenance and upkeep of \$15,450 per year per crossing. The diamond interchange sees a lot of use during the course of the year, and to maintain a state of good repair requires maintenance of \$ 126,072 every two years (an average of \$63,036 annually).

Maintenance Costs for Proposed Crossings

In comparison, the project provides six overpass structures (five vehicular underpasses and one over the UPRR). Each of the bridges costs \$10,300 annually to maintain.

Track Maintenance Costs

Track maintenance costs with and without the project are shown in **Table 3** below. Per-mile track maintenance costs for both projects are similar, however the segments of track that lie on an overpass in the Build Alternative are included in the overpass maintenance costs in the table. This makes it appear that there is less track to maintain in the Build alternative.

Table 3: Annual Maintenance Savings

	Vehicular Crossings	BNSF-UPRR Crossing	Track Maintenance	TOTAL Annual Maintenance Costs
No Build	\$ 77,250	\$ 63,036	\$ 30,900	\$ 171,186
Build	\$ 51,500	\$ 10,300	\$ 27,810	\$ 89,610
Annual Savings starting in 2013				\$ 81,576
Present Value 2013-2030 at 3% discount rate				\$952,193
Present Value 2013-2030 at 7% discount rate				\$628,104

Source: ODOT

As shown in **Table 3**, the above costs, when combined with track maintenance costs, result in an annual maintenance savings of \$81,576 per year. The present value of this savings is \$952,193 using a three percent discount rate and \$628,105 using a seven percent discount rate.

Travel Time Savings for Vehicles

One of the major advantages of the proposed BNSF overpass is the travel time savings that auto and truck drivers will experience, resulting from two benefits of the project:

- 1) Removal of train-related delays at the five BNSF intersections that are to be grade-separated, and at one intersection scheduled for closure.
- 2) Reduced delay times for vehicles at the eight UPRR intersections, which will remain at-grade. The savings at these intersections will result from the UPRR trains being able to run at higher speeds, and from the fact that there will no longer be a stop order for UPRR trains if BNSF trains are in the vicinity.

The average delay time for vehicles stopped at the BNSF crossings is estimated at 185 seconds (3.1 minutes). This will be eliminated by the overpass project. For the UPRR crossings, the current average delay of 194 seconds (3.2 minutes) will be reduced to approximately 120 seconds (two minutes).

As shown in **Tables 4 and 5**, travel time savings for the first full year of project operation (2014) are estimated at 43,200 hours at the BNSF crossings, and 29,300 hours for the UPRR crossings, a total savings of 72,500 hours. With traffic growth rates of 1.2 percent per year, and the effect of additional traffic compounding delays at the crossings, annual travel time savings is projected to reach 91,600 hours by 2030.

Table 4: Travel Time Savings at the BNSF Vehicular Crossings

Year	Sum ADT	No Build			Build	BNSF Crossings Annual Benefit (hours)
		Avg % Vehicles Delayed	Average** Delay Per Vehicle (seconds)	Total Annual Vehicle Delay (hours)	Total Annual Vehicle Delay (hours)	
2010	48,600	4.49%	185	40,850	40,850	-
2011	49,047	4.50%	185	41,432	41,432	-
2012	49,494	4.51%	186	42,019	42,019	-
2013	49,940	4.52%	186	42,611	42,611	-
2014	50,387	4.53%	187	43,207	-	43,207
2015	50,834	4.55%	187	43,808	-	43,808
2016	51,281	4.56%	187	44,415	-	44,415
2017	51,728	4.57%	188	45,026	-	45,026
2018	52,174	4.58%	188	45,642	-	45,642
2019	52,621	4.59%	189	46,264	-	46,264
2020	53,068	4.60%	189	46,890	-	46,890
2021	53,515	4.61%	190	47,521	-	47,521
2022	53,962	4.63%	190	48,158	-	48,158
2023	54,408	4.64%	191	48,800	-	48,800
2024	54,855	4.65%	191	49,447	-	49,447
2025	55,302	4.66%	192	50,099	-	50,099
2026	55,749	4.67%	192	50,757	-	50,757
2027	56,196	4.68%	193	51,420	-	51,420
2028	56,642	4.70%	193	52,088	-	52,088
2029	57,089	4.71%	194	52,762	-	52,762
2030	57,536	4.72%	194	53,441	-	53,441
TOTAL	1,114,428	5.12%	5.12%	986,657	166,912	819,745

Source: ODOT

Table 5: Travel Time Savings at the UPRR Vehicular Crossings

Year	Sum ADT	No Build			Build			UPRR Crossings Annual Benefit (hours)
		Avg % Vehicles Delayed	Average Delay Per Vehicle (seconds)	Total Annual Vehicle Delay (hours)	Avg % Vehicles Delayed	Average Delay Per Vehicle (seconds)	Total Annual Vehicle Delay (hours)	
2010	63,100	4.4897%	193.58	55,601				
2011	63,939	4.5009%	194.06	56,622				
2012	64,777	4.5121%	194.54	57,652				
2013	65,616	4.5234%	195.03	58,690				
2014	66,454	4.5347%	195.52	59,738	3.75%	120.42	30,466	29,272
2015	67,293	4.5461%	196.01	60,795	3.76%	120.72	31,005	29,790
2016	68,132	4.5574%	196.50	61,861	3.77%	121.02	31,548	30,312
2017	68,970	4.5688%	196.99	62,936	3.78%	121.32	32,096	30,839
2018	69,809	4.5802%	197.48	64,020	3.79%	121.63	32,649	31,370
2019	70,647	4.5917%	197.97	65,113	3.80%	121.93	33,207	31,906
2020	71,486	4.6032%	198.47	66,216	3.81%	122.24	33,769	32,446
2021	72,325	4.6147%	198.97	67,328	3.82%	122.54	34,337	32,991
2022	73,163	4.6262%	199.46	68,450	3.83%	122.85	34,909	33,541
2023	74,002	4.6378%	199.96	69,581	3.84%	123.16	35,485	34,095
2024	74,840	4.6494%	200.46	70,722	3.85%	123.46	36,067	34,654
2025	75,679	4.6610%	200.96	71,872	3.86%	123.77	36,654	35,218
2026	76,518	4.6727%	201.46	73,032	3.87%	124.08	37,246	35,787
2027	77,356	4.6843%	201.97	74,202	3.88%	124.39	37,842	36,360
2028	78,195	4.6960%	202.47	75,382	3.89%	124.70	38,444	36,938
2029	79,033	4.7078%	202.98	76,572	3.90%	125.02	39,051	37,521
2030	79,872	4.7196%	203.49	77,772	3.91%	125.33	39,663	38,109
TOTAL	1,501,206	5.12%	5.12%	1,394,155	5.12%	5.12%	594,438	571,152

Source: ODOT

Table 6 shows the valuation of these travel time savings. The assumptions used are as follows:

Traffic Composition

- Truck traffic is assumed to make up 11 percent of the traffic on Lynn Riggs Boulevard, eight percent at Will Rogers, Blue Starr and Patti Page, and four percent of the traffic stream at the remaining crossings (Jim Davis, Seventh Street, Sixth Street, Cherokee, First Street and Archer)
- Business-related trips (truck, plus work-related car travel) make up 30 percent of total traffic on each crossing
- Non-business-related auto trips make up 70 percent of total traffic

Value of Time

- The hourly rate of time for trucks is based on the average of the Bureau of Labor Statistics (BLS) Tulsa metropolitan area hourly wage rates for heavy-duty and light-duty truck drivers (\$15.61)
- The hourly rate of time for auto business trips is based on the average Tulsa metropolitan area hourly wage from BLS (\$17.85)

Table 6: Value of Travel Time Savings at the BNSF and UPRR Vehicular Crossings

Year	Total Annual Benefit - All Vehicles (Hours)	Benefit - Trucks Hours/Year	Benefit - Auto Business Trips Hours/Year	Benefit - Auto Personal Trips Hours/Year	Value of Annual Truck Time Savings (at \$15.61/hr)	Value of Annual Auto Business Trip Time Savings (at \$17.85/hr)	Value of Annual Auto Personal Trip Time Savings (at \$8.93/hr)	Value of Annual Travel Time Savings	Present Value (3%) Discount Rate	Present Value (7%) Discount Rate
2010	-	-	-	-	-	-	-	\$0	\$0	\$0
2011	-	-	-	-	-	-	-	\$0	\$0	\$0
2012	-	-	-	-	-	-	-	\$0	\$0	\$0
2013	-	-	-	-	-	-	-	\$0	\$0	\$0
2014	72,479	5,314	16,430	50,736	82,954	293,269	453,069	\$829,292	\$736,815	\$632,663
2015	73,599	5,393	16,687	51,519	84,180	297,860	460,064	\$842,105	\$726,407	\$600,409
2016	74,727	5,472	16,946	52,309	85,417	302,489	467,119	\$855,025	\$716,070	\$569,739
2017	75,865	5,552	17,208	53,106	86,664	307,157	474,232	\$868,054	\$705,807	\$540,580
2018	77,013	5,632	17,471	53,909	87,921	311,864	481,405	\$881,191	\$695,620	\$512,861
2019	78,170	5,714	17,737	54,719	89,189	316,611	488,638	\$894,439	\$685,513	\$486,515
2020	79,336	5,795	18,005	55,535	90,467	321,397	495,932	\$907,796	\$675,486	\$461,478
2021	80,513	5,878	18,276	56,359	91,756	326,224	503,286	\$921,266	\$665,542	\$437,687
2022	81,699	5,961	18,548	57,189	93,055	331,090	510,701	\$934,847	\$655,683	\$415,083
2023	82,895	6,045	18,823	58,027	94,365	335,998	518,178	\$948,541	\$645,910	\$393,611
2024	84,101	6,130	19,101	58,871	95,686	340,946	525,717	\$962,349	\$636,226	\$373,216
2025	85,317	6,215	19,380	59,722	97,018	345,935	533,319	\$976,271	\$626,631	\$353,846
2026	86,543	6,301	19,662	60,580	98,361	350,965	540,983	\$990,309	\$617,128	\$335,452
2027	87,780	6,388	19,946	61,446	99,714	356,037	548,711	\$1,004,463	\$607,717	\$317,987
2028	89,026	6,475	20,233	62,318	101,079	361,152	556,503	\$1,018,733	\$598,399	\$301,406
2029	90,283	6,563	20,521	63,198	102,455	366,308	564,359	\$1,033,122	\$589,175	\$285,667
2030	91,550	6,652	20,813	64,085	103,842	371,507	572,279	\$1,047,629	\$580,047	\$270,727
TOTAL	1,390,897	101,481	315,788	973,628				\$15,915,432	\$11,164,176	\$7,288,928

Source notes:

1. Calculations are based on delay estimates from ODOT Traffic Department
2. Travel time values are based on wage rates for the Tulsa metropolitan area from the Bureau of Labor Statistics.

- The hourly rate of time for personal auto trips, following TIGER guidance, is based on half of the average hourly wage (\$17.85 divided by two = \$8.93)

Based on these assumptions, the present value of auto travel time savings from 2014 (the opening year) to 2030 is \$11.2 million using the three percent discount rate, and \$7.3 million using the seven percent rate.

As noted in the application, there would be some interference with vehicular traffic during the project's construction years. This impact was not calculated as it was assumed that the delay from construction activities will be minor – detours for a blocked intersection would be only a short distance away given that most of the BNSF public rail crossings are less than 1,000 feet apart. Further, construction could be done in off-peak periods to minimize delays. Additional work, such as removing the old crossings and re-paving roadways would be done one lane at a time to reduce the interference with traffic flow.

Vehicle Operator Cost Savings from Fuel Savings

In addition to travel time savings, vehicle operators will benefit from reduced fuel usage due to reduced delay and less time spent idling at rail crossings (**Table 7**). Assuming that .01 gallons of fuel is used for every minute of delay (based on the Texas Transportation Institute Urban Mobility Report <http://mobility.tamu.edu/ums/report/>), an estimated 43,500 gallons of fuel will be saved in the first year of operation, growing to 54,900 gallons in 2030. At an average cost of \$3.19 per gallon for all the vehicle types, the present value of this savings is \$2.0 million using the three percent discount rate, and \$1.3 million using the seven percent rate.

The \$3.19 average fuel costs were based on projections from the Energy Information Agency's December 2009 *Annual Energy Outlook 2010*.

Travel Time Savings for Rail Traffic

With the removal of the at-grade diamond interchange as well as the removal of six at-grade auto crossings, trains traveling on both rail lines will be able to travel at faster speeds, and without stop requirements. The result will be shorter travel times for both BNSF and UPRR trains, amounting to a conservatively estimated 400 hours in the first year of operation.

The assumed value of an hour of train time is \$1,339 based on Aggregate Association of American Railroads (AARR) Class I Railroad data from 2006, escalated to 2010 dollars. The value of train time savings was developed based on the hourly variable costs to railroads of running trains. There would be additional value for the train's customers (those shipping and receiving the coal, grain, and other commodities carried), however, these benefits were not assessed for this analysis because many of the shipped items – while vital for regional ranching and power generation – are not considered to be items with a high time value of shipping.

Table 7: Gallons and Value of Vehicular Fuel Savings from Reduced Delay

2010	-	-	\$2.536	\$0	\$0	\$0
2011	-	-	\$2.568	\$0	\$0	\$0
2012	1,207	724	\$2.711	\$1,964	\$1,851	\$1,715
2013	1,208	725	\$2.946	\$2,135	\$1,954	\$1,743
2014	72,479	43,488	\$3.058	\$133,001	\$118,169	\$101,466
2015	73,599	44,159	\$3.114	\$137,509	\$118,616	\$98,042
2016	74,727	44,836	\$3.187	\$142,873	\$119,654	\$95,202
2017	75,865	45,519	\$3.253	\$148,065	\$120,390	\$92,207
2018	77,013	46,208	\$3.308	\$152,840	\$120,653	\$88,954
2019	78,170	46,902	\$3.347	\$156,978	\$120,311	\$85,386
2020	79,336	47,602	\$3.394	\$161,561	\$120,217	\$82,130
2021	80,513	48,308	\$3.422	\$165,308	\$119,422	\$78,537
2022	81,699	49,019	\$3.466	\$169,896	\$119,162	\$75,436
2023	82,895	49,737	\$3.494	\$173,799	\$118,349	\$72,120
2024	84,101	50,461	\$3.509	\$177,088	\$117,076	\$68,678
2025	85,317	51,190	\$3.550	\$181,702	\$116,628	\$65,857
2026	86,543	51,926	\$3.588	\$186,297	\$116,094	\$63,105
2027	87,780	52,668	\$3.623	\$190,800	\$115,437	\$60,402
2028	89,026	53,416	\$3.674	\$196,267	\$115,286	\$58,068
2029	90,283	54,170	\$3.720	\$201,529	\$114,929	\$55,725
2030	91,550	54,930	\$3.739	\$205,369	\$113,708	\$53,071
TOTAL	1,393,312	835,987			\$2,007,906	\$1,297,844

Source Notes:

1. Time savings are based on ODOT estimates of traffic and time delays.
2. Formula used to calculate fuel savings is based on information from the Texas Transportation Institute Urban Mobility Report (<http://mobility.tamu.edu/ums/report/>).
3. Fuel costs are from the Energy Information Agency's December 2009 *Annual Energy Outlook 2010*.

As **Table 8** shows, the assumed delay for trains on the BNSF railroad totals 25 minutes a day (0.41 hours). The reduction in delay for trains on the UPRR railroad would be 44 minutes (0.73 hours) per day once the project is in place. Using an annualization factor of 365, and a value of \$1,339 per train, in 2014 (the first full year of operation after the project is constructed) the value of the improvement to the BNSF is \$202,000 and the value to the UPRR is estimated at around \$355,000. Assuming a slight increase over time (0.2% annually for BNSF and 3.6% annually for UPRR), the present value for 2014-2030 is \$8.1 million using the three percent discount rate, and \$5.2 million using the seven percent rate.

It is likely that these values are underestimated because of the lack of adequate information on the true value of shipments, and the future growth of train traffic. In future years the planned transload facility in north Claremore may greatly increase both the number of trains going through Claremore, and the value of the goods they are carrying.

Table 8: Rail Travel Time Savings for BNSF and UPRR

Year	BNSF					UPRR				
	Delay (hrs)	Annual Delay (hrs)	Base Annual Benefit (\$)	DR = 3%	DR = 7%	Delay (hrs)	Annual Delay (hrs)	Base Annual Benefit (\$)	DR = 3%	DR = 7%
				2010 - \$	2010 - \$				2010 - \$	2010 - \$
2010										
2011										
2012										
2013										
2014	0.41	150.85	\$201,989	\$179,465	\$154,097	0.73	264.89	\$354,693	\$315,140	\$270,594
2015	0.41	151.15	\$202,393	\$174,586	\$144,304	0.75	274.43	\$367,462	\$316,976	\$261,996
2016	0.41	151.45	\$202,798	\$169,840	\$135,133	0.78	284.31	\$380,691	\$318,823	\$253,670
2017	0.42	151.76	\$203,204	\$165,223	\$126,545	0.81	294.55	\$394,396	\$320,680	\$245,610
2018	0.42	152.06	\$203,610	\$160,732	\$118,503	0.84	305.15	\$408,594	\$322,548	\$237,805
2019	0.42	152.37	\$204,017	\$156,362	\$110,972	0.87	316.13	\$423,303	\$324,427	\$230,249
2020	0.42	152.67	\$204,425	\$152,112	\$103,919	0.90	327.51	\$438,542	\$326,317	\$222,933
2021	0.42	152.98	\$204,834	\$147,977	\$97,315	0.93	339.31	\$454,330	\$328,218	\$215,849
2022	0.42	153.28	\$205,244	\$143,954	\$91,131	0.96	351.52	\$470,686	\$330,130	\$208,990
2023	0.42	153.59	\$205,654	\$140,041	\$85,339	1.00	364.18	\$487,630	\$332,053	\$202,349
2024	0.42	153.90	\$206,066	\$136,234	\$79,916	1.03	377.29	\$505,185	\$333,987	\$195,920
2025	0.42	154.20	\$206,478	\$132,530	\$74,837	1.07	390.87	\$523,372	\$335,932	\$189,694
2026	0.42	154.51	\$206,891	\$128,927	\$70,081	1.11	404.94	\$542,213	\$337,889	\$183,666
2027	0.42	154.82	\$207,304	\$125,423	\$65,627	1.15	419.52	\$561,733	\$339,858	\$177,830
2028	0.43	155.13	\$207,719	\$122,013	\$61,457	1.19	434.62	\$581,955	\$341,837	\$172,180
2029	0.43	155.44	\$208,134	\$118,696	\$57,551	1.23	450.27	\$602,906	\$343,829	\$166,708
2030	0.43	155.75	\$208,551	\$115,469	\$53,893	1.28	466.48	\$624,610	\$345,832	\$161,411
TOTAL				\$2,469,583	\$1,630,619				\$5,614,474	\$3,597,454

Source: ODOT Rail Division

Safety Benefits

The project will result in the elimination of all accidents at the grade crossings that are being closed or separated. As noted in the grant application, in the 11 years between 1999 and 2008, there have been ten accidents – two involved fatalities, four involved injuries and the remaining three accidents were property damage only.

The benefit cost analysis assumes that without the overpass, accidents will occur at the same rate (ten accidents every 11 years under current traffic levels) and at the same average severity (two out of ten accidents will be fatal, five will involve injuries). Furthermore, because Claremore is a growing city, the safety benefits are expected to grow at the same rate as traffic along these five roads. The forecasted traffic growth along the BNSF crossings averages approximately 1.0% per year. While additional safety benefits would likely result from reduced interference with the safe operation of intersections upstream of the BNSF rail crossings, this analysis only quantifies the benefits of removing all rail-vehicle crashes at the existing BNSF at-grade public railroad crossings.

Valuation

Guidance for the TIGER grant suggests a valuation of \$6.49 million for each fatal accident avoided based on the Employment Cost Index and the Consumer Price Index (CPI-U). Injuries are valued based on level of severity as shown in **Table 9**.

**Table 9: Relative Values of Injuries by Severity Level
(MAIS – Max. Abbreviated Injury Scale)**

MAIS Level	Severity	Fraction of assumed value of a statistical life	Resulting dollar value of injuries and fatalities
MAIS 1	Minor	0.0020	\$13,000
MAIS 2	Moderate	0.0155	\$101,000
MAIS 3	Serious	0.0575	\$373,000
MAIS 4	Severe	0.1875	\$1,212,000
MAIS 5	Critical	0.7625	\$4,950,000
MAIS 6	Fatal	1.0000	\$6,490,000

Source: *Treatment of the Economic Value of a Statistical Life in Departmental Analysis, USDOT, 3/18/09*, inflated to 2010 dollars.

For this analysis, as no data is available on the severity levels of past accidents, it is assumed that the average injury accident is valued at \$101,000. The property damage only crashes are valued at \$7,892, based on 2007 data from the National Safety Council, inflated to 2010 dollars.

These assumptions result in an expected annual savings of \$1.2 million in the first year of operation, which will grow at a rate of 1% annually (based on traffic growth). As shown in **Table 10** the resulting present value of the avoided accidents for 2014-2030 is \$16.3 million using the three percent discount rate, and \$10.7 million using the seven percent rate.

Table 10: Valuation of Safety Benefits

Injury Type >	PDO	INJURIES	FATALITIES	TOTAL
Blue Starr Dr.	2	2	0	4
Sixth St.	0	2	1	4
Will Rogers Blvd.	0	0	1	4
First St.	0	0	0	4
Archer Dr.	1	1	0	4
Number of Incidents	3	5	2	4
Value of Crash Type	\$ 7,892	\$ 101,000	\$ 6,490,000	
Total 11-Year Cost of Crashes	\$ 23,676	\$ 505,000	\$ 12,980,000	\$ 13,508,676
Annual Average Crash Cost	\$ 2,152	\$ 45,909	\$ 1,180,000	\$ 1,228,061
			Present Value 2014-2030 (3%)	\$ 16,290,198
			Present Value 2014-2030 (7%)	\$ 10,694,728

Source: State and local crash data 1999-2008.

Emissions Reduction Benefits

As vehicular idling and delays are reduced, and speed increases, the amount of vehicle emissions will be substantially reduced. An estimate of these emissions was developed by using the following formulas derived from MOBILE6 Vehicle Emissions Modeling Software:

- Volatile organic compound (VOC) emissions are reduced by 23.59 grams per hour
- Nitrogen oxides (NOx) emissions are reduced by 5.8 grams per hour
- Carbon monoxide (CO) emissions are reduced by 324.64 grams per hour
- Carbon dioxide (CO₂) emissions are reduced by 13.2 pounds per hour
- Particulate matter (PM₁₀) emissions are reduced by around one gram per hour of truck travel.

The reduction in emissions of these compounds in 2014 is estimated at 1.4 tons, as shown in **Table 12**. Because of growing traffic, by 2030 the annual emissions savings are an estimated 1.8 tons per day.

Table 11: Emissions Reduction Calculations

Year	Total Daily Auto & Truck Time Savings (hours)	Total Daily Truck Time Savings (hours)	Estimated Idling (Pounds/Day)						
			VOC	NOX	CO	CO ₂	PM	PM	TOTAL
			23.59 grams/hr	5.8 grams/hr	324.64 grams/hr	13.2 lbs/hr	Emissions factor in grams per hour (varies by year)	pounds/day	pounds/day
2010	-	-	-	-	-	-	1.1501	-	-
2011	-	-	-	-	-	-	1.1242	-	-
2012	-	-	-	-	-	-	1.0750	-	-
2013	-	-	-	-	-	-	1.0639	-	-
2014	199	15	10	3	142	2,621	1.0547	0.034	2,776
2015	202	15	11	3	145	2,662	1.0272	0.034	2,819
2016	205	15	11	3	147	2,702	1.0230	0.034	2,862
2017	208	15	11	3	149	2,744	1.0197	0.034	2,906
2018	211	15	11	3	151	2,785	1.0040	0.034	2,950
2019	214	16	11	3	153	2,827	1.0040	0.035	2,994
2020	217	16	11	3	156	2,869	1.0040	0.035	3,039
2021	221	16	11	3	158	2,912	1.0040	0.036	3,084
2022	224	16	12	3	160	2,955	1.0040	0.036	3,130
2023	227	17	12	3	163	2,998	1.0040	0.037	3,175
2024	230	17	12	3	165	3,041	1.0040	0.037	3,222
2025	234	17	12	3	168	3,085	1.0040	0.038	3,268
2026	237	17	12	3	170	3,130	1.0040	0.038	3,315
2027	240	18	13	3	172	3,175	1.0040	0.039	3,362
2028	244	18	13	3	175	3,220	1.0040	0.039	3,410
2029	247	18	13	3	177	3,265	1.0040	0.040	3,458
2030	251	18	13	3	180	3,311	1.0040	0.040	3,507
TOTAL	3,811		198	49	2,731	50,301		0.620	53,280

Source notes:

1. Time savings are based on ODOT estimates of traffic and time delays
2. Emissions estimates are based on MOBILE6.2.

The dollar value of reduced emissions was developed, following TIGER guidance, using values from the March 2009 *Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY2011 Passenger Cars and Light Trucks*. Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis.

- Volatile organic compounds \$1,700/ton

- Nitrogen oxides \$4,000/ton
- Carbon monoxide \$0/ton
- Carbon dioxide \$33/ton
- Particulate matter \$168,000/ton

The resulting value of emissions reductions in the first year of operation, shown in **Table 12**, is estimated at \$23,300, growing to \$29,400 by 2030. The present value of total emissions reductions 2014-2030 is \$313,500 using a three percent discount rate and \$204,700 using a seven percent discount rate.

Avoided Costs of SH 20 Bypass Project

As noted in the application, SH 20 and SH 88 pass through Claremore traveling over the BNSF and UPRR at grade, resulting in frequent and lengthy delays. Oklahoma DOT has already completed a study titled *SH 20 from US 75 East to Claremore* to determine a recommendation for an alternative to address traffic, mobility and safety needs along the corridor. The study concluded with a preferred alternative, part of which included a recommendation for a four-lane bypass around Claremore. This project is included in the long-range transportation plan, and the cost of the project (updated to 2010 dollars) is estimated at \$182.4 million.

Because the Claremore Freight Railway Grade Separation project would increase capacity on existing roads, it would allow ODOT to cancel the SH 20 Bypass project, as it would no longer be needed. The benefits of avoiding the bypass project are many. The most easily valued is the avoided construction cost. Assuming that the bypass would be built between 2020 and 2022, the construction cost has a present value of \$131.8 million using a three percent discount rate, and \$86.8 million using a seven percent discount rate.

Additional benefits, not quantified in this analysis, include the avoidance of the bypass' estimated environmental impacts:

- 40 residences, six businesses and one fire station would need to be relocated
- 5.8 acres of wetlands would be impacted
- 335 acres of prime farmland would be impacted

Furthermore, the overpass project would help Claremore's economy, enhancing retail sales by keeping traffic on existing commercial thoroughfares. The overpass would also enhance overall sustainability and livability by keeping traffic and development focused on areas that already have infrastructure and services available to support it.

Table 12: Emissions Reduction Value Calculations

Year	Total Daily Auto & Truck Time Savings (hours)	Total Daily Truck Time Savings (hours)	Annual Value						TOTAL (\$2010)	Present Value (3% Discount Rate)	Present Value (7% Discount Rate)
			VOC	NOX	CO	CO2	PM				
2010	-	-	\$1,840/ton	\$4,310/ton	\$0/ton	\$35/ton	\$182,000/ton	\$0	\$0	\$0	
2011	-	-	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
2012	-	-	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
2013	-	-	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
2014	199	15	\$3,472	\$2,000	\$0	\$16,743	\$1,126	\$23,341	\$20,738	\$17,807	
2015	202	15	\$3,526	\$2,031	\$0	\$17,001	\$1,113	\$23,671	\$20,419	\$16,877	
2016	205	15	\$3,580	\$2,062	\$0	\$17,262	\$1,125	\$24,028	\$20,123	\$16,011	
2017	208	15	\$3,635	\$2,093	\$0	\$17,525	\$1,137	\$24,390	\$19,831	\$15,189	
2018	211	15	\$3,690	\$2,125	\$0	\$17,790	\$1,136	\$24,740	\$19,530	\$14,399	
2019	214	16	\$3,745	\$2,157	\$0	\$18,057	\$1,152	\$25,111	\$19,246	\$13,659	
2020	217	16	\$3,801	\$2,189	\$0	\$18,327	\$1,169	\$25,486	\$18,964	\$12,956	
2021	221	16	\$3,857	\$2,221	\$0	\$18,598	\$1,186	\$25,863	\$18,684	\$12,287	
2022	224	16	\$3,914	\$2,254	\$0	\$18,873	\$1,202	\$26,243	\$18,406	\$11,652	
2023	227	17	\$3,971	\$2,287	\$0	\$19,149	\$1,219	\$26,627	\$18,131	\$11,049	
2024	230	17	\$4,029	\$2,320	\$0	\$19,427	\$1,236	\$27,013	\$17,859	\$10,476	
2025	234	17	\$4,087	\$2,354	\$0	\$19,708	\$1,254	\$27,403	\$17,589	\$9,932	
2026	237	17	\$4,146	\$2,388	\$0	\$19,992	\$1,271	\$27,796	\$17,322	\$9,416	
2027	240	18	\$4,205	\$2,422	\$0	\$20,277	\$1,288	\$28,193	\$17,057	\$8,925	
2028	244	18	\$4,265	\$2,456	\$0	\$20,565	\$1,306	\$28,593	\$16,795	\$8,460	
2029	247	18	\$4,325	\$2,491	\$0	\$20,855	\$1,324	\$28,996	\$16,536	\$8,018	
2030	251	18	\$4,386	\$2,526	\$0	\$21,148	\$1,342	\$29,402	\$16,279	\$7,598	
TOTAL	3,811							\$446,896	\$313,510	\$204,710	

Source: Values of emission reductions are based on the March 2009 Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks. Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis, inflated to 2010 dollars.

Cost/Benefit Summary

Table 1 summarizes the costs and the quantifiable benefits of the project that are discussed above. The table shows net present value and the benefit/cost ratio using both the three percent and the seven percent discount rates suggested in the TIGER II guidance.

The net present value of the project (value of the benefits minus the costs over the 2014 to 2030 period) is calculated above at between \$57 and \$110 million, with a benefit cost ratio of between 2.03 and 2.80.

Other Non-Quantifiable Costs and Benefits

The full measure of this project's benefits is not reflected in the summary table, as many benefits cannot be quantified. The dollar figures above, for example, do not include the many tourists and shoppers who will take trips to downtown Claremore that they would have avoided without the project¹. The figures also do not include the following:

- A potential trade-off with the project would be the elimination of the industrial rail access track parallel to the existing BNSF tracks near Will Rogers Boulevard. When the grade of the main railroad track is raised, access to this track will be eliminated. Two businesses are served by this track, and various options to continue service to these businesses are being explored. One possible option would be for the UPRR to deliver the rail cars to these customers using the existing connection track near Blue Starr Drive. Another possibility is for the businesses to move the shipping portion of their operations to the City's North Industrial Park. The park is owned and operated by the Claremore Industrial and Economic Development Authority (CIEDA) which, as noted above, is currently pursuing the addition of a rail spur from the Park to the BNSF. At this point, the preferred solution for continuing services to these two businesses has not been identified. Thus, it is not possible to quantify the cost of a revised service plan. It is assumed that the benefits generated by retaining these existing businesses will offset the costs of partial relocation or reconfiguring shipping arrangements.
- Oklahoma's farmers, ranchers and manufacturers may benefit from the improved access to markets (faster delivery times and lower transportation costs) beyond the travel time savings already quantified in the above analysis.
- This project will enhance the potential for the recently-approved north Claremore transload facility to be successful in providing an efficient, cost-effective and more sustainable freight movement system, removing trucks from the road.
- Local employers will benefit from the reduced congestion – deliveries will be more reliable, a more productive workforce should result from the reduced delay times, plus the enhanced quality of life will make it easier to attract employees, improving retention and making it easier to retain and grow businesses in this part of the Tulsa metropolitan area.

¹ According to The City of Claremore 2009 Strategic Plan, the overpass project will lead to increased shopping and tourism downtown

- Sustainability and livability benefits of having the ability of cars, pedestrians, and bicycles to more easily and safely pass over the rail lines.
- Improved development potential at a 100-acre retail/commercial zoned property located south of Archer Street, west of SH 66. The Claremore Economic Development Director stated that with the elimination of conflicts at major at-grade public railroad crossings, “the accessibility and attractiveness of the parcel will increase geometrically.”
- With increased rail freight speeds, the concurrent development of a Transload Facility in the Claremore North Industrial Park, and available real estate experiencing improved access opportunities after the grade separation project is in place, the City is expected to attract other commercial and light industrial development. Several available tracts are served by City services and utilities. Likely prospects include machinery manufacturing, petroleum products manufacturing, transportation equipment manufacturing, tourism, and freight and port service businesses.
- Quality of life: vital public and health services such as hospitals, police, fire, and schools, will be within easier and more predictable reach of area residents after the project’s completion. Other livability benefits include reduced noise (from fewer train horns and crossing bells), as well as easier interactions between neighborhoods.

While the above-listed benefits cannot be included in the annual benefit streams that are the basis of this benefit-cost analysis, the benefits are real, and will be experienced by Claremore residents, as well as workers, farmers and business owners in the region, both in the near term and for generations to come.

APPENDIX

Table A-1 Average Daily Traffic Projections at BNSF Rail Crossings

Year	BNSF Crossings in Claremore					Sum ADT
	W BLUE STARR	W 6TH	W WILL ROGERS	1ST	ARCHER	
2010	18,000	2,000	17,500	5,300	5,800	48,600
2011	17,850	2,140	17,915	5,332	5,810	49,047
2012	17,700	2,280	18,330	5,364	5,820	49,494
2013	17,550	2,420	18,745	5,395	5,830	49,940
2014	17,400	2,560	19,160	5,427	5,840	50,387
2015	17,250	2,700	19,575	5,459	5,850	50,834
2016	17,100	2,840	19,990	5,491	5,860	51,281
2017	16,950	2,980	20,405	5,523	5,870	51,728
2018	16,800	3,120	20,820	5,554	5,880	52,174
2019	16,650	3,260	21,235	5,586	5,890	52,621
2020	16,500	3,400	21,650	5,618	5,900	53,068
2021	16,350	3,540	22,065	5,650	5,910	53,515
2022	16,200	3,680	22,480	5,682	5,920	53,962
2023	16,050	3,820	22,895	5,713	5,930	54,408
2024	15,900	3,960	23,310	5,745	5,940	54,855
2025	15,750	4,100	23,725	5,777	5,950	55,302
2026	15,600	4,240	24,140	5,809	5,960	55,749
2027	15,450	4,380	24,555	5,841	5,970	56,196
2028	15,300	4,520	24,970	5,872	5,980	56,642
2029	15,150	4,660	25,385	5,904	5,990	57,089
2030	15,000	4,800	25,800	5,936	6,000	57,536
TOTAL	346,500	71,400	454,650	117,978	123,900	1,114,428

Source: ODOT

The above projections are for the no build. To be conservative, these counts are also used in calculations for Build travel time savings, although it is likely that additional traffic growth will result from the project.

Table A-2 Average Daily Traffic Projections at UPRR Rail Crossings

UPRR Crossings in Claremore									
Year									Sum ADT
	BLUE STARR	JIM DAVIS	LYNN RIGGS	W 7TH	W 6TH	CHEROKE E	W WILL ROGER S	PATTI PAGE	
2010	18,000	2,500	18,600	800	2,000	1,700	7,000	12,500	63,100
2011	17,850	2,515	18,712	805	2,140	1,710	7,042	13,165	63,939
2012	17,700	2,530	18,823	810	2,280	1,720	7,084	13,830	64,777
2013	17,550	2,545	18,935	814	2,420	1,731	7,126	14,495	65,616
2014	17,400	2,560	19,046	819	2,560	1,741	7,168	15,160	66,454
2015	17,250	2,575	19,158	824	2,700	1,751	7,210	15,825	67,293
2016	17,100	2,590	19,270	829	2,840	1,761	7,252	16,490	68,132
2017	16,950	2,605	19,381	834	2,980	1,771	7,294	17,155	68,970
2018	16,800	2,620	19,493	838	3,120	1,782	7,336	17,820	69,809
2019	16,650	2,635	19,604	843	3,260	1,792	7,378	18,485	70,647
2020	16,500	2,650	19,716	848	3,400	1,802	7,420	19,150	71,486
2021	16,350	2,665	19,828	853	3,540	1,812	7,462	19,815	72,325
2022	16,200	2,680	19,939	858	3,680	1,822	7,504	20,480	73,163
2023	16,050	2,695	20,051	862	3,820	1,833	7,546	21,145	74,002
2024	15,900	2,710	20,162	867	3,960	1,843	7,588	21,810	74,840
2025	15,750	2,725	20,274	872	4,100	1,853	7,630	22,475	75,679
2026	15,600	2,740	20,386	877	4,240	1,863	7,672	23,140	76,518
2027	15,450	2,755	20,497	882	4,380	1,873	7,714	23,805	77,356
2028	15,300	2,770	20,609	886	4,520	1,884	7,756	24,470	78,195
2029	15,150	2,785	20,720	891	4,660	1,894	7,798	25,135	79,033
2030	15,000	2,800	20,832	896	4,800	1,904	7,840	25,800	79,872
TOTAL	346,500	55,650	414,036	17,808	71,400	37,842	155,820	402,150	1,501,206

Source: ODOT

The above projections are for the no build. To be conservative, these counts are also used in calculations for Build travel time savings, although it is likely that additional traffic growth will result from the project.