Tulsa I-244 Arkansas River Crossing
TIGER Grant Application
Benefit Cost Analysis Technical Memo
September 10, 2009

Introduction

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

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

- State of Good Repair – the project will reduce maintenance cost substantially over the next few decades. Reducing work zone related delay is another quantifiable aspect of improving the facility's state of repair. Detailed engineering and life cycle analysis comparing the replacement and maintenance costs of the new bridge relative to those of existing bridge indicate a life cycle cost savings. The 60-year life cycle costs of the new bridge, measured in 2009 dollars are $279.8 million, much less than the $328.8 million cost of maintaining the existing structure for another 25 years[1].
- Long Term Economic Competitiveness – reducing vehicular delays from reduced work zone lane closures as well as from the additional capacity provided by a fourth lane in each direction will allow commuters to have increased productivity, and improved quality of life, and will allow Tulsa employers access to a wider pool of potential employees . This improved mobility for commutes, deliveries, and other types of trips will retain jobs in Tulsa's economy, allow for growth, and will benefit Tulsa by making it a more dynamic interactive region.
- Sustainability – the project will reduce auto emissions resulting from slow speeds and idling by reducing work zone lane closures and speeding trips across the bridge by providing a fourth lane in future years. This will enhance sustainability in the region, and reduce Greenhouse Gas Emissions. Note that additional sustainability benefits, such as those provided by future commuter and passenger rail service, are not specifically quantified here.
- Livability – Downtown Tulsa, the core of the metropolitan region, will benefit greatly from reduced traffic on the I-244 bridge. Making commutes shorter and less frustrating, and reducing barriers for recreational trips to downtown will enhance the region's connectivity and promote job and entertainment growth in the CBD.
- Safety – The new bridge will improve safety in a number of ways:
    1. Because of the frequent lane closures, and the inadequate shoulder widths on the current bridge, safety for construction personnel is currently of great concern. The new structure, built to meet current standards, would improve safety for construction personnel as well as for drivers.
    2. Safety vehicle response time will improve, as these vehicles will be able to use the shoulders to move quickly around traffic even when congestion is high
    3. In emergency situations, the shoulder can be utilized as a fifth travel lane.

[1] In present value terms using a discount rate of three percent, the life-cycle cost savings is $31.3 million. However, using a seven percent discount rate, which puts a high value on the near-term 2010-2012 construction costs, the current project's life cycle costs would be valued at $16 million *more* than the option of maintaining the current bridge through 2034.

4. The fact that this bridge is currently Structurally Deficient coupled with its very low sufficiency ratings is cause for concern; replacing the structure eliminates the possibility of a critical failure that would be catastrophic in nature.

In addition, the project will enable commuter rail and high speed rail projects to go forward, as well as a number of other "Tulsa Bundle" projects, further adding to Tulsa's long-term economic competitiveness, and creating a more sustainable, livable, transit-friendly region.

Given the definitions and limitations noted above, the computed benefit-cost ratio for the Tulsa I-244 Arkansas River Bridge project is11.7 using a three percent discount rate, and 7.84 using a seven percent discount rate, reflecting a net present value of $1.6 billion and $840 million, respectively.

The cost-benefit analysis described in this section compares the project's capital construction costs to the quantifiable benefits of the project including:

a. Reduced maintenance costs
b. Travel delay savings for vehicles resulting from reduced lane closures
c. Travel delay savings for vehicles resulting from the use of an additional lane in each direction to meet future travel needs
d. Vehicle fuel and operations cost savings
e. Emissions reductions
f. Economic development benefits

A Note on the Discount Rates

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

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

Project Costs

Initial Construction Costs

The total project cost is $131,730,000. This does not include $240,000 in preliminary engineering that has already been completed. If the final funding piece can be secured, final engineering and environmental studies are ready to begin this year, with land acquisition to start in early 2010. Construction can begin in mid-2010, and is expected to be complete by the first quarter of 2012.

Table 1 Project Capital Costs

Uses of Funds (In thousands of 2009 dollars)	2009	2010	2011	2012	Total
Environmental Studies	$50				$50
Land Acquisition		$250			$250
Final Design	$1,946	$1,908			$3,855
Construction Management		$2,080	$4,564	$578	$7,221
Construction		$34,662	$76,064	$9,628	$120,354
TOTAL	**$1,996**	**$38,901**	**$80,627**	**$10,206**	**$131,730**

Source: ODOT

Life-Cycle Costs

With the new bridge, the need for maintenance and rehabilitation over the next few decades will be dramatically less. The dollars spent on rehabilitating the decaying bridge structures is a heavy burden on the Oklahoma DOT, with current maintenance costs averaging $1.1 million dollars per year. Due to the current condition of the structures, a $45 million rehabilitation will be required in 2010 if funding cannot be identified to replace the structures. This rehabilitation – at a cost of nearly a third of the replacement cost -- will stabilize the bridges' safety rating, and will help reduce the need for regularly-scheduled maintenance closures for the next few years. The $45 million, will not, however, reduce the need for an expected $500,000 annually in non-routine repairs. . Maintenance costs in (non-discounted) 2009 dollars for maintaining the existing structures through to 2034 are an estimated $193.5 million, greatly exceeding the $132 million replacement cost, even if maintenance costs through 2034 for the new structures (at $2 million total) are added in.

A 60-year life-cycle cost analysis is presented in Table 2, comparing the costs of replacing the bridge now as proposed or undergoing increasingly expensive maintenance on the existing structure for the next 25 years before replacing it in 2035 (No Build). A time period of 60 years was examined so that a fair comparison could be made between the life cycle costs of the Build and No Build alternatives. Life cycle costs include initial construction, yearly maintenance, and occasional capital rehabilitation projects. According to the detailed estimates produced by the ODOT Bridge Maintenance Division and ODOT Division VII, the Build alternative involves a high ($131.7 million) construction cost followed by low maintenance costs in the near term. The No Build alternative requires a $45 million capital rehabilitation cost in the near term with high maintenance costs in the early years, followed by a high capital cost during the replacement year of 2035. In the out-years (2036-2062) the situation changes. The maintenance for the Build alternative is higher, as the bridge structures built in 2010 will be over 25 years old starting in 2036. The No Build structure would be brand new in 2036, requiring much less maintenance.

The calculation of the present value of the life cycle costs is shown in Table 2, using both of the discount rates suggested in the TIGER guidance. Depending on the discount rate, the build scenario is either more or less costly than the No-Build. The three percent discount rate more heavily favors the long-term cost savings, while the seven percent discount rate is heavily influenced by the early, up-front construction costs of the build scenario, making the No Build option appear less expensive.

Table 2 Life Cycle Cost Comparison (in thousands of 2009 dollars)

	Build Alternative				No-Build Baseline			
Year	Decription	Expense	Present Value at 3%	Present Value at 7%	Decription	Expense	Present Value at 3%	Present Value at 7%
2010	Construction	$40,896	$39,705	$38,221	Major Rehab	$45,000	$43,689	$42,056
2011	Construction	$80,628	$76,000	$70,424	Yearly maint	$500	$471	$437
2012	Construction	$10,206	$9,340	$8,331	Yearly maint	$500	$458	$408
2013	Yearly maint	$50	$44	$38	Yearly maint	$500	$444	$381
2014	Yearly maint	$50	$43	$36	Yearly maint	$500	$431	$356
2015	Yearly maint	$50	$42	$33	Yearly maint	$500	$419	$333
2016	Yearly maint	$50	$41	$31	Yearly maint	$1,000	$813	$623
2017	Yearly maint	$50	$39	$29	Yearly maint	$1,000	$789	$582
2018	Yearly maint	$50	$38	$27	Yearly maint	$1,500	$1,150	$816
2019	Yearly maint	$50	$37	$25	Yearly maint	$1,500	$1,116	$763
2020	Yearly maint	$50	$36	$24	Yearly maint	$2,000	$1,445	$950
2021	Yearly maint	$50	$35	$22	Yearly maint	$2,000	$1,403	$888
2022	Yearly maint	$50	$34	$21	Yearly maint	$3,000	$2,043	$1,245
2023	Yearly maint	$50	$33	$19	Yearly maint	$4,000	$2,644	$1,551
2024	Yearly maint	$50	$32	$18	Yearly maint	$5,000	$3,209	$1,812
2025	Yearly maint	$50	$31	$17	Yearly maint	$6,000	$3,739	$2,032
2026	Yearly maint	$50	$30	$16	Yearly maint	$7,000	$4,235	$2,216
2027	Yearly maint	$50	$29	$15	Yearly maint	$8,000	$4,699	$2,367
2028	Yearly maint	$50	$29	$14	Yearly maint	$9,000	$5,133	$2,489
2029	Yearly maint	$50	$28	$13	Yearly maint	$10,000	$5,537	$2,584
2030	Light Rehab	$1,000	$538	$242	Major Rehab	$45,000	$24,190	$10,868
2031	Yearly maint	$100	$52	$23	Yearly maint	$10,000	$5,219	$2,257
2032	Yearly maint	$100	$51	$21	Yearly maint	$10,000	$5,067	$2,109
2033	Yearly maint	$100	$49	$20	Yearly maint	$10,000	$4,919	$1,971
2034	Yearly maint	$100	$48	$18	Yearly maint	$10,000	$4,776	$1,842
2035	Yearly maint	$100	$46	$17	Replacement	$131,730	$61,083	$22,683
2036	Yearly maint	$100	$45	$16	Yearly maint	$50	$23	$8
2037	Yearly maint	$100	$44	$15	Yearly maint	$50	$22	$8
2038	Yearly maint	$100	$42	$14	Yearly maint	$50	$21	$7
2039	Yearly maint	$100	$41	$13	Yearly maint	$50	$21	$7
2040	Yearly maint	$100	$40	$12	Yearly maint	$50	$20	$6
2041	Yearly maint	$150	$58	$17	Yearly maint	$50	$19	$6
2042	Yearly maint	$150	$57	$16	Yearly maint	$50	$19	$5
2043	Yearly maint	$150	$55	$15	Yearly maint	$50	$18	$5
2044	Yearly maint	$150	$53	$14	Yearly maint	$50	$18	$5
2045	Yearly maint	$150	$52	$13	Yearly maint	$50	$17	$4
2046	Yearly maint	$250	$84	$20	Yearly maint	$50	$17	$4
2047	Yearly maint	$250	$81	$19	Yearly maint	$50	$16	$4
2048	Yearly maint	$250	$79	$18	Yearly maint	$50	$16	$4
2049	Major Rehab	$250	$77	$17	Yearly maint	$50	$15	$3
2050	Yearly maint	$45,000	$13,393	$2,809	Yearly maint	$50	$15	$3
2051	Yearly maint	$500	$144	$29	Yearly maint	$50	$14	$3
2052	Yearly maint	$500	$140	$27	Yearly maint	$50	$14	$3
2053	Yearly maint	$500	$136	$25	Yearly maint	$50	$14	$3
2054	Yearly maint	$500	$132	$24	Yearly maint	$50	$13	$2
2055	Yearly maint	$500	$128	$22	Light Rehab	$1,000	$257	$44
2056	Yearly maint	$1,000	$249	$42	Yearly maint	$100	$25	$4
2057	Yearly maint	$1,000	$242	$39	Yearly maint	$100	$24	$4
2058	Yearly maint	$1,500	$352	$54	Yearly maint	$100	$23	$4
2059	Yearly maint	$1,500	$342	$51	Yearly maint	$100	$23	$3
2060	Yearly maint	$2,000	$443	$63	Yearly maint	$100	$22	$3
2061	Yearly maint	$2,000	$430	$59	Yearly maint	$100	$22	$3
2062	Yearly maint	$3,000	$626	$83	Yearly maint	$100	$21	$3
2063	Yearly maint	$4,000	$811	$104	Yearly maint	$100	$20	$3
2064	Yearly maint	$5,000	$984	$121	Yearly maint	$100	$20	$2
2065	Yearly maint	$6,000	$1,146	$136	Yearly maint	$100	$19	$2
2066	Yearly maint	$7,000	$1,298	$148	Yearly maint	$150	$28	$3
2067	Yearly maint	$8,000	$1,441	$158	Yearly maint	$150	$27	$3
2068	Yearly maint	$9,000	$1,573	$166	Yearly maint	$150	$26	$3
2069	Major Rehab	$45,000	$7,638	$777	Yearly maint	$150	$25	$3
TOTAL		**$279,830**	**$158,889**	**$122,872**		**$328,780**	**$190,035**	**$106,798**

Source: ODOT Bridge Maintenance Division and ODOT Division VII.

Travel Delay Savings from Reduced Need for Work Zone Closures

One of the major and most immediate benefits of the bridge replacement project is the travel time savings that will result from reducing the extensive current lane closures on the bridge. This section quantifies those travel time savings.

As noted, the maintenance requirements of the current bridge structures require frequent lane closures from both planned bridge maintenance work and responding to emergency repair needs. In a typical year, planned bridge maintenance requires 20 weeks (10 weeks per structure). During this time one lane of the bridge is closed for six hours per day, four days per week. This totals 480 hours of annual lane closure per bridge. Major incident repairs require two-lane closures. These repairs are averaging ten weeks per year (five weeks on each structure), with each week of closure involving a six-hour long closure time four days per week. The need for this type of closure can also be expected to escalate at an additional week every two years if the existing structures are not replaced –even with the $45 million rehabilitation work that will be needed in 2010, and again in 2030, if funding cannot be secured for the replacement project.

With total closures for the bridge structures currently occurring for a minimum of 30 four-day weeks per year, there is on average at least one lane closed every other week throughout the year. The maintenance-related travel delays will compound over time as traffic grows and as maintenance closures become more extensive as a result of the aging of the structures.

The new structures will dramatically reduce lane closures for two reasons. First, the new structure will require much less maintenance work. And secondly, even as the new structure ages and begins to require more upkeep, the additional lanes and wider shoulders will allow three or even four lanes to remain open during any required maintenance work.

Travel delay savings for passenger and freight/delivery vehicles have been calculated with Highway Capacity Software Plus using actual 2009 traffic figures, which are assumed to grow by two percent annually. These figures were then integrated into equations centered around reduced capacity caused by the one-lane and two-lane closures. The number of weeks of closures varies by year:

- The one-lane closures (Table 3) will be temporarily eliminated after the major rehabilitation that will occur in 2010 if the bridges are not replaced. The need for one-lane closures will return in 2020, growing by one week every other year until the scheduled 2030 rehabilitation.
- Two-lane closures (Table 4) are expected to remain at 10 weeks per year through 2015. In 2016 and 2017, this will double to 20 weeks. After that they will increase by an additional five weeks every other year, and then five additional weeks each year until the 2030 rehabilitation.
- The benefits analysis stops in 2036, as it is assumed that due to sufficiency point loss and the fact that the bridge will then be past its life expectancy of 75 years, the bridge will have to be replaced with a new structure. There is little doubt that the replacement bridge designed at that time will provide a minimum of four lanes in each direction, with shoulders adequate to provide for occasional maintenance closures.

Traffic volumes were cut in half to account for the fact that the closures only affect one structure at a time, and not both. This also explains how the total weeks of closure exceeds 52 weeks per year beginning in 2026.

As the tables indicate, the delay resulting from the two-lane closures (90 seconds) is substantially higher than the delay from the one-lane closures (four seconds).

Table 3 Travel Delays Resulting from One-Lane Maintenance Closures

Year	Daily Traffic volume Cars	Daily Traffic volume Trucks	Daily Traffic volume Cars on each structure	Daily Traffic volume Cars on each structure	Weeks of closure/ year	Seconds of delay	Auto time delay (hours/year)	Truck time delay (hours/year)
2010	64,362	4,080	32,181	2,040	20	4	1024	65
2011	65,649	4,162	32,825	2,081		4	0	0
2012	66,962	4,245	33,481	2,122		4	0	0
2013	68,301	4,330	34,151	2,165		4	0	0
2014	69,667	4,416	34,834	2,208		4	0	0
2015	71,061	4,505	35,530	2,252		4	0	0
2016	72,482	4,595	36,241	2,297		4	0	0
2017	73,932	4,687	36,966	2,343		4	0	0
2018	75,410	4,780	37,705	2,390		4	0	0
2019	76,919	4,876	38,459	2,438		4	0	0
2020	78,457	4,973	39,228	2,487	1	4	62	4
2021	80,026	5,073	40,013	2,536	1	4	64	4
2022	81,627	5,174	40,813	2,587	2	4	130	8
2023	83,259	5,278	41,630	2,639	2	4	132	8
2024	84,924	5,383	42,462	2,692	3	4	203	13
2025	86,623	5,491	43,311	2,746	3	4	207	13
2026	88,355	5,601	44,178	2,800	4	4	281	18
2027	90,122	5,713	45,061	2,856	4	4	287	18
2028	91,925	5,827	45,962	2,914	5	4	366	23
2029	93,763	5,944	46,882	2,972	5	4	373	24
2030	95,639	6,063	47,819	3,031		4	0	0
2031	97,551	6,184	48,776	3,092		4	0	0
2032	99,502	6,308	49,751	3,154		4	0	0
2033	101,492	6,434	50,746	3,217		4	0	0
2034	103,522	6,562	51,761	3,281		4	0	0
2035	105,593	6,694	52,796	3,347		4	0	0
TOTAL	**3,091,552**	**195,978**					**3,129**	**198**

Table 4 Travel Delays Resulting from Two-Lane Maintenance Closures

Year	Daily Traffic volume Cars	Daily Traffic volume Trucks	Daily Traffic volume Cars on each structure	Daily Traffic volume Cars on each structure	Weeks of closure per year	Seconds of delay	Auto time delay (hours/ year)	Truck time delay (hours/ year)
2010	64,362	4,080	32,181	2,040	10	90	11,521	730
2011	65,649	4,162	32,825	2,081	10	90	11,751	745
2012	66,962	4,245	33,481	2,122	10	90	11,986	760
2013	68,301	4,330	34,151	2,165	10	90	12,226	775
2014	69,667	4,416	34,834	2,208	10	90	12,470	791
2015	71,061	4,505	35,530	2,252	10	90	12,720	806
2016	72,482	4,595	36,241	2,297	20	90	25,949	1,645
2017	73,932	4,687	36,966	2,343	20	90	26,468	1,678
2018	75,410	4,780	37,705	2,390	25	90	33,746	2,139
2019	76,919	4,876	38,459	2,438	25	90	34,421	2,182
2020	78,457	4,973	39,228	2,487	30	90	42,131	2,671
2021	80,026	5,073	40,013	2,536	30	90	42,974	2,724
2022	81,627	5,174	40,813	2,587	35	90	51,139	3,242
2023	83,259	5,278	41,630	2,639	40	90	59,614	3,779
2024	84,924	5,383	42,462	2,692	45	90	68,407	4,336
2025	86,623	5,491	43,311	2,746	50	90	77,527	4,915
2026	88,355	5,601	44,178	2,800	55	90	86,986	5,514
2027	90,122	5,713	45,061	2,856	60	90	96,791	6,136
2028	91,925	5,827	45,962	2,914	65	90	106,954	6,780
2029	93,763	5,944	46,882	2,972	70	90	117,485	7,448
2030	95,639	6,063	47,819	3,031	70	90	119,835	7,597
2031	97,551	6,184	48,776	3,092	70	90	122,232	7,748
2032	99,502	6,308	49,751	3,154	70	90	124,676	7,903
2033	101,492	6,434	50,746	3,217	70	90	127,170	8,061
2034	103,522	6,562	51,761	3,281	70	90	129,713	8,223
2035	105,593	6,694	52,796	3,347	70	90	132,308	8,387
TOTAL	**3,091,552**	**195,978**					1,699,201	107,715

Table 5 shows the valuation of these travel delays, based on the assumptions below.

Traffic composition:

- Truck traffic is six percent of the total traffic
- Business-related auto trips make up 20 percent of non-truck traffic
- Non-business-related auto trips make up 80 percent of non-truck traffic

Value of Travel Time

- The hourly rate of time for trucks is based on the average of the latest (May 2008) Bureau of Labor Statistics 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 May 2008 average Tulsa metropolitan area hourly wage ($17.85)
- The hourly rate of time for personal auto trips, following TIGER guidance, is based on half of the May 2008 average hourly wage ($17.85 divided by two = $8.93)

Other Assumptions

- The benefits of the project begin in 2012, the year the bridge is opened to traffic.
- The benefits end in 2035, the year that the bridge would be replaced under the No Build. The structure that would replace the bridge in 2035 would likely be similar to what is being proposed currently: a pair of four-lane bridges with ample shoulders to handle maintenance requirements

without lane closures. Thus, after 2035 there would be no difference in travel times or maintenance closure needs compared to the "replace now" option.

- During the construction years of 2010-2011, the maintenance-related lane closures on the existing structures would be very high, as the planned $45 million rehabilitation would not take place. For this reason, the time delay benefit is negative in 2011. In 2010 the two alternatives are assumed to be roughly equal, as the lane closures required for the $45 million rehabilitation would be similar to the closures required if no action was taken.

Based on these assumptions, the present value of auto travel time savings for 2010 to 2035 is $11.4 million using a three percent discount rate, and $5.9 million using a seven percent discount rate.

Table 5 Valuation of Travel Delay Reduction

	TOTAL Auto time savings (hours/year)	TOTAL Truck time delay (hours/year)	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 Truck Time Savings (at $15.61/hr)	TOTAL VALUE OF TIME SAVINGS FROM REDUCED CLOSURES	Present Value (3%)	Pr Val
2010	-	-	$ -	$ -	$ -	$ -	$ -	$
2011	(2,272)	(144)	$ (8,111)	$ (16,230)	$ (2,248)	$ (26,589)	$ (25,063)	$ (
2012	11,986	760	$ 42,791	$ 85,630	$ 11,861	$ 140,281	$ 128,377	$ 1
2013	12,226	775	$ 43,647	$ 87,342	$ 12,098	$ 143,087	$ 127,131	$ 1
2014	12,470	791	$ 44,520	$ 89,089	$ 12,340	$ 145,949	$ 125,897	$ 1
2015	12,720	806	$ 45,410	$ 90,871	$ 12,587	$ 148,868	$ 124,674	$
2016	25,949	1,645	$ 92,636	$ 185,377	$ 25,677	$ 303,690	$ 246,928	$ 1
2017	26,468	1,678	$ 94,489	$ 189,084	$ 26,191	$ 309,764	$ 244,531	$ 1
2018	33,746	2,139	$ 120,474	$ 241,082	$ 33,393	$ 394,949	$ 302,696	$ 2
2019	34,421	2,182	$ 122,883	$ 245,904	$ 34,061	$ 402,848	$ 299,757	$ 2
2020	42,194	2,675	$ 150,632	$ 301,432	$ 41,752	$ 493,817	$ 356,744	$ 2
2021	43,038	2,728	$ 153,644	$ 307,461	$ 42,588	$ 503,693	$ 353,280	$ 2
2022	51,269	3,250	$ 183,030	$ 366,265	$ 50,733	$ 600,028	$ 408,590	$ 2
2023	59,746	3,787	$ 213,293	$ 426,825	$ 59,121	$ 699,240	$ 462,280	$ 2
2024	68,609	4,349	$ 244,935	$ 490,144	$ 67,892	$ 802,971	$ 515,396	$ 2
2025	77,734	4,928	$ 277,511	$ 555,333	$ 76,921	$ 909,764	$ 566,935	$ 3
2026	87,267	5,532	$ 311,543	$ 623,435	$ 86,354	$ 1,021,332	$ 617,922	$ 3
2027	97,078	6,154	$ 346,569	$ 693,527	$ 96,063	$ 1,136,158	$ 667,373	$ 3
2028	107,320	6,803	$ 383,133	$ 766,695	$ 106,198	$ 1,256,026	$ 716,294	$ 3
2029	117,858	7,471	$ 420,754	$ 841,980	$ 116,626	$ 1,379,360	$ 763,718	$ 3
2030	119,835	7,597	$ 427,811	$ 856,102	$ 118,582	$ 1,402,495	$ 753,910	$ 3
2031	122,232	7,748	$ 436,368	$ 873,224	$ 120,953	$ 1,430,545	$ 746,591	$ 3
2032	124,676	7,903	$ 445,095	$ 890,688	$ 123,372	$ 1,459,156	$ 739,342	$ 3
2033	127,170	8,061	$ 453,997	$ 908,502	$ 125,840	$ 1,488,339	$ 732,164	$ 2
2034	129,713	8,223	$ 463,077	$ 926,672	$ 128,357	$ 1,518,106	$ 725,056	$ 2
2035	132,308	8,387	$ 472,338	$ 945,206	$ 130,924	$ 1,548,468	$ 718,016	$ 2
TOTAL	**1,675,762**	**106,229**	**$ 5,982,469**	**$ 11,971,641**	**$ 1,658,234**	**$ 19,612,343**	**$ 11,418,539**	**##**

Travel Delay Savings from Additional Lanes

In later years, traffic on the bridge will continue to grow, hitting LOS E in 2019. At this point, it is assumed that the wide shoulders on the new bridge structures will be re-striped to allow for a fourth lane of traffic in each direction. The current structures, with three lanes and narrow, four-foot shoulders, do not allow for this conversion.

By 2027, traffic growth will lead to LOS F conditions during peak travel times on the existing structure, increasing peak hour delays from an estimated 2.4 seconds to 90 seconds per vehicle, as shown in Table 6.

Table 6 Travel Delay Savings Resulting from Fourth Lane

Year	Daily Traffic Volume	Daily # of vehicles delayed (38%)	Delay (seconds per vehicle)	Delay (vehicle seconds per day)	Delay (vehicle hours per year)
2019	81,795	31,082	2.4	74,597	5,388
2020	83,430	31,704	2.4	76,089	5,495
2021	85,099	32,338	2.4	77,610	5,605
2022	86,801	32,984	2.4	79,163	5,717
2023	88,537	33,644	2.4	80,746	5,832
2024	90,308	34,317	2.4	82,361	5,948
2025	92,114	35,003	2.4	84,008	6,067
2026	93,956	35,703	2.4	85,688	6,189
2027	95,835	36,417	90.0	3,277,568	236,713
2028	97,752	37,146	90.0	3,343,119	241,448
2029	99,707	37,889	90.0	3,409,982	246,276
2030	101,701	38,646	90.0	3,478,181	251,202
2031	103,735	39,419	90.0	3,547,745	256,226
2032	105,810	40,208	90.0	3,618,700	261,351
2033	107,926	41,012	90.0	3,691,074	266,578
2034	110,085	41,832	90.0	3,764,895	271,909
2035	112,286	42,669	90.0	3,840,193	277,347
TOTAL					**2,355,291**

Source: Travel delay estimates are from ODOT using Highway Capacity Software Plus.

Valuation of the traffic delays is shown in Table 7, and is based on the assumptions below.

Traffic composition:

- Truck traffic is six percent of the total traffic
- Business-related auto trips make up 20 percent of non-truck traffic
- Non-business-related auto trips make up 80 percent of non-truck traffic

Value of Travel Time

- The hourly rate of time for trucks is based on the average of the latest (May 2008) Bureau of Labor Statistics 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 May 2008 average Tulsa metropolitan area hourly wage ($17.85)
- The hourly rate of time for personal auto trips, following TIGER guidance, is based on half of the May 2008 average hourly wage ($17.85 divided by two = $8.93)

Other Assumptions

- The benefits of the project begin in 2019, the year the fourth lane on each bridge structure is assumed to open to traffic (because 2019 is the year that traffic levels reach LOS E during peak periods).

- The benefits end in 2035, the year that the bridge would be replaced under the No Build. The structure that would replace the bridge in 2035 would likely be similar to what is being proposed currently: a pair of four-lane bridges.

As with the travel delay savings resulting from reduced maintenance closures, the travel delay savings from the availability of a fourth lane will increase each year as traffic grows. The present value of this stream of benefits over the 2019-2035 period is actually greater than the value of the savings resulting from the maintenance closures. Total present value is $13.6 million using a three percent discount rate, and $6.0 million using a seven percent discount rate.

Table 7 Value of Travel Delay Savings Resulting from Fourth Lane

Year	Delay (vehicle hours per year)	Auto Delay (vehicle hours per year)	Truck Delay (vehicle hours per year)	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 Truck Time Savings (at $15.61/hr)	TOTAL VALUE OF TIME SAVINGS FROM FOURTH LANE	Present Value (3%)	Pr
2019	5,388	5,064	323	$ 18,079	$ 36,179	$ 5,046	$ 59,305	$ 44,128	
2020	5,495	5,166	330	$ 18,441	$ 36,903	$ 5,147	$ 60,491	$ 43,700	
2021	5,605	5,269	336	$ 18,810	$ 37,641	$ 5,250	$ 61,701	$ 43,276	
2022	5,717	5,374	343	$ 19,186	$ 38,394	$ 5,355	$ 62,935	$ 42,855	
2023	5,832	5,482	350	$ 19,570	$ 39,162	$ 5,462	$ 64,193	$ 42,439	
2024	5,948	5,591	357	$ 19,961	$ 39,945	$ 5,571	$ 65,477	$ 42,027	
2025	6,067	5,703	364	$ 20,360	$ 40,744	$ 5,683	$ 66,787	$ 41,619	
2026	6,189	5,817	371	$ 20,768	$ 41,559	$ 5,796	$ 68,122	$ 41,215	
2027	236,713	222,510	14,203	$ 794,362	$ 1,589,615	$ 221,706	$ 2,605,683	$ 1,530,564	
2028	241,448	226,961	14,487	$ 810,250	$ 1,621,407	$ 226,140	$ 2,657,796	$ 1,515,704	
2029	246,276	231,500	14,777	$ 826,455	$ 1,653,835	$ 230,663	$ 2,710,952	$ 1,500,989	
2030	251,202	236,130	15,072	$ 842,984	$ 1,686,912	$ 235,276	$ 2,765,171	$ 1,486,416	
2031	256,226	240,852	15,374	$ 859,843	$ 1,720,650	$ 239,981	$ 2,820,475	$ 1,471,985	
2032	261,351	245,670	15,681	$ 877,040	$ 1,755,063	$ 244,781	$ 2,876,884	$ 1,457,693	
2033	266,578	250,583	15,995	$ 894,581	$ 1,790,164	$ 249,677	$ 2,934,422	$ 1,443,541	
2034	271,909	255,595	16,315	$ 912,473	$ 1,825,968	$ 254,670	$ 2,993,110	$ 1,429,526	
2035	277,347	260,706	16,641	$ 930,722	$ 1,862,487	$ 259,763	$ 3,052,972	$ 1,415,647	
TOTAL	**2,355,291**	**2,213,973**	**141,317**					**$ 13,593,325**	

Sources: Travel delay estimates are from ODOT using Highway Capacity Software Plus. Values of Travel Time are from BLS May 2008 wage data for the Tulsa metropolitan area.

Vehicle Fuel and Operations Cost Savings

As discussed above, replacing the bridge structures will substantially reduce travel delay times. The travel time savings will begin on the opening day as a result of reduced maintenance closures. In the out years, the availability of a fourth lane on the new structures will result in even greater reductions in travel delay.

In addition to saving time and enhancing regional quality of life, the project's travel time savings will also reduce the use of gasoline and diesel fuel, as cars and trucks can travel faster or with less idling time. This results in lower fuel usage, as well as drivers spending substantially less on fuel.

Table 8 shows the fuel savings, using an assumption that each minute of travel time saved results in a reduction in fuel usage of 0.01 gallons of gasoline (based on the Texas Transportation Institute Urban Mobility Report. http://mobility.tamu.edu/ums/report/). The fuel saved by the project between 2012 (the year the new bridge opens) and 2035 is estimated at 2.5 million gallons.

Using an average fuel cost of $3.22 per gallon, the present value of fuel savings is $4.5 million (using a three percent discount rate), and $2.2 million (using a seven percent discount rate).

The $3.22 average fuel costs were based on projections developed by Cambridge Systematics for the State of Washington Joint Transportation Committee. The report can be accessed at http://www.leg.wa.gov/documents

/LTC/jtc/Studies/Transportation%20Financing%20Study%20Executive%20Summary%20Jan%2007.pdf . These national-level fuel costs were localized to establish projections for the Tulsa region, reflecting both the average anticipated cost savings associated with higher volumes purchased for fleet services, as well as the average lower retail fuel costs historically realized in Oklahoma prices as compare to national average fuel prices.

Table 8 Fuel Savings 2010-2035 for Replace Now vs. Replace in 2035

	Total Annual Savings (hours)	Annual Fuel Used during delays (0.01 gallons per minute)	Per-Gallon Fuel Cost	Value of fuel savings (dollars)	2009 PV of Fuel Savings (3%)	2009 PV of Fuel Savings (7%)
2019	41,991	25,194.3	$3.15	$79,378	$59,065	$40,352
2020	50,364	30,218.3	$3.17	$95,747	$69,169	$45,489
2021	51,371	30,822.6	$3.19	$98,215	$68,886	$43,609
2022	60,236	36,141.7	$3.20	$115,817	$78,866	$48,060
2023	69,365	41,619.0	$3.22	$134,125	$88,673	$52,016
2024	78,907	47,344.0	$3.24	$153,440	$98,487	$55,614
2025	88,729	53,237.4	$3.26	$173,519	$108,131	$58,777
2026	98,987	59,392.5	$3.28	$194,677	$117,783	$61,630
2027	339,945	203,967.2	$3.30	$672,356	$394,939	$198,926
2028	355,571	213,342.5	$3.32	$707,248	$403,334	$195,560
2029	371,606	222,963.6	$3.33	$743,333	$411,565	$192,091
2030	378,634	227,180.2	$3.35	$761,684	$409,443	$183,957
2031	386,206	231,723.8	$3.37	$781,322	$407,766	$176,355
2032	393,930	236,358.2	$3.39	$801,466	$406,096	$169,067
2033	401,809	241,085.4	$3.41	$822,130	$404,433	$162,080
2034	409,845	245,907.1	$3.43	$843,326	$402,777	$155,382
2035	418,042	250,825.3	$3.45	$865,069	$401,128	$148,961
TOTAL	**4,137,281**	**2,482,369**		**$ 8,306,120**	**$ 4,549,728**	**$ 2,158,234**

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 adapted to the Tulsa area based on a 2007 Cambridge Systematics report, Long-Term Transportation Financing Study. (http://www.leg.wa.gov/documents/LTC/jtc/Studies/Transportation%20Financing%20Study%20Executive%20Summary%20Jan%2007.pdf)

Emissions

As vehicular delays and fuel use are reduced, and travel speeds increase, the amount of vehicle emissions produced by vehicles crossing the bridge will be substantially reduced. An estimate of these emissions was developed by using the following formulas derived from MOBILE6 Vehicle Emission Modeling Software:

- Volatile organic compound (VOC) emissions are reduced by 23.59 grams per vehicle hour
- Nitrogen oxides (NO_x) emissions are reduced by 5.8 grams per hour
- Carbon monoxide (CO) emissions are reduced by 324.64 grams/hour
- Carbon dioxide (CO_2) emissions are reduced by 13.2 pounds per hour
- Particulate Matter (PM_{10}) emissions are reduced by around 1 gram per hour of truck travel

The reduction in emissions of these compounds in 2012 is estimated at approximately 89 tons. Because of the growing traffic on the bridge, and the increased peak hour congestion that will result if the bridge is not replaced, by 2035 the annual emissions savings, compared to the No Build, grows to nearly 3,000 tons.

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 MY 2011 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 is estimated at $3,800, growing to $124,900 by 2030. As shown in Table 9, the present value of total emissions reductions 2012-2030 is $678,900 using a three percent discount rate and $323,600 using a seven percent discount rate.

Table 9 Emissions Reduction Benefits

			Estimated Emissions Produced by Delay (Tons/Year)							Annual Value of Reduction in Emissions						
			VOC	NOX	CO	C02	PM			VOC	NOX	CO	C02	PM		
Year	TOTAL TIME SAVINGS (vehicle hours per year)	Truck Time Savings (vehicle hours per year)	23.59 grams/hr	5.8 grams/hr	324.64 grams/hr	13.2 lbs/hr	PM grams/hr factor (varies)	Tons/year	Total Tons	$1,700/ton	$4,000/ton	$0/ton	$33/ton	$168,000/ ton	TOTAL Value of Emissions Reductions	20(B
2010	-	-	0.00	0.00	0.00	0.00	1.1501	-	1.15	$0	$0	$0	$0	$0	**$0**	
2011	(2,416)	(145)	-0.06	-0.02	-0.86	-15.95	1.1242	(0.0002)	-15.76	-$107	-$62	$0	-$526	-$30	**-$725**	
2012	12,746	765	0.33	0.08	4.56	84.12	1.0750	0.0009	90.17	$563	$326	$0	$2,776	$152	**$3,818**	
2013	13,001	780	0.34	0.08	4.65	85.81	1.0639	0.0009	91.94	$575	$332	$0	$2,832	$154	**$3,893**	
2014	13,261	796	0.34	0.08	4.75	87.52	1.0547	0.0009	93.75	$586	$339	$0	$2,888	$155	**$3,969**	
2015	13,526	812	0.35	0.09	4.84	89.27	1.0272	0.0009	95.58	$598	$346	$0	$2,946	$154	**$4,044**	
2016	27,593	1,656	0.72	0.18	9.87	182.12	1.0230	0.0019	193.91	$1,220	$706	$0	$6,010	$314	**$8,249**	
2017	28,145	1,689	0.73	0.18	10.07	185.76	1.0197	0.0019	197.76	$1,244	$720	$0	$6,130	$319	**$8,413**	
2018	35,885	2,153	0.93	0.23	12.84	236.84	1.0040	0.0024	251.85	$1,586	$918	$0	$7,816	$400	**$10,720**	
2019	41,991	2,519	1.09	0.27	15.03	277.14	1.0040	0.0028	294.53	$1,856	$1,074	$0	$9,146	$468	**$12,544**	
2020	50,364	3,022	1.31	0.32	18.02	332.40	1.0040	0.0033	353.06	$2,226	$1,288	$0	$10,969	$562	**$15,045**	
2021	51,371	3,082	1.34	0.33	18.38	339.05	1.0040	0.0034	360.10	$2,271	$1,314	$0	$11,189	$573	**$15,346**	
2022	60,236	3,614	1.57	0.39	21.56	397.56	1.0040	0.0040	422.07	$2,663	$1,540	$0	$13,119	$672	**$17,995**	
2023	69,365	4,162	1.80	0.44	24.82	457.81	1.0040	0.0046	485.89	$3,066	$1,774	$0	$15,108	$774	**$20,722**	
2024	78,907	4,734	2.05	0.50	28.24	520.78	1.0040	0.0052	552.59	$3,488	$2,018	$0	$17,186	$880	**$23,572**	
2025	88,729	5,324	2.31	0.57	31.75	585.61	1.0040	0.0059	621.25	$3,922	$2,269	$0	$19,325	$990	**$26,507**	
2026	98,987	5,939	2.57	0.63	35.42	653.32	1.0040	0.0066	692.96	$4,376	$2,531	$0	$21,559	$1,104	**$29,571**	
2027	339,945	20,397	8.84	2.17	121.65	2243.64	1.0040	0.0226	2377.33	$15,028	$8,694	$0	$74,040	$3,792	**$101,554**	
2028	355,571	21,334	9.25	2.27	127.24	2346.77	1.0040	0.0236	2486.56	$15,718	$9,093	$0	$77,443	$3,967	**$106,222**	
2029	371,606	22,296	9.66	2.38	132.98	2452.60	1.0040	0.0247	2598.65	$16,427	$9,503	$0	$80,936	$4,146	**$111,012**	
2030	378,634	22,718	9.85	2.42	135.50	2498.98	1.0040	0.0251	2647.77	$16,738	$9,683	$0	$82,466	$4,224	**$113,111**	
2031	386,206	23,172	10.04	2.47	138.21	2548.96	1.0040	0.0256	2700.71	$17,073	$9,877	$0	$84,116	$4,308	**$115,373**	
2032	393,930	23,636	10.24	2.52	140.97	2599.94	1.0040	0.0262	2754.70	$17,414	$10,074	$0	$85,798	$4,395	**$117,681**	
2033	401,809	24,109	10.45	2.57	143.79	2651.94	1.0040	0.0267	2809.78	$17,762	$10,276	$0	$87,514	$4,482	**$120,035**	
2034	409,845	24,591	10.66	2.62	146.66	2704.98	1.0040	0.0272	2865.95	$18,118	$10,481	$0	$89,264	$4,572	**$122,435**	
2035	418,042	25,083	10.87	2.67	149.60	2759.08	1.0040	0.0278	2923.25	$18,480	$10,691	$0	$91,050	$4,664	**$124,884**	
TOTAL	4,137,281		108	**26**	**1,481**	**27,306**		**0.2750**	**28,948**							**$**

Source notes:

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

Economic Development
The eastern I-244 bridge structure has been designed to support two rail tracks over the Arkansas River. This is critical to the implementation of the region's commuter rail plans, which in turn will trigger private investment in the transit-oriented developments (TODs) that are already being planned for future Phase I station areas. The bridge will allow the civic improvements associated with the bridge's rail, bicycle and pedestrian facilities to move forward as well.

While the full commuter rail plan will have benefits reaching throughout the region, only a portion of the localized benefits are being considered attributable as benefits in the project benefit cost ratio. Specifically, the benefits taking place near the bridge as part of the first phase of the commuter rail plan. Only a portion of the localized benefits are being included in view of the fact that only a portion of the localized (Phase I) commuter rail project costs are included in this analysis. Total costs for Phase I rail improvements include the I-244 bridge construction, as well as the cost of track, signals, rolling stock, station construction, and other rail improvements. Associated civic improvements include streetscape improvements, parking facilities, and an estimated $80 million in planned grade separation of local streets crossing the alignment. Examples of the benefits of these improvements that are not included in the BCA include, but are not limited to, development at station areas for Phase I stations other than those near Evans Fintube, Greenwood and West Bank, TOD at later-phase station areas, increased patronage at baseball games and other venues along the rail line, travel time savings for commuters using rail, mobility benefits for transit-dependent individuals, and sustainability benefits from reducing regional dependence on the automobile.

The City of Tulsa has developed construction cost and job estimates for some of the many "I-244 Bundle" and commuter rail related projects. Only the four TOD projects are being included in the benefit calculations:

1. Development of Evans Fintube site – $80 million
2. Development of West Bank site (phase I) – $128 million
3. Development of West Bank site (phase II) – $163 million
4. Development of Greenwood site – $47 million
5. Permanent jobs (at all four sites combined) – 580 jobs
6. Retail sales (at all four sites combined) - $37.8 million

Items 1-4: The first four items were included in the BCA by assuming that the $418 million in largely private sector investments would take four years to construct beginning in 2012 (the year the bridge is completed). In reality, some of the construction may start in advance of the bridge completion, in anticipation of future rail service. It is also possible that it will take more than four years for complete build-out of these four developments. For the purposes of this analysis, a 2012-2015 construction period is assumed.

Item 5: The City of Tulsa analysis indicates that approximately 520-600 new jobs (averaged to be an assumed 580 in the BCA) will be created because of the development – including office workers, retail staff, and teachers at the school proposed for the Evans Fintube site. In the BCA, because some of these positions are part-time, the average earnings per job was conservatively assumed to be $20,000. The BCA assumes that it will take until 2016 for employment to reach the full 580 jobs.

Item 6: An additional quantified benefit of the project is the estimated $33.6 to $42.0 million in retail sales ($37.8 million was used in the BCA) to be generated by these developments once fully built out. The BCA assumes that it will take until 2016 for the retail sales activity to reach the levels assumed by the project.

As Table 10 shows, the present value of the resulting construction, retail sales and permanent employment benefits over the next 60 years is $1.6 billion using the three percent discount rate, and $842 million using the seven percent discount rate.

Table 10 Public Sector Development Benefits

Year	Retail Sales	Constr. Expenditures for TOD projects	Ongoing Jobs	Income from Ongoing Jobs ($20,000/year)	TOTAL BENEFITS	Present Value (3%)	Present Value (7%)
2010	-		20	400,000	$ 400,000	$ 388,350	$ 373,832
2011			80	1,600,000	$ 1,600,000	$ 1,508,153	$ 1,397,502
2012	7,551,000	104,407,625	200	4,000,000	$ 115,958,625	$ 106,118,568	$ 94,656,779
2013	15,102,000	104,407,625	250	5,000,000	$ 124,509,625	$ 110,625,189	$ 94,987,797
2014	22,653,000	104,407,625	400	8,000,000	$ 135,060,625	$ 116,504,482	$ 96,296,359
2015	30,204,000	104,407,625	500	10,000,000	$ 144,611,625	$ 121,109,959	$ 96,360,832
2016	37,755,000		580	11,600,000	$ 49,355,000	$ 40,130,132	$ 30,735,814
2017	37,755,000		580	11,600,000	$ 49,355,000	$ 38,961,293	$ 28,725,059
2018	37,755,000		580	11,600,000	$ 49,355,000	$ 37,826,498	$ 26,845,850
2019	37,755,000		580	11,600,000	$ 49,355,000	$ 36,724,755	$ 25,089,579
2020	37,755,000		580	11,600,000	$ 49,355,000	$ 35,655,102	$ 23,448,205
2021	37,755,000		580	11,600,000	$ 49,355,000	$ 34,616,604	$ 21,914,210
2022	37,755,000		580	11,600,000	$ 49,355,000	$ 33,608,353	$ 20,480,570
2023	37,755,000		580	11,600,000	$ 49,355,000	$ 32,629,469	$ 19,140,720
2024	37,755,000		580	11,600,000	$ 49,355,000	$ 31,679,096	$ 17,888,523
2025	37,755,000		580	11,600,000	$ 49,355,000	$ 30,756,404	$ 16,718,246
2026	37,755,000		580	11,600,000	$ 49,355,000	$ 29,860,587	$ 15,624,529
2027	37,755,000		580	11,600,000	$ 49,355,000	$ 28,990,861	$ 14,602,364
2028	37,755,000		580	11,600,000	$ 49,355,000	$ 28,146,467	$ 13,647,069
2029	37,755,000		580	11,600,000	$ 49,355,000	$ 27,326,667	$ 12,754,270
2030	37,755,000		580	11,600,000	$ 49,355,000	$ 26,530,745	$ 11,919,878
2031	37,755,000		580	11,600,000	$ 49,355,000	$ 25,758,004	$ 11,140,073
2032	37,755,000		580	11,600,000	$ 49,355,000	$ 25,007,771	$ 10,411,283
2033	37,755,000		580	11,600,000	$ 49,355,000	$ 24,279,390	$ 9,730,171
2034	37,755,000		580	11,600,000	$ 49,355,000	$ 23,572,223	$ 9,093,618
2035	37,755,000		580	11,600,000	$ 49,355,000	$ 22,885,653	$ 8,498,709
2036	37,755,000		580	11,600,000	$ 49,355,000	$ 22,219,081	$ 7,942,718
2037	37,755,000		580	11,600,000	$ 49,355,000	$ 21,571,923	$ 7,423,101
2038	37,755,000		580	11,600,000	$ 49,355,000	$ 20,943,615	$ 6,937,478
2039	37,755,000		580	11,600,000	$ 49,355,000	$ 20,333,607	$ 6,483,624
2040	37,755,000		580	11,600,000	$ 49,355,000	$ 19,741,366	$ 6,059,462
2041	37,755,000		580	11,600,000	$ 49,355,000	$ 19,166,374	$ 5,663,048
2042	37,755,000		580	11,600,000	$ 49,355,000	$ 18,608,130	$ 5,292,569
2043	37,755,000		580	11,600,000	$ 49,355,000	$ 18,066,146	$ 4,946,326
2044	37,755,000		580	11,600,000	$ 49,355,000	$ 17,539,948	$ 4,622,734
2045	37,755,000		580	11,600,000	$ 49,355,000	$ 17,029,075	$ 4,320,312
2046	37,755,000		580	11,600,000	$ 49,355,000	$ 16,533,083	$ 4,037,675
2047	37,755,000		580	11,600,000	$ 49,355,000	$ 16,051,537	$ 3,773,528
2048	37,755,000		580	11,600,000	$ 49,355,000	$ 15,584,016	$ 3,526,662
2049	37,755,000		580	11,600,000	$ 49,355,000	$ 15,130,113	$ 3,295,946
2050	37,755,000		580	11,600,000	$ 49,355,000	$ 14,689,430	$ 3,080,323
2051	37,755,000		580	11,600,000	$ 49,355,000	$ 14,261,583	$ 2,878,807
2052	37,755,000		580	11,600,000	$ 49,355,000	$ 13,846,197	$ 2,690,473
2053	37,755,000		580	11,600,000	$ 49,355,000	$ 13,442,909	$ 2,514,461
2054	37,755,000		580	11,600,000	$ 49,355,000	$ 13,051,368	$ 2,349,964
2055	37,755,000		580	11,600,000	$ 49,355,000	$ 12,671,231	$ 2,196,228
2056	37,755,000		580	11,600,000	$ 49,355,000	$ 12,302,166	$ 2,052,549
2057	37,755,000		580	11,600,000	$ 49,355,000	$ 11,943,851	$ 1,918,270
2058	37,755,000		580	11,600,000	$ 49,355,000	$ 11,595,972	$ 1,792,776
2059	37,755,000		580	11,600,000	$ 49,355,000	$ 11,258,225	$ 1,675,492
2060	37,755,000		580	11,600,000	$ 49,355,000	$ 10,930,315	$ 1,565,880
2061	37,755,000		580	11,600,000	$ 49,355,000	$ 10,611,957	$ 1,463,439
2062	37,755,000		580	11,600,000	$ 49,355,000	$ 10,302,871	$ 1,367,700
2063	37,755,000		580	11,600,000	$ 49,355,000	$ 10,002,787	$ 1,278,225
2064	37,755,000		580	11,600,000	$ 49,355,000	$ 9,711,444	$ 1,194,602
2065	37,755,000		580	11,600,000	$ 49,355,000	$ 9,428,586	$ 1,116,451
2066	37,755,000		580	11,600,000	$ 49,355,000	$ 9,153,967	$ 1,043,412
2067	37,755,000		580	11,600,000	$ 49,355,000	$ 8,887,347	$ 975,151
2068	37,755,000		580	11,600,000	$ 49,355,000	$ 8,628,492	$ 911,356
2069	37,755,000		580	11,600,000	$ 49,355,000	$ 8,377,177	$ 851,735
TOTAL	**2,114,280,000**	**208,815,250**	**32,770**	**655,400,000**	**$ 3,187,310,500**	**$ 1,554,816,662**	**$ 841,724,321**

Source: Planning Department, City of Tulsa, Oklahoma; 08.06.2009

These figures are included as benefits in Benefit Cost summary below as a rough estimate of the benefits attributable solely to the I-244 bridge project. The economic benefits of the numerous I-244 bundle and commuter rail related projects are sizeable, and far exceed the above-evaluated benefits. Similarly, the I-244 bridge project's costs represent only a portion of the total costs of the many road, rail, bicycle, pedestrian, and park improvements being planned.

It is important to note that this analysis assumes that the TOD projects will materialize only if the bridge is rebuilt to accommodate Tulsa's long range plan to develop passenger rail. Reconstruction of the bridge, as noted, will be necessary in order for the rail project to proceed. While other market factors must also be in place in order for the TOD developments to be fully realized, INCOG believes that such market-based factors are going to be present – i.e., that strong demand exists now, and will continue to exist, in the Tulsa metropolitan area for these types of developments. Accordingly, the I-244 bridge project with passenger rail carrying capacity represents the remaining piece of the puzzle needed to complete these major land use and economic development projects in Tulsa.

Cost/Benefit Summary

Table 11 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 guidance.

The investment now in replacing and upgrading the I-244 Bridge is a very cost-effective investment. Using a discount rate of three percent, the benefit/cost ratio is 11.7 and at a seven percent discount rate, it is 7.84. The Net Present Value of the investment is $1.62 billion and $840 million, respectively.

Table 11 Calculation of Benefit Cost Ratio and Net Present Value (in $2009)

Category	Present Value at 3%	Present Value at 7%
Costs		
60-year Life-Cycle Cost of the Bridge	**$158,889,191**	**$122,871,957**
Evaluated Benefits		
Travel Time Savings from Reduced Maintenance Work Zone Delay	$11,418,539	$5,942,768
Travel Time Savings from Use of Fourth Lane	$13,593,325	$5,978,616
Avoided 60-year life-cycle expenses needed to maintain existing bridge through to 2035	$190,035,395	$106,798,137
Vehicle Fuel Cost Savings	$4,549,728	$2,158,234
Emissions Savings	$678,873	$323,584
Economic Development Benefits	$1,554,816,662	$841,724,321
Total Evaluated Benefits	**$1,775,092,522**	**$962,925,661**
Net Present Value	**$1,616,203,331**	**$840,053,704**
Benefit/Cost Ratio	**11.17**	**7.84**

Other Non-Quantifiable Benefits

The true measure of all of this project's many benefits is not summarized in the above table, as many benefits cannot be quantified. The regional economic benefit in terms of population and employment growth resulting from having a fully operational bridge, shorter commute times as well as a pedestrian and bicycle friendly, dynamic, growing downtown will result in many benefits – including happier, wealthier families and increased tax revenues.

Similarly, the travel time savings benefits for drivers, for example, do not include the thousands of riders who will zip underneath traffic congestion riding the future rail system that the bridge will carry, saving time, fuel, and emissions for generations to come. Improved transit options can also allow households to reduce the number of cars they own, allowing them to spend more on housing and other items, boosting the local economy. And the additional development benefits of commuter rail are vast when TOD opportunities at the post-Phase-I rail stations are considered. Thus, the calculated net present value of $840 million to $1.6 billion may be only the start of project benefits.