

## Bella Vista Bypass 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 75, Number 104, Docket No. DOT-OST-2010-0076) 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 Bella Vista Bypass and evaluate the effects of an aggressive funding schedule. The BCA compares 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 (2014 through 2034). The BCA compares benefits and costs for two scenarios: 1) Building the entire Bypass as a toll facility, and 2) No-Build for the entire Bypass, where motorists would continue to use existing Highway 71. The project would not realize the intended full regional and national benefits of the Bella Vista Bypass until completion of the Interstate-type route between the Cities of Bella Vista, Arkansas and Pineville, Missouri, thus the analysis considers benefits and costs of the entire 18.9 mile route.

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).

The benefit cost analysis summarized in **Table 1** showed a cost savings of \$139 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. For each month that the BVB is not open to the traveling public, the public will have spent an additional \$580,000 on travel related expenses with regards to travel delays, vehicle crash related costs and the cost of increased vehicle emissions.

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 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. Project cost estimates are shown in **Table 2**.

The Toll Revenue Operation and Maintenance Costs (**Table 3**) 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 (Table 4)** analysis quantifies the road user impacts that the Bella Vista Bypass would have in terms of in terms of travel time savings for the highway system in Benton and McDonald Counties 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.

The **Vehicle Operating Cost (Table 5)** analysis quantified the cost of owning and operating a vehicle, and compared the road user vehicle 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. 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 (Table 6)** 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.

The **Value of Safety Improvements (Table 7)** 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. 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 (Table 8)** 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 2010 dollars by applying a 7% discount rate. 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.

The following tables show detailed calculations for each of the criteria analyzed.

**BELLA VISTA BYPASS  
SUMMARY TABLE**

<b>Bella Vista Bypass Benefit Cost Evaluation Summary <sup>1</sup></b>	<b>2010 Present Worth</b>		<b>Construction, O&amp;M Costs</b>
	<b>No-Build</b>	<b>Build with Tolls</b>	
Arkansas	\$ -	\$ 231,700,000.00	\$ 231,700,000.00
Arkansas - Toll O&M Costs	\$ -	\$ 85,300,000.00	\$ 85,300,000.00
Missouri	\$ -	\$ 66,000,000.00	\$ 66,000,000.00
			<b>\$ 383,000,000.00</b>
<b>Road User Cost</b>			<b>Road User Cost Savings</b>
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	\$ 359,590,000.00	\$ 239,710,000.00
Cost of Tolls to Drivers	\$ -	\$ (60,980,000.00)	\$ (60,980,000.00)
<b>Total</b>			<b>\$ 522,175,000.00</b>

1. Costs in 2010 dollars include Construction of Grading, Structures, Pavement, Special Features, Toll Facility, Purchase of Right-of-Way, Engineering, and Contingencies.

<b>Benefit Cost Ratio = 1.36</b>
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TABLE 1

**BELLA VISTA BYPASS  
PROJECT COST ESTIMATES**

**Bella Vista Bypass Project Cost Estimate** status

**Arkansas Segment**

Preliminary Engineering	\$ 6,800,000.00	completed-exclude sunk cost
Right of Way and Utilities	\$ 23,000,000.00	completed-exclude sunk cost
Roadway and Bridge Construction	\$ 199,000,000.00	
Toll Plaza and Customer Center	\$ 12,700,000.00	
Construction Engineering	\$ 20,000,000.00	
<b>TOTAL</b>	<b>\$ 231,700,000.00</b>	

**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	
<b>MISSOURI TOTAL COSTS</b>	<b>\$ 66,000,000.00</b>	rounded

**TABLE 2**

**BELLA VISTA BYPASS  
TOLL OPERATION AND MAINTENANCE COST**

**Toll Facility Operation and Maintenance - SOURCE IS JACOBS 2009 REPORT**

Year	w/staffing	w/o staffing	Toll Facility O & M
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

**TABLE 3**

BELLA VISTA BYPASS

Value of Time in 2010 Dollars for Existing No-Build Network - Improved Network with Bypass																				
YEAR	YEAR SINCE PRESENT	WAAADT - Bypass	WAAADT - US 71 Existing/ US 71B No Bypass	WAAADT - 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 (MPH)	Travel Time - Existing Without Bypass (Hours)	Travel Speed on US 71 with Bypass (MPH)	Travel Time Existing No Build (Hours)	Travel Time Savings No Build versus Bypass (Hours)	Travel Time Savings Existing-Build Versus Bypass (Hours)	Travel Time Savings No-Build versus 71B (Hours)	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
2010	0	0	29,100	29,100	0%	13.6%		40.0	0.41						\$ 176,003.88	\$ 64,285,417.82				
2011	1	0	29,300	29,300	0%	13.6%		39.7	0.41						\$ 178,687.70	\$ 65,265,683.89				
2012	2	0	29,500	29,500	0%	13.6%		39.3	0.41						\$ 181,416.55	\$ 66,262,395.70				
2013	3	0	29,700	29,700	0%	13.6%		39.0	0.42						\$ 184,191.57	\$ 67,275,970.62				
2014	4	0	29,900	29,900	0%	13.6%		38.7	0.42						\$ 187,013.94	\$ 68,306,840.26				
2015	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
2016	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
2017	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
2018	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
2019	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
2020	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
2021	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
2022	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
2023	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
2024	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
2025	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
2026	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
2027	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
2028	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	\$ 232,279.90	\$ 85,095,907.34	\$ 48,550.09	\$ 132,052.02	\$ 180,602.11	\$ 65,964,920.86
2029	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
2030	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
2031	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
2032	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
2033	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
2034	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	\$ 52,316.91	\$ 144,815.64	\$ 197,132.55	\$ 72,002,662.97	\$ 1,280,986,726.84

2010 Dollar Value of Time

Autos \$ 13.92  
Trucks \$ 21.24

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

TABLE 4  
Benefit Cost Analysis - Page 7

**BENEFIT COST ANALYSIS  
VEHICLE OPERATING COST**

Bella Vista Bypass Operating and Ownership Cost			
		<b>Site Information</b>	
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
<b>Inputs</b>			
	Finance Rate:	7.0%	
<b>Autos</b>		<b>Trucks</b>	
Speed (mph):	<b>mid-year</b>	Speed (mph):	<b>mid-year</b>
without improvement	35	without improvement	35
with improvement	50	with improvement	50
Fuel Cost Per Gallon	\$2.45	Fuel Cost Per Gallon	\$2.50
Fuel Consumption per Mile (Table 5-5):		Fuel Consumption per Mile (Table 5-5):	
without improvement	0.045	without improvement	0.182
with improvement	0.041	with improvement	0.166
Other Operating Costs per Mile (Table 5-4) (tires, maintenance, etc.)	\$0.124	Other Operating Costs per Mile (tires, maintenance, etc.)	\$0.645
Vehicle Life (years)	10	Vehicle Life (years)	8
Vehicle Cost	\$20,000	Vehicle Cost	\$60,000
Salvage Value at End of Life	\$2,000	Salvage Value at End of Life	\$5,000
Miles per Year	15,000	Miles per Year	50,000
		Cargo Value	\$350,000
Insurance per Year (Table 5-3)	\$1,000	Insurance per Year	\$1,500
<b>Calculations</b>			
<b>Autos</b>		<b>Trucks</b>	
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)	
<b>Highway 71</b>		Build Network	\$ 3,083,559,180.19
		No Build Network	\$ 3,082,086,959.92
no build	2012	2022	2032
E&C	29100	31500	33900
	23000	22000	21000
<b>Bypass</b>		<b>Net Savings =</b>	<b>\$ (1,472,220.27)</b>
E&C	6100	9500	12900

Calculations based upon mid-year traffic

**TABLE 5-1**



**BENEFIT COST ANALYSIS  
VEHICLE OPERATING COST**

Reference User Benefit Analysis for Highways Page 5-14

**Fuel Consumption (Gallons) per Minute of Delay by Vehicle Type (i.e. Signals, Queues)**

Free Flow Speed	Small Car	Large Car	SUV	2-Axle SU	3-Axle SU	Combo	
20	0.011	0.22	0.023	0.074	0.102	0.198	
25	0.013	0.026	0.027	0.097	0.133	0.242	
30	0.015	0.03	0.032	0.122	0.167	0.284	
35	0.018	0.034	0.037	0.149	0.203	0.327	
40	0.021	0.038	0.043	0.177	0.241	0.369	
45	0.025	0.043	0.049	0.206	0.28	0.411	
50	0.028	0.048	0.057	0.235	0.321	0.453	average =
55	0.032	0.054	0.065	0.266	0.362	0.495	0.336333333
60	0.037	0.06	0.073	0.297	0.404	0.537	
65	0.042	0.066	0.083	0.328	0.447	0.578	
70	0.047	0.073	0.094	0.36	0.49	0.62	
75	0.053	0.08	0.105	0.392	0.534	0.661	
	0.25	0.27	0.29	0.05	0.07	0.07	Distribution

**No Build Additional Fuel Consumption per Day**

10 signals

assume 8 stops

1 @ 65 & LOS D	1217.16	1912.68	2405.34	9505.44	12954.06	16750.44	
2 @ 55 & LOS D	1854.72	3129.84	3767.4	15417.4	20981.52	28690.2	
5 @ 45 & LOS F or worse	5236.88	9007.425	10264.275	43151.9	58653	86094.225	
	8308.76	14049.95	16437.015	68074.7	92588.58	131534.865	330,994

**No Build Additional Fuel Consumption per Day**

10 signals

assume 8 stops

1 @ 65 & LOS C	462	726	913	3608	4917	6358	0.42 s decrease in delay
2 @ 55 & LOS C	704	1188	1430	5852	7964	10890	0.42 s decrease in delay
5 @ 45 & LOS E/F	2750	4730	5390	22660	30800	45210	0.33 s decrease in delay
	3916	6644	7733	32120	43681	62458	156,552

Fuel Savings on US 71 By Traffic Reduction = 174,442

Gallons/Year = 63,714,871.10  
Gallons/20 Years = 1,274,297,422.05

Gallons/Trip due to Delay	Gallons		Cost	
	No Build	No Build		
Small Car	0.26377	\$0.65	average for pc	
Large Car	0.44603	\$1.09	\$1.01	
SUV	0.52181	\$1.28		
2-Axle SU	2.1611	\$5.29	average for truck	
3-Axle SU	2.93932	\$7.20	\$7.58	3.55752
Combo	4.17571	\$10.23		

Gallons/Trip due to Delay	Gallons		Cost	
	Build	Build		
Small Car	0.178	\$0.44	average for truck	
Large Car	0.302	\$0.74	\$0.68	
SUV	0.3515	\$0.86		
2-Axle SU	1.46	\$3.58	average for truck	
3-Axle SU	1.9855	\$4.86	\$5.13	
Combo	2.839	\$6.96	2.41225	

**TABLE 5-3**

**BENEFIT COST ANALYSIS  
GREEHOUSE GAS CALCULATIONS**

SUSTAINABILITY BENEFITS FOR BELLA VISTA BYPASS BASED ON PROJECT 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 FY 2011 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					Bella Vista Bypass Southbound					Bella Vista Bypass Total					Using AHTD 20% for trucking	
Year	PV	LT	HT	Total	Year	PV	LT	HT	Total	Year	PV	LT	HT	Total	Year	
2014	200	0	0	200	2014	200	0	0	200	2014	400	0	0	400	2014	80
2015	2100	100	200	2400	2015	2100	100	200	2400	2015	4200	200	400	4800	2015	960
2016	2900	100	300	3300	2016	2700	100	300	3100	2016	5600	200	600	6400	2016	1280
2017	3600	100	400	4100	2017	3300	100	300	3700	2017	6900	200	700	7800	2017	1560
2018	3900	100	400	4400	2018	3600	100	400	4100	2018	7500	200	800	8500	2018	1700
2019	4400	100	400	4900	2019	4100	100	400	4600	2019	8500	200	800	9500	2019	1900
2020	4500	100	400	5000	2020	4300	100	400	4800	2020	8800	200	800	9800	2020	1960
2021	4600	100	400	5100	2021	4700	100	400	5200	2021	9300	200	800	10300	2021	2060
2022	4700	100	400	5200	2022	4800	100	400	5300	2022	9500	200	800	10500	2022	2100
2023	4700	100	400	5200	2023	4900	100	400	5400	2023	9600	200	800	10600	2023	2120
2024	4800	100	500	5400	2024	5000	100	400	5500	2024	9800	200	900	10900	2024	2180
2025	4900	100	500	5500	2025	5100	100	400	5600	2025	10000	200	900	11100	2025	2220
2026	5000	100	500	5600	2026	5200	100	400	5700	2026	10200	200	900	11300	2026	2260
2027	5100	100	500	5700	2027	5200	100	400	5700	2027	10300	200	900	11400	2027	2280
2028	5200	100	500	5800	2028	5300	100	400	5800	2028	10500	200	900	11600	2028	2320
2029	5200	100	500	5800	2029	5400	100	400	5900	2029	10600	200	900	11700	2029	2340
2030	5300	100	500	5900	2030	5500	100	400	6000	2030	10800	200	900	11900	2030	2380
2031	5400	100	500	6000	2031	5600	100	400	6100	2031	11000	200	900	12100	2031	2420
2032	5500	100	500	6100	2032	5600	100	500	6200	2032	11100	200	1000	12300	2032	2460
2033	5500	100	500	6100	2033	5700	100	500	6300	2033	11200	200	1000	12400	2033	2480
2034	5600	100	500	6200	2034	5700	100	500	6300	2034	11300	200	1000	12500	2034	2500
2035	5600	100	500	6200	2035	5800	100	500	6400	2035	11400	200	1000	12600	2035	2520
2036	5700	100	500	6300	2036	5800	100	500	6400	2036	11500	200	1000	12700	2036	2540
2037	5700	100	500	6300	2037	5900	100	500	6500	2037	11600	200	1000	12800	2037	2560
2038	5800	100	500	6400	2038	5900	100	500	6500	2038	11700	200	1000	12900	2038	2580
2039	5800	100	500	6400	2039	6000	100	500	6600	2039	11800	200	1000	13000	2039	2600
2040	5900	100	500	6500	2040	6100	100	500	6700	2040	12000	200	1000	13200	2040	2640
2041	5900	100	500	6500	2041	6100	100	500	6700	2041	12000	200	1000	13200	2041	2640
2042	6000	200	500	6700	2042	6200	100	500	6800	2042	12200	300	1000	13500	2042	2700
2043	6100	200	500	6800	2043	6200	100	500	6800	2043	12300	300	1000	13600	2043	2720
2044	6100	200	500	6800	2044	6300	100	500	6900	2044	12400	300	1000	13700	2044	2740
2045	6400	200	500	7100	2045	6400	100	500	7000	2045	12800	300	1000	14100	2045	2820
2046	6500	200	600	7300	2046	6400	100	500	7000	2046	12900	300	1100	14300	2046	2860
2047	6500	200	600	7300	2047	6500	100	500	7100	2047	13000	300	1100	14400	2047	2880
2048	6600	200	600	7400	2048	6600	100	500	7200	2048	13200	300	1100	14600	2048	2920
2049	6700	200	600	7500	2049	6700	100	500	7300	2049	13400	300	1100	14800	2049	2960
2050	6700	200	600	7500	2050	6700	100	500	7300	2050	13400	300	1100	14800	2050	2960
2051	6800	200	600	7600	2051	6800	100	500	7400	2051	13600	300	1100	15000	2051	3000

cumulative truck traffic present - 2034 41480 AADT  
 this is from Sustainability calculation - BVB  
 (395.47) 9.53 tpd CO2 reduction/1000 trucks  
 2010 value of tpd reduction \$ 31.44  
 365 days/year  
 Total value of CO2 reductions using global impact over the life of the project (2010) (4,537,522.40)

**TABLE 6**

**BENEFIT COST ANALYSIS  
COST OF VEHICLE CRASHES: EXISTING HIGHWAY NETWORK AND IMPROVED HIGHWAY NETWORK**

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

Analyst	KKR
Agency/Company	AHTD
Project	BVB
Date Performed	8/12/2010

**Inputs**

**Without Improvement**

Annual Traffic Volume

# of Accidents

Accidents can be calculated from the following:

**Calculations**

Annual VMT   
(traffic \* length)

Accidents per Million VMT:		<b><u>Avg Crash Rate</u></b>
Fatality (rate of 1 fatality/1 fatal crash)	<input type="text" value="0.0244"/>	1.8685
Injury (Rate of 2.35 injuries per Injury Crash)	<input type="text" value="1.1416"/>	
Property Damage Only	<input type="text" value="1.3590"/>	
(accidents per year*1000000/VMT )		

Accident Cost per VMT		Existing Conditions
Fatal	<input type="text" value="\$0.1463"/>	\$26,905,200.00
Injury	<input type="text" value="\$0.0126"/>	\$2,310,000.00
Property Damage Only	<input type="text" value="\$0.0041"/>	\$750,000.00
(acc. per mm #VMT * cost / 1000000)		

Accident Cost per VMT (all types)  \$29,965,200.00  
(fatal + injury + P.D.O.)   
- 20 years (2010\$\$)

Accident Cost Savings per VMT:

Fatal	<input type="text" value="\$0.050977526"/>
Injury	<input type="text" value="\$0.004980740"/>
Property Damage Only	<input type="text" value="\$0.002316814"/>
All Accidents	<input type="text" value="\$0.009176048"/>
(without - with)	

Value of Safety Improvements ::: Existing Highway 71	\$	599,304,000.00
Existing Highway 71 with traffic diverted by Bypass		\$328,080,000.00
Bypass		\$31,500,000.00
Value of Safety Improvements in terms of Statistical Crash Outcome Improvements	\$	239,724,000.00

**TABLE 7-1**

**BENEFIT COST ANALYSIS**

**COST OF VEHICLE CRASHES: EXISTING HIGHWAY NETWORK AND IMPROVED HIGHWAY NETWORK**

**Existing Highway 71 with and without Bypass**

Facility	HIGHWAY 71
Segment	EXISTING ROUTE
Analysis Time Period	All
Analysis Year	2006-2007
Segment Length (mi.)	16

**With Improvement**

Annual Traffic Volume	9,800,250
# of Accidents	

Annual VMT (traffic * length)	156,804,000
----------------------------------	-------------

Accidents per Million VMT:		<b><u>Avg Crash Rate</u></b>
Fatal	0.0159	1.2914
Injury	0.6888	
Property Damage Only	0.5867	
(accidents per year*1000000/VMT )		

Accident Cost per VMT		
Fatal	\$0.0953	\$14,940,000.00
Injury	\$0.0076	\$1,188,000.00
Property Damage Only	\$0.0018	\$276,000.00
(acc. per mm #VMT * cost / 1000000)		

Accident Cost per VMT (all types)	\$0.1046	\$16,404,000.00
(fatal + injury + P.D.O.)		\$328,080,000.00
		- 20 years (2010\$\$)

On existing Highway 71 with Bypass in Place

\$0.00608698	
\$0.00292326	\$359,580,000.00
\$0.00016581	\$ 359,580,000.00

**TABLE 7-2**

**BENEFIT COST ANALYSIS**

**COST OF VEHICLE CRASHES: EXISTING HIGHWAY NETWORK AND IMPROVED HIGHWAY NETWORK**

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

Analyst	KKR
Agency/Company	AHTD
Project	BVB
Date Performed	8/1/2009

**Inputs**

**With Improvement**

Annual Traffic Volume	1,697,250
# of Accidents	

Accidents can be calculated from the following:

**Calculations**

Annual VMT	32,078,025
(traffic * length)	

Accidents per Million VMT:		<b>Avg Crash Rate</b>
Fatal	0.0075	0.9115
Injury	0.1870	
Property Damage Only	0.7170	
(accidents per year*1000000/VMT )		

Accident Cost per VMT		
Fatal	\$0.0449	\$1,440,000.00
Injury	\$0.0021	\$66,000.00
Property Damage Only	\$0.0022	\$69,000.00
(acc. per mm #VMT * cost / 1000000)		

Accident Cost per VMT (all types)	\$0.0491	\$1,575,000.00
(fatal + injury + P.D.O.)		\$31,500,000.00
		- 20 years (2010\$\$)

**TABLE 7-3**

**BELLA VISTA BYPASS  
TOLL REVENUES**

**Present Worth of Value of Toll Revenue**

YEAR	YEAR SINCE PRESENT	DISCOUNT		PW Value of Tolls (2010 DOLLARS)
		FACTOR FOR 7% RATE	VALUE OF TOLLS (2010 DOLLARS)	
2010	0	1	0	
2011	1	0.9346	0	
2012	2	0.8734	0	
2013	3	0.8163	0	
2014	4	0.7629	\$320,000	\$ 244,126.47
2015	5	0.7130	\$3,820,000	\$ 2,723,607.21
2016	6	0.6663	\$4,970,000	\$ 3,311,720.85
2017	7	0.6227	\$6,160,000	\$ 3,836,138.41
2018	8	0.5820	\$6,660,000	\$ 3,876,180.64
2019	9	0.5439	\$7,610,000	\$ 4,139,335.78
2020	10	0.5083	\$7,920,000	\$ 4,026,126.39
2021	11	0.4751	\$8,060,000	\$ 3,829,247.94
2022	12	0.4440	\$8,190,000	\$ 3,636,457.95
2023	13	0.4150	\$8,320,000	\$ 3,452,504.21
2024	14	0.3878	\$8,460,000	\$ 3,280,933.86
2025	15	0.3624	\$8,590,000	\$ 3,113,411.31
2026	16	0.3387	\$8,700,000	\$ 2,946,991.00
2027	17	0.3166	\$8,820,000	\$ 2,792,186.12
2028	18	0.2959	\$8,950,000	\$ 2,647,982.05
2029	19	0.2765	\$9,070,000	\$ 2,507,930.58
2030	20	0.2584	\$9,190,000	\$ 2,374,870.64
2031	21	0.2415	\$9,280,000	\$ 2,241,241.44
2032	22	0.2257	\$9,380,000	\$ 2,117,189.49
2033	23	0.2109	\$9,480,000	\$ 1,999,776.45
2034	24	0.1971	\$9,570,000	\$ 1,886,693.15
				<b>\$ 60,984,651.94</b>

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.

**TABLE 8**

## 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
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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