

Benefit Cost Analysis

The Benefit Cost Analysis (BCA) was performed in accordance with the ARRA guidance provided in the Federal Register. These benefits and costs were quantified in accordance with the Federal Register (Volume 74, Number 115) and Circulars A-4 and A-94 (See <http://www.whitehouse.gov/omb/circulars/>).

The purpose of the BCA is to systematically compare the benefits and costs of constructing the Bypass and evaluate the effects of an aggressive funding schedule. The BCA compared the Bypass as an Interstate-type toll facility with the existing four-lane divided Highway 71 facility for the first twenty years the facility is open (2013 through 2033). The BCA compared benefits and costs for two scenarios: 1) Building the Bypass as a toll facility, and 2) No-Build for the Bypass, where motorists would continue to use existing Highway 71.

The analysis considered standard features of roadway and toll facility construction costs in Arkansas and Missouri, and toll operation and maintenance costs in Arkansas. Table 1 summarizes the findings of the BCA analysis. Road User Benefits that were considered include:

- Value of Time saved while traveling on the Bypass,
- Operating Costs of vehicles on the highway network,
- Costs Savings by Greenhouse Gas Reduction,
- Value to Society of Enhancing Safety with an improved highway network, and
- Cost of Tolls to drivers (Negative Benefit).

**Table 1
Benefit Cost Analysis Summary**

Bella Vista Bypass Benefit Cost Evaluation Summary ¹	2009 Present Worth		2009 Present Worth Construction, O&M Costs
	No-Build	Build with Tolls	
Arkansas		\$ 261,500,000.00	\$ 261,500,000.00
Arkansas - Toll O&M Costs		\$ 85,300,000.00	\$ 85,300,000.00
Missouri		\$ 66,000,000.00	\$ 66,000,000.00
			\$ 412,800,000.00
	Road User Cost		Road User Cost Savings
Value of Time	\$ 1,621,366,000.00	\$ 1,280,987,000.00	\$ 340,379,000.00
Value of Operating Costs	\$ 3,082,087,000.00	\$ 3,083,559,000.00	\$ (1,472,000.00)
Value of Greenhouse Gases			\$ 4,538,000.00
Value of Safety Improvements	\$ 599,300,000.00	\$ 359,580,000.00	\$ 239,720,000.00
Cost of Tolls to Drivers	\$ -	\$ (62,300,000.00)	\$ (62,300,000.00)
Total			\$ 520,865,000.00
1. Costs in 2009 dollars include Construction of Grading, Structures, Pavement, Special Features, Toll Facility, Purchase of Right-of-Way, Engineering, and Contingencies.			
Benefit Cost Ratio =		1.26	

The BCA showed a cost savings of \$108 million to drivers over the twenty-year study period. Similar additional cost savings are expected to continue well beyond the twenty-year study horizon, and will increase as traffic on the existing roadway network grows.

The BCA was calculated using the following key factors for evaluation:

- Construction Cost
- Project Financing Costs
- Operations and Maintenance Costs
- Highway Geometry
- Highway Traffic Control Devices
- Forecast Traffic
- Travel Speeds and Congestion
- Historic Crash Data
- Vehicle Miles Traveled
- Traffic Distribution by Vehicle Type
- Benefit of Emission Reduction
- Value of Time

Construction Cost Estimates for portions of the Bypass in the States of Arkansas and Missouri are shown in **Attachment 1**. These costs reflect basic construction costs that would be incurred if the project were built using traditional construction methods and schedules. If TIGER grant financing is approved, additional features, such as Intelligent Transportation System elements and toll credits, may be added to enhance the benefit of the project.

Attachment 2 includes **Toll Revenue Operation and Maintenance Costs** and was based upon **Jacob's August 2009 Traffic and Revenue Report**. Toll facility operation and maintenance cost includes the cost to maintain the toll road facility, provide operating and administrative staff, and maintain ancillary structures. The Arkansas Highway Commission will be the tolling authority, and Arkansas State Highway and Transportation Department (AHTD) staff will supplement toll facility operations with in-house resources.

The BCA **Value of Time** analysis quantifies the impact of an improvement to road user savings in terms of travel time by first determining travel time savings, then assigning a dollar value to time. This includes differentiating time valuations by trip type, assuming passenger vehicle trips have several purposes, including work and pleasure, with a value of time at 50% of the standard wage rate in the area. A vehicle occupancy rate of 1.5 persons per vehicle was used, per the Northwest Arkansas Regional Travel Demand Model. Trucks and commercial vehicles were assumed to operate at 100% of a driver's appropriate standard wage rate. Trucks and buses in the existing corridor average about 13.6% of all vehicles. It is expected that trucks would average about 20% of vehicles on the Bypass. Time savings for road users on the Bypass was estimated to be between eight minutes and fifteen minutes based upon **Jacob's August 2009 Traffic and Revenue Report**. Time savings on the existing route was estimated to be between four and six minutes due to a reduction of traffic on the existing facility. Detailed worksheets showing factors considered are included in **Attachment 3**.

The **Operating Cost** analysis quantified the cost of owning and operating a vehicle, and compared the Road User Operating Costs for alternatives both with and without the Bypass. With the tolled Bypass, the existing route would also see benefits by reduced traffic volumes, reduced truck traffic, and lower levels of congestion. See **Attachment 4** for detailed information regarding operating cost calculations. Operating costs on the Bypass are slightly higher than on

the existing route due to an approximate three-mile increase in trip length and higher travels speeds. This expense is offset by the value of time savings and other factors.

Reduction in Greenhouse Gas Emissions was calculated for the Existing No-Build Alternative versus the Bypass Alternative. Greenhouse gas emissions would be reduced by a value of \$4.5 million in the twenty-year study period. Greenhouse gas reductions are attributed to idling and delay on the Bypass for trucks and heavy vehicles. **Attachment 5** shows detailed calculations.

The **Value of Safety Improvements** considers statistical cost savings that can be attributed to safety features of an Interstate-type facility as compared to driving on a four-lane arterial. **Attachment 6** shows these calculations. The Safety Analysis discusses specific existing safety conditions within the corridor. For the BCA, the Value to Society of lost resources and lives resulting from crashes was calculated from two years of crash data, and was then averaged. The average crash rate on Highway 71 in Arkansas is below the Statewide Average Rate for similar facilities. Per the guidance, the crash rate for the existing facility was adjusted up by a factor of 1.3 based upon the assumption that over time, facilities would tend to become more similar to the statewide average. The assumed future crash rate was still less than the Statewide average rate. The crash rate on the improved roadway network, including the Bypass and the existing facility, was found to be reduced by a factor of 60% compared to the expected future crash rate. As a standard for quality control, the crash rates and statistics were checked for existing Highway 71, and fall under the statewide average crash rates.

Cost of Tolls to Drivers is a negative benefit to road users, in that they must pay a fee to use the Bypass. The Cost of Tolls was calculated over the twenty-year study period, and was adjusted to present worth of year 2009 dollars by applying a 7% discount rate, as shown in **Attachment 7**. It was assumed that the toll fees would not be adjusted for inflation. For the entire 14.6 mile tolled trip, a toll rate for two-axle (passenger) vehicles of \$1.50 was assumed at the mainline toll plaza. This equates to approximately 10 cents per mile for a passenger vehicle.

References

User Benefit Analysis for Highways, August 2003, AASHTO
Bella Vista Bypass Traffic and Revenue Report, August 27, 2009, Jacobs Engineering Group, Inc., and Stantec
Manual on User Benefit Analysis for Highway and Bus Transit Improvements, 1977, AASHTO
Chapter VIII of the Final Regulatory Impact Analysis of the National Highway Traffic Safety Administration's rulemaking on Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks
Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Office of Management and Budget
BCA.Net-Highway Project Benefit-Cost Analysis System User's Manual, Federal Highway Administration
Memorandum: Departmental Guidance for the Valuation of Travel Time in Economic Analysis, Guidance for Conducting Economic Evaluations, April 9, 1997, U.S. Department of Transportation
Memorandum to: Secretarial Officers Modal Administrators Re: Treatment of the Economic Value of a Statistical life in Departmental Analyses – 2009 Annual Revision, March 18, 2009
Circular A-4: To the Heads of Executive Agencies and Establishments; Subject: Regulatory Analysis, September 17, 2003, Office of Management and Budget
Federal Register (Volume 74, Number 115); Notice of Funding Availability for Supplemental Discretionary Grants for Capital Investments in Surface Transportation Infrastructure Under the American Recovery and Reinvestment Act; Page 28760; June 17, 2009

ATTACHMENT 1

Table 1 - Bella Vista Bypass Project Cost Estimate

Arkansas Segment

Preliminary Engineering	\$	6,800,000.00
Right of Way and Utilities	\$	23,000,000.00
Roadway and Bridge Construction	\$	199,000,000.00
Toll Plaza and Customer Center	\$	12,700,000.00
Construction Engineering	\$	20,000,000.00

TOTAL \$ 261,500,000.00

Missouri Segment

Preliminary Engineering	N/A	
Right of Way and Utilities	\$	6,600,000.00
Roadway and Bridge Construction	\$	55,400,000.00
Construction Engineering	\$	4,300,000.00

MISSOURI TOTAL COSTS \$ 66,300,000.00

ATTACHMENT 2

Bella Vista Bypass Toll Facility O&M

Year	E&C with Staff	ETO	O&M Costs
2014	\$ 4,526,223.64	\$ 1,754,276.47	\$ 2,771,947.17
2015	\$ 4,752,428.68	\$ 1,671,141.00	\$ 3,081,287.69
2016	\$ 4,972,682.25	\$ 1,742,825.30	\$ 3,229,856.95
2017	\$ 5,277,970.98	\$ 1,822,843.92	\$ 3,455,127.05
2018	\$ 5,399,763.92	\$ 1,970,861.46	\$ 3,428,902.46
2019	\$ 5,489,767.89	\$ 1,916,868.30	\$ 3,572,899.59
2020	\$ 5,674,868.51	\$ 1,983,968.62	\$ 3,690,899.89
2021	\$ 5,912,776.84	\$ 2,059,215.76	\$ 3,853,561.08
2022	\$ 6,084,112.39	\$ 2,100,428.99	\$ 3,983,683.40
2023	\$ 6,278,871.31	\$ 2,161,021.64	\$ 4,117,849.67
2024	\$ 6,484,893.40	\$ 2,227,522.95	\$ 4,257,370.46
2025	\$ 6,745,701.94	\$ 2,295,885.32	\$ 4,449,816.62
2026	\$ 6,971,954.78	\$ 2,367,415.53	\$ 4,604,539.25
2027	\$ 7,187,678.00	\$ 2,430,623.15	\$ 4,757,054.85
2028	\$ 7,418,879.25	\$ 2,504,218.20	\$ 4,914,661.04
2029	\$ 7,657,920.07	\$ 2,579,739.85	\$ 5,078,180.22
2030	\$ 7,904,370.80	\$ 2,657,559.03	\$ 5,246,811.77
2031	\$ 8,159,313.18	\$ 2,734,470.81	\$ 5,424,842.37
2032	\$ 8,408,513.59	\$ 2,809,972.46	\$ 5,598,541.13
2033	\$ 8,676,517.37	\$ 2,892,933.48	\$ 5,783,583.88
			\$ 85,301,416.55

Assumes cost of toll facility maintenance is included in the financing costs.

Future O&M costs are those carried by AHTD only.

Assumes 20 year O&M, beginning in Year 2014

Sources: O&M forecast with staffing: Jacobs July 18, 2009 spreadsheet.

O&M forecast with no staffing: Jacobs August 10, 2009 spreadsheet

ATTACHMENT 3

Value of Time - Existing Route - No Build versus Build

General Information	
Analyst	KKR
Agency/Company	AHTD
Project	BYPASS
Date Performed	8/8/2009

Site Information	
Facility	Bella Vista Bypass
Segment	Ex US 71
Analysis Time Period	Peak Hour
Analysis Year	2009
Segment Length (mi.)	16.2

Inputs

Autos	
Percentage of hourly wage (Table 5-1)	50%
Average hourly wage (Table 5-2)	\$18.56
Average vehicle occupancy	1.5
Speed without Improvement (mph)	41
Speed with Improvement (mph)	47
or	
Delay without improvement (min.)	
Delay with improvement (min.)	

Trucks	
Percentage of compensation (Table 5-1)	100%
Average hourly compensation (Table 5-2)	\$20.23
Average vehicle occupancy	1.05
Speed without Improvement (mph)	40
Speed with Improvement (mph)	46
or	
Delay without improvement (min.)	
Delay with improvement (min.)	

Calculations

Autos	
Value of time per hour (wage X percentage X occupancy)	\$13.92
For speed change:	
Time without improvement (min.)	23.707
Time with improvement (min.)	20.681
(1 / speed) X length X 60	
Travel time saved per vehicle (min.):	3.026
or	
For delay change:	
Travel time saved per vehicle (min.): (delay without - delay with)	0.000
Value of time saved per vehicle (VOT per hour * time saved / 60)	\$0.7021
Value of time saved per VMT (VOT per vehicle / length)	\$0.0433

Trucks	
Value of time per hour (wage X percentage X occupancy)	\$21.24
For speed change:	
Time without improvement (min.)	24.300
Time with improvement (min.)	21.130
(1 / speed) X length X 60	
Travel time saved per vehicle (min.):	3.170
or	
For delay change:	
Travel time saved per vehicle (min.): (delay without - delay with)	0.000
Value of time saved per vehicle (VOT per hour * time saved / 60)	\$1.1221
Value of time saved per VMT (VOT per vehicle / length)	\$0.0693

ATTACHMENT 3

Value of Time - Bypass with Tolls

General Information	
Analyst	<i>KKR</i>
Agency/Company	<i>AHTD</i>
Project	<i>BYPASS</i>
Date Performed	<i>8/8/2009</i>

Site Information	
Facility	<i>Bella Vista Bypass</i>
Segment	<i>EXUS 71</i>
Analysis Time Period	<i>Peak Hour</i>
Analysis Year	<i>2009</i>
Segment Length (mi.)	<i>18.5</i>

Inputs

Autos	
Percentage of hourly wage (Table 5-1)	<i>50%</i>
Average hourly wage (Table 5-2)	<i>\$18.56</i>
Average vehicle occupancy	<i>1.5</i>
Speed without Improvement (mph)	<i>67</i>
Speed with Improvement (mph)	<i>67</i>
or	
Delay without improvement (min.)	
Delay with improvement (min.)	

Trucks	
Percentage of compensation (Table 5-1)	<i>100%</i>
Average hourly compensation (Table 5-2)	<i>\$20.23</i>
Average vehicle occupancy	<i>1.05</i>
Speed without Improvement (mph)	<i>67</i>
Speed with Improvement (mph)	<i>67</i>
or	
Delay without improvement (min.)	
Delay with improvement (min.)	

Calculations

Autos	
Value of time per hour (wage X percentage X occupancy)	<i>\$13.92</i>
For speed change:	
Time without improvement (min.)	<i>16.567</i>
Time with improvement (min.)	<i>16.567</i>
(1 / speed) X length X 60	
Travel time saved per vehicle (min.):	<i>0.000</i>
or	
For delay change:	
Travel time saved per vehicle (min.): (delay without - delay with)	<i>0.000</i>
Value of time saved per vehicle (VOT per hour * time saved / 60)	<i>\$0.0000</i>
Value of time saved per VMT (VOT per vehicle / length)	<i>\$0.0000</i>

Trucks	
Value of time per hour (wage X percentage X occupancy)	<i>\$21.24</i>
For speed change:	
Time without improvement (min.)	<i>16.567</i>
Time with improvement (min.)	<i>16.567</i>
(1 / speed) X length X 60	
Travel time saved per vehicle (min.):	<i>0.000</i>
or	
For delay change:	
Travel time saved per vehicle (min.): (delay without - delay with)	<i>0.000</i>
Value of time saved per vehicle (VOT per hour * time saved / 60)	<i>\$0.0000</i>
Value of time saved per VMT (VOT per vehicle / length)	<i>\$0.0000</i>

ATTACHMENT 3

Value of Time in 2009 Dollars for Existing No-Build Network - Improved Network with Bypass

YEAR	YEAR SINCE PRESENT	WAADT - Bypass	WAADT - US 71 Existing/ US 71B No Bypass	WAADT - US 71 Existing/ US 71B With Bypass	Bypass Truck Percent	Existing Route Truck Percent	Travel Time @ 67.5 mph - Bypass (Hours)	Travel Speed on US 71 without Bypass	Travel Time - Existing Without Bypass (Hours)	Travel Speed on US 71 with Bypass	Travel Time Existing No Build (Hours)	Travel Time Savings No Build versus Build on Bypass	Travel Time Savings Existing-Build Versus Build on Bypass	Travel Time Savings No-Build versus Build on US 71B	Daily Value of Time on Existing	TOTAL Annual Value of Time on Existing	TOTAL Daily Value of Time on Bypass	TOTAL Daily Value of Existing w/ Bypass	TOTAL Daily Value of Time on Improved Network	Total Annual VOT on Improved Network
2009	0	0	29,100	29,100	0%	13.6%				40.0	0.41				\$ 176,003.88	\$ 64,285,417.82				
2010	1	0	29,300	29,300	0%	13.6%				39.7	0.41				\$ 178,687.70	\$ 65,265,683.89				
2011	2	0	29,500	29,500	0%	13.6%				39.3	0.41				\$ 181,416.55	\$ 66,262,395.70				
2012	3	0	29,700	29,700	0%	13.6%				39.0	0.42				\$ 184,191.57	\$ 67,275,970.62				
2013	4	0	29,900	29,900	0%	13.6%				38.7	0.42				\$ 187,013.94	\$ 68,306,840.26				
2014	5	4,800	30,100	25,300	20%	13.6%	0.272	44.35	0.37	38.4	0.42	0.151	0.09	0.06	\$ 189,884.88	\$ 69,355,451.06	\$ 20,089.69	\$ 142,346.57	\$ 162,436.27	\$ 59,329,846.82
2015	6	6,400	30,300	23,900	20%	13.6%	0.272	44.02	0.37	38.0	0.43	0.155	0.10	0.06	\$ 192,805.65	\$ 70,422,265.00	\$ 26,786.26	\$ 135,477.75	\$ 162,264.01	\$ 59,266,930.19
2016	7	7,800	30,500	22,700	20%	13.6%	0.272	43.69	0.37	37.7	0.43	0.158	0.10	0.06	\$ 195,777.58	\$ 71,507,760.21	\$ 32,645.75	\$ 129,647.44	\$ 162,293.19	\$ 59,277,587.40
2017	8	8,500	30,700	22,200	20%	13.6%	0.272	43.36	0.37	37.4	0.43	0.162	0.10	0.06	\$ 198,802.00	\$ 72,612,431.73	\$ 35,575.50	\$ 127,756.74	\$ 163,332.24	\$ 59,657,100.74
2018	9	9,500	30,900	21,400	20%	13.6%	0.272	43.03	0.38	37.0	0.44	0.166	0.10	0.06	\$ 201,880.33	\$ 73,736,792.24	\$ 39,760.85	\$ 124,097.36	\$ 163,858.21	\$ 59,849,212.88
2019	10	9,800	31,100	21,300	20%	13.6%	0.272	42.70	0.38	36.7	0.44	0.170	0.11	0.06	\$ 205,014.03	\$ 74,881,372.85	\$ 41,016.46	\$ 124,472.05	\$ 165,488.51	\$ 60,444,678.61
2020	11	10,300	31,300	21,000	20%	13.6%	0.272	42.37	0.38	36.4	0.45	0.174	0.11	0.06	\$ 208,204.58	\$ 76,046,723.97	\$ 43,109.14	\$ 123,674.72	\$ 166,783.86	\$ 60,917,804.82
2021	12	10,500	31,500	21,000	20%	13.6%	0.272	42.04	0.39	36.0	0.45	0.178	0.11	0.06	\$ 211,453.57	\$ 77,233,416.15	\$ 43,946.21	\$ 124,645.53	\$ 168,591.74	\$ 61,578,131.52
2022	13	10,600	31,700	21,100	20%	13.6%	0.272	41.71	0.39	35.7	0.45	0.182	0.12	0.07	\$ 214,762.60	\$ 78,442,041.03	\$ 44,364.74	\$ 126,229.94	\$ 170,594.68	\$ 62,309,708.44
2023	14	10,900	31,900	21,000	20%	13.6%	0.272	41.38	0.39	35.4	0.46	0.186	0.12	0.07	\$ 218,133.37	\$ 79,673,212.33	\$ 45,620.35	\$ 126,633.59	\$ 172,253.94	\$ 62,915,751.62
2024	15	11,100	32,100	21,000	20%	13.6%	0.272	41.05	0.40	35.1	0.46	0.191	0.12	0.07	\$ 221,567.60	\$ 80,927,566.88	\$ 46,457.42	\$ 127,651.60	\$ 174,109.02	\$ 63,593,317.81
2025	16	11,300	32,300	21,000	20%	13.6%	0.272	40.72	0.40	34.7	0.47	0.195	0.13	0.07	\$ 225,067.12	\$ 82,205,765.73	\$ 47,294.49	\$ 128,686.10	\$ 175,980.59	\$ 64,276,910.64
2026	17	11,400	32,500	21,100	20%	13.6%	0.272	40.39	0.40	34.4	0.47	0.200	0.13	0.07	\$ 228,633.80	\$ 83,508,495.30	\$ 47,713.02	\$ 130,355.31	\$ 178,068.33	\$ 65,039,458.43
2027	18	11,600	32,800	21,200	20%	13.6%	0.272	40.06	0.40	34.1	0.48	0.204	0.13	0.07	\$ 232,979.90	\$ 85,095,907.34	\$ 48,550.09	\$ 132,052.02	\$ 180,602.11	\$ 65,964,920.86
2028	19	11,700	33,100	21,400	20%	13.6%	0.272	39.73	0.41	33.7	0.48	0.209	0.14	0.07	\$ 237,411.03	\$ 86,714,380.51	\$ 48,968.63	\$ 134,404.97	\$ 183,373.60	\$ 66,977,207.31
2029	20	11,900	33,400	21,500	20%	13.6%	0.272	39.40	0.41	33.4	0.49	0.214	0.14	0.07	\$ 241,929.73	\$ 88,364,835.49	\$ 49,805.70	\$ 136,164.02	\$ 185,969.72	\$ 67,925,439.60
2030	21	12,100	33,700	21,600	20%	13.6%	0.272	39.07	0.42	33.1	0.49	0.218	0.14	0.08	\$ 246,538.62	\$ 90,048,229.69	\$ 50,642.77	\$ 137,952.78	\$ 188,595.55	\$ 68,884,525.35
2031	22	12,300	34,000	21,700	20%	13.6%	0.272	38.74	0.42	32.7	0.50	0.223	0.15	0.08	\$ 251,240.41	\$ 91,765,559.15	\$ 51,479.84	\$ 139,772.02	\$ 191,251.86	\$ 69,854,741.93
2032	23	12,400	34,300	21,900	20%	13.6%	0.272	38.41	0.42	32.4	0.50	0.228	0.15	0.08	\$ 256,037.95	\$ 93,517,860.45	\$ 51,898.38	\$ 142,272.16	\$ 194,170.54	\$ 70,920,788.89
2033	24	12,500	34,600	22,100	20%	13.6%	0.272	38.08	0.43	32.1	0.51	0.234	0.15	0.08	\$ 260,934.19	\$ 95,306,212.84	\$ 52,316.91	\$ 144,815.64	\$ 197,132.55	\$ 72,002,662.97
																\$ 1,621,366,279.98			\$ 3,507,150.52	\$ 1,280,986,726.84

2009 Dollar Value of Time

Autos \$ 13.92

Cost of Time No-Build - Cost of Time Improved Network = \$ 340,379,553.14

Bella Vista Bypass Operating and Ownership Cost

		Site Information	
Analyst	KKR	Facility	Existing US 71
Agency/Company	AHTD	Segment	existing vs w/bypass
Project	Bella Vista Bypass	Analysis Time Period	peak hour
Date Performed	8/12/2009	Analysis Year	Mid-Year (2023)
		Segment Length (mi.)	16.5

Inputs

Autos		Trucks	
Finance Rate:	7.0%	Speed (mph):	mid-year
Speed (mph):		without improvement	35
without improvement	35	with improvement	50
with improvement	50	Fuel Cost Per Gallon	\$2.50
Fuel Cost Per Gallon	\$2.45	Fuel Consumption per Mile (Table 5-5):	
Fuel Consumption per Mile (Table 5-5):		without improvement	0.182
without improvement	0.045	with improvement	0.166
with improvement	0.041	Other Operating Costs per Mile	\$0.645
Other Operating Costs per Mile (Table 5-4)	\$0.124	(tires, maintenance, etc.)	
(tires, maintenance, etc.)		Vehicle Life (years)	8
Vehicle Life (years)	10	Vehicle Cost	\$60,000
Vehicle Cost	\$20,000	Salvage Value at End of Life	\$5,000
Salvage Value at End of Life	\$2,000	Miles per Year	50,000
Miles per Year	15,000	Cargo Value	\$350,000
Insurance per Year (Table 5-3)	\$1,000	Insurance per Year	\$1,500

Calculations

Autos		Trucks	
Fuel Cost per VMT (Equation 5-3):		Fuel Cost per VMT (Equation 5-3):	
without improvement	\$0.1103	without improvement	\$0.4550
with improvement	\$0.1005	with improvement	\$0.4150
(cost per gallon X gallons per mile)		(cost per gallon X gallons per mile)	
Total Operating Cost per VMT:		Total Operating Cost per VMT:	
without improvement	\$0.2343	without improvement	\$1.0998
with improvement	\$0.2245	with improvement	\$1.0598
(fuel cost per VMT + other oper. cost)		(fuel cost per VMT + other oper. cost)	
Amortized Vehicle Cost Per Year:	\$2.703	Amortized Vehicle Cost Per Year:	\$9.561
(Equation 5-6)		(Equation 5-6)	
		Inventory Cost per Hour	\$2.7968
		(Equation 5-10)	
		Inventory Cost per Mile:	
		without improvement	\$0.0799
		with improvement	\$0.0559
		(cost per hour / miles per hour)	
Amortized Vehicle Cost per VMT	\$0.1802	Vehicle Cost per VMT	\$0.1912
Insurance Cost per VMT	\$0.0667	Insurance Cost per VMT	\$0.0300
Ownership Cost per VMT		Ownership Cost per VMT	
without improvement	\$0.2469	without improvement	\$1.3210
with improvement	\$0.2469	with improvement	\$1.2810
(vehicle + insurance)		(vehicle + insurance + inventory)	
Oper. and Ownership Cost per VMT		Oper. and Ownership Cost per VMT	
without improvement	\$0.4811	without improvement	\$2.4208
with improvement	\$0.4713	with improvement	\$2.3408
(operating + ownership)		(operating + ownership)	
Oper. and Ownership Savings / VMT	\$0.0098	Oper. and Ownership Savings / VMT	\$0.0800
(without - with)		(without - with)	

Highway 71			
	2012	2022	2032
no build	29100	31500	33900
E&C	23000	22000	21000

Build Network	\$	3,083,559,180.19
No Build Network	\$	3,082,086,959.92
Net Savings =	\$	(1,472,220.27)

Bypass			
	2012	2022	2032
E&C	6100	9500	12900

Calculations based upon mid-year traffic
Assumes current dollars (7% finance rate, 7% inflation)

Disaggregate values for Road Users - Not included in BCA

	Per Trip		Per year		Per 20 Year	
	Trucks	Autos	trucks	autos	trucks	autos
For single trip						
On Bypass	\$ 24.20	\$ 8.63	\$ 16,781,660.91	\$ 23,928,570.50	\$ 335,633,218.30	\$ 478,571,409.95
On Existing with Bypass	\$ 39.55	\$ 7.78	\$ 63,511,494.46	\$ 49,956,233.13	\$ 1,270,229,889.24	\$ 999,124,662.70

SUSTAINABILITY BENEFITS for BELLA VISTA BYPASS BASED ON PROJECTED TRUCK TRANSACTIONS AND ESTIMATED CO2 SAVINGS

\$31.44 2009 value to measure the global benefits of reducing US CO2 emissions
 This is based on the estimate of \$33 per metric ton of carbon cited on page VIII-45 of the Final Regulatory Impact Analysis of the National Highway Traffic Safety Administration's rulemaking on Corporate Average Fuel Economy for MY2011 Passenger Cars and Light Trucks. This value was reduced by the given 2.4% for the annual growth of the social costs of carbon.

\$33.00 2011 value per metric ton
 2.4% annual growth thereafter for the Social Cost of Carbon

Bella Vista Bypass Northbound AADT					Bella Vista Bypass Southbound AADT					Bella Vista Bypass TOTAL AADT					Using AHTD 20% for trucking	
	PV	LT	HT	Total		PV	LT	HT	Total		PV	LT	HT	Total		
2013	200	0	0	200	2013	200	0	0	200	2013	200	0	0	400	2013	
2014	2,100	100	200	2,400	2014	2,100	100	200	2,400	2014	2,100	100	200	4,800	2014	960
2015	2,900	100	300	3,300	2015	2,700	100	300	3,100	2015	2,700	100	300	6,400	2015	1280
2016	3,600	100	400	4,100	2016	3,300	100	300	3,700	2016	3,300	100	300	7,800	2016	1560
2017	3,900	100	400	4,400	2017	3,600	100	400	4,100	2017	3,600	100	400	8,500	2017	1700
2018	4,400	100	400	4,900	2018	4,100	100	400	4,600	2018	4,100	100	400	9,500	2018	1900
2019	4,500	100	400	5,000	2019	4,300	100	400	4,800	2019	4,300	100	400	9,800	2019	1960
2020	4,600	100	400	5,100	2020	4,700	100	400	5,200	2020	4,700	100	400	10,300	2020	2060
2021	4,700	100	400	5,200	2021	4,800	100	400	5,300	2021	4,800	100	400	10,500	2021	2100
2022	4,700	100	400	5,200	2022	4,900	100	400	5,400	2022	4,900	100	400	10,600	2022	2120
2023	4,800	100	500	5,400	2023	5,000	100	400	5,500	2023	5,000	100	400	10,900	2023	2180
2024	4,900	100	500	5,500	2024	5,100	100	400	5,600	2024	5,100	100	400	11,100	2024	2220
2025	5,000	100	500	5,600	2025	5,200	100	400	5,700	2025	5,200	100	400	11,300	2025	2260
2026	5,100	100	500	5,700	2026	5,200	100	400	5,700	2026	5,200	100	400	11,400	2026	2280
2027	5,200	100	500	5,800	2027	5,300	100	400	5,800	2027	5,300	100	400	11,600	2027	2320
2028	5,200	100	500	5,800	2028	5,400	100	400	5,900	2028	5,400	100	400	11,700	2028	2340
2029	5,300	100	500	5,900	2029	5,500	100	400	6,000	2029	5,500	100	400	11,900	2029	2380
2030	5,400	100	500	6,000	2030	5,600	100	400	6,100	2030	5,600	100	400	12,100	2030	2420
2031	5,500	100	500	6,100	2031	5,600	100	500	6,200	2031	5,600	100	500	12,300	2031	2460
2032	5,500	100	500	6,100	2032	5,700	100	500	6,300	2032	5,700	100	500	12,400	2032	2480
2033	5,600	100	500	6,200	2033	5,700	100	500	6,300	2033	5,700	100	500	12,500	2033	2500
2034	5,600	100	500	6,200	2034	5,800	100	500	6,400	2034	5,800	100	500	12,600	2034	2520
2035	5,700	100	500	6,300	2035	5,800	100	500	6,400	2035	5,800	100	500	12,700	2035	2540
2036	5,700	100	500	6,300	2036	5,900	100	500	6,500	2036	5,900	100	500	12,800	2036	2560
2037	5,800	100	500	6,400	2037	5,900	100	500	6,500	2037	5,900	100	500	12,900	2037	2580
2038	5,800	100	500	6,400	2038	6,000	100	500	6,600	2038	6,000	100	500	13,000	2038	2600
2039	5,900	100	500	6,500	2039	6,100	100	500	6,700	2039	6,100	100	500	13,200	2039	2640
2040	5,900	100	500	6,500	2040	6,100	100	500	6,700	2040	6,100	100	500	13,200	2040	2640
2041	6,000	200	500	6,700	2041	6,200	100	500	6,800	2041	6,200	100	500	13,500	2041	2700
2042	6,100	200	500	6,800	2042	6,200	100	500	6,800	2042	6,200	100	500	13,600	2042	2720
2043	6,100	200	500	6,800	2043	6,300	100	500	6,900	2043	6,300	100	500	13,700	2043	2740
2044	6,400	200	500	7,100	2044	6,400	100	500	7,000	2044	6,400	100	500	14,100	2044	2820
2045	6,500	200	600	7,300	2045	6,400	100	500	7,000	2045	6,400	100	500	14,300	2045	2860
2046	6,500	200	600	7,300	2046	6,500	100	500	7,100	2046	6,500	100	500	14,400	2046	2880
2047	6,600	200	600	7,400	2047	6,600	100	500	7,200	2047	6,600	100	500	14,600	2047	2920
2048	6,700	200	600	7,500	2048	6,700	100	500	7,300	2048	6,700	100	500	14,800	2048	2960
2049	6,700	200	600	7,500	2049	6,700	100	500	7,300	2049	6,700	100	500	14,800	2049	2960
2050	6,800	200	600	7,600	2050	6,800	100	500	7,400	2050	6,800	100	500	15,000	2050	3000

cumulative truck traffic present - 2033 41480 AADT
this is from Sustainability calculation - BVB
 (395.47) 9.53 tpd CO2 reduction / 1000 trucks
 2009 value of tpd reduction \$ 31.44
 365 days/year
Total value of CO2 reductions using global impact over the life of the project (2009) \$ (4,537,522.40)

ATTACHMENT 6

Cost of Crashes and Comparison of Benefits that could be Anticipated by Improved Facilities :::: Bypass

General Information		Site Information	
Analyst	KKR	Facility	HIGHWAY 71
Agency/Company	AHTD	Segment	EXISTING ROUTE
Project	BVB	Analysis Time Period	AU
Date Performed	8/1/2009	Analysis Year	2006-2007
		Segment Length (mi.)	18.9

Inputs

Accident Cost (net of insurance reimbursement):	From Table 5-17
Fatal	\$6,000,000
Injury	\$11,000
Property Damage Only	\$3,000

With Improvement

Annual Traffic Volume	1,697,250
# of Accidents	

Accidents can be calculated from the following:

Number of Fatal Accidents per Year	0.2400
Number of Injury Accidents per Year	6.0000
Number of P.D.O. Accidents per Year	23.0000

Calculations

Annual VMT (traffic * length)	32,078,025	
Accidents per Million VMT:		Avg Crash Rate
Fatal	0.0075	0.9115
Injury	0.1870	
Property Damage Only (accidents per year*1000000/VMT)	0.7170	
Accident Cost per VMT		
Fatal	\$0.0449	\$1,440,000.00
Injury	\$0.0021	\$66,000.00
Property Damage Only (acc. per mm #VMT * cost / 1000000)	\$0.0022	\$69,000.00
Accident Cost per VMT (all types) (fatal + injury + P.D.O.)	\$0.0491	\$1,575,000.00
		\$31,500,000.00
		- 20 years (2009\$\$)

ATTACHMENT 7

Present Worth of Value of Toll Revenue

YEAR	YEAR SINCE PRESENT	DISCOUNT FACTOR FOR 7% RATE	VALUE OF TOLLS (2009 DOLLARS)	PW Value of Tolls in 2009 Dollars
2009	0	1		
2010	1	0.9346		
2011	2	0.8734		
2012	3	0.8163		
2013	4	0.7629	\$ 3,540,000.00	\$ 2,700,649.05
2014	5	0.7130	\$ 3,700,000.00	\$ 2,638,048.86
2015	6	0.6663	\$ 4,870,000.00	\$ 3,245,086.63
2016	7	0.6227	\$ 6,040,000.00	\$ 3,761,408.44
2017	8	0.5820	\$ 6,530,000.00	\$ 3,800,519.45
2018	9	0.5439	\$ 7,400,000.00	\$ 4,025,109.70
2019	10	0.5083	\$ 7,610,000.00	\$ 3,868,538.11
2020	11	0.4751	\$ 7,920,000.00	\$ 3,762,734.95
2021	12	0.4440	\$ 8,060,000.00	\$ 3,578,736.39
2022	13	0.4150	\$ 8,190,000.00	\$ 3,398,558.83
2023	14	0.3878	\$ 8,320,000.00	\$ 3,226,639.45
2024	15	0.3624	\$ 8,460,000.00	\$ 3,066,293.33
2025	16	0.3387	\$ 8,590,000.00	\$ 2,909,730.20
2026	17	0.3166	\$ 8,700,000.00	\$ 2,754,197.20
2027	18	0.2959	\$ 8,820,000.00	\$ 2,609,519.74
2028	19	0.2765	\$ 8,920,000.00	\$ 2,466,454.33
2029	20	0.2584	\$ 9,070,000.00	\$ 2,343,860.36
2030	21	0.2415	\$ 9,190,000.00	\$ 2,219,505.27
2031	22	0.2257	\$ 9,280,000.00	\$ 2,094,618.17
2032	23	0.2109	\$ 9,380,000.00	\$ 1,978,681.77
2033	24	0.1971	\$ 9,480,000.00	\$ 1,868,949.96
				\$ 62,317,840.17

7% discount rate applied but inflation rate not applied, assuming that toll rate is not adjusted for inflation.
 Cost of Tolls from Jacobs Traffic and Maintenance Study.