

# **FY 2011 Continuing Appropriations Act**

## **TIGER Discretionary Grant Program**

### **Highway 92 Bridge Improvement Project**

#### **Appendices**

**A – Benefit Cost Analysis**

**B – Federal Wage Rate Certification**



Submitted by  
Arkansas State Highway and Transportation Department  
October 31, 2011

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## **Appendix A - 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 systemically compare the benefits and costs of replacing two structures along Highway 92 in Conway and Van Buren Counties, Arkansas. The BCA compared the cost of replacing the two structures to the cost of not doing anything outside of routine maintenance. The analysis considers a 20-year project life (2013 through 2033) for purposes of the BCA.

The analysis considered typical roadway construction and maintenance costs in Arkansas. Table 1 summarizes the findings of the BCA analysis. Road User Benefits that were considered include the value of travel time savings provided by the improved facility, vehicle operating cost benefits, and the value to society of enhancing the safety within the improved highway network.

Many benefits of this project do not easily lend themselves to simple quantification. The economic benefits of connecting timber rich areas of north central Arkansas to the mills and other secondary industries as well as providing a safe and efficient transportation network for the region cannot be easily quantified beyond the impacts of construction activities and travel time savings. Providing an improved transportation network in the region does make an impact in terms of improving the per capita income in areas of the country that are below the national average which is a goal of the TIGER Discretionary Grant program.

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

- Construction Costs
- Operation and Maintenance Costs
- Forecasted Traffic
- Travel Speeds and Congestion
- Historic Crash Data
- Vehicles Miles Traveled
- Traffic Distribution by Vehicle Type
- Value of Time

The Construction Cost Estimate for the improvement of the two structures along Highway 92 is \$1.93 million. These costs reflect basic construction costs that would be incurred if the project were built using traditional construction methods and schedules. A 3% inflation rate was applied to calculate future costs and benefits. Additionally, a 3% discount rate was used to bring future benefits and costs to present value.

Maintenance Costs are also reported in this section. The two scenarios (replacing the bridges versus leaving the weight-restricted bridge in place) are different in the future maintenance needs and the road user costs. Without the bridge replacement, trucks used in the timber industries will face a significant detour to avoid steep grades and the weight-restricted routes and bridges. The costs of bridge maintenance have been taken into account and brought to present value. Cost associated with bridge construction and maintenance activities are reported in Attachment 1.

**Table 1: Benefit Cost Analysis Results**

Year	Activity	Construction and Maintenance Costs		Travel Time Benefit		Vehicle Operation Cost		Safety Benefits	
		Non-Disc.	Discounted	Non-Disc.	Discounted	Non-Disc.	Discounted	Non-Disc.	Discounted
2013	(Construction)	\$1,916,000	\$1,916,000	\$0	\$0	\$0	\$0	\$0	\$0
2014		-\$8,240	-\$8,000	\$418,226	\$406,044	\$933,599	\$906,407	\$188,135	\$182,655
2015		-\$8,487	-\$8,000	\$430,772	\$406,044	\$961,607	\$906,407	\$193,779	\$182,655
2016		-\$8,742	-\$8,000	\$443,696	\$406,044	\$990,455	\$906,407	\$199,592	\$182,655
2017		-\$9,004	-\$8,000	\$457,006	\$406,044	\$1,020,169	\$906,407	\$205,580	\$182,655
2018		-\$9,274	-\$8,000	\$470,717	\$406,044	\$1,050,774	\$906,407	\$211,747	\$182,655
2019		-\$9,552	-\$8,000	\$484,838	\$406,044	\$1,082,297	\$906,407	\$218,100	\$182,655
2020		-\$9,839	-\$8,000	\$499,383	\$406,044	\$1,114,766	\$906,407	\$224,643	\$182,655
2021		-\$10,134	-\$8,000	\$514,365	\$406,044	\$1,148,209	\$906,407	\$231,382	\$182,655
2022		-\$10,438	-\$8,000	\$529,796	\$406,044	\$1,182,655	\$906,407	\$238,323	\$182,655
2023		-\$10,751	-\$8,000	\$545,690	\$406,044	\$1,218,135	\$906,407	\$245,473	\$182,655
2024		-\$11,074	-\$8,000	\$562,060	\$406,044	\$1,254,679	\$906,407	\$252,837	\$182,655
2025		-\$11,406	-\$8,000	\$578,922	\$406,044	\$1,292,320	\$906,407	\$260,422	\$182,655
2026		-\$11,748	-\$8,000	\$596,290	\$406,044	\$1,331,089	\$906,407	\$268,235	\$182,655
2027		-\$12,101	-\$8,000	\$614,178	\$406,044	\$1,371,022	\$906,407	\$276,282	\$182,655
2028		-\$12,464	-\$8,000	\$632,604	\$406,044	\$1,412,152	\$906,407	\$284,570	\$182,655
2029		-\$12,838	-\$8,000	\$651,582	\$406,044	\$1,454,517	\$906,407	\$293,108	\$182,655
2030		-\$13,223	-\$8,000	\$671,129	\$406,044	\$1,498,153	\$906,407	\$301,901	\$182,655
2031		-\$13,619	-\$8,000	\$691,263	\$406,044	\$1,543,097	\$906,407	\$310,958	\$182,655
2032		-\$14,028	-\$8,000	\$712,001	\$406,044	\$1,589,390	\$906,407	\$320,287	\$182,655
2033		-\$14,449	-\$8,000	\$733,361	\$406,044	\$1,637,072	\$906,407	\$329,895	\$182,655
<b>TOTAL</b>			\$1,756,000		\$8,120,885		\$18,128,139		\$3,653,099
			\$29,902,123	Discounted Benefit					
			\$1,756,000	Discounted Costs					
			<b>17.03</b>	Overall B/C					

The BCA Value of Time analysis quantifies the road user impacts that the Highway 92 bridge improvements would have in terms of travel time savings by first determining the amount of travel time saved and then assigning a dollar value for this time. This includes differentiating time valuations by trip type, assuming passenger vehicle trips will not be impacted by the replacement of the structures since they are not subject to the detours caused by the weight-restrictions. The value of time for commercial vehicles was calculated as 100% of the total compensation. A vehicle occupancy rate of 1.0 person per commercial vehicle was used. Detailed worksheets showing factors considered for the Value of Time are included in Attachment 2.

The impacts of the Vehicle Operating costs account for the actual cost to operate the vehicle, aside from the travel time costs. Again, it should be noted that only commercial vehicles are considered in this calculation because passenger vehicles are not subject to the detour of the weight-restricted bridges. The detailed worksheets for this calculation are shown in Attachment 3.

The Value of Safety Improvements considers cost savings that can be attributed to the reduction in travel distance by commercial vehicles, that will no longer have to detour through

very congested conditions with a high volume of pedestrian movements. Crash rate reductions were estimated by determining the miles traveled along different facility types both under the detour route and using an improved Highway 92. Detailed worksheets illustrating this analysis are included in Attachment 4.

When examined as a single segment of improvements made within this corridor, the proposed bridge replacements along Highway 92 exhibits a net positive economic impact of 17.03.

## REFERENCES

- User Benefit Analysis for Highways, August 2003, AASHTO
- Manual on User Benefit Analysis for Highway and Bus Transit Improvements, 1977, AASHTO
- 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: Department Guidance for the Valuation of Travel Time in Economic Analysis; Guidance for Conducting Economic Evaluations, April 9, 1997, US 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 76, Number 156): Notice of Fund Availability for the Department of Transportation's National Infrastructure Investments Under the Full-Year Continuing Appropriations, 2011; and Request for Comments

## ATTACHMENT 1

<b>Construction and Maintenance Costs for Highway 92</b>				
	Buid	No-Build	DIFFERENCE (2012)	DIFFERENCE (Future Year)
2013	\$1,930,000	\$14,000	\$1,916,000	\$1,916,000
2014	\$6,000	\$14,000	-\$8,000	-\$8,240
2015	\$6,000	\$14,000	-\$8,000	-\$8,487
2016	\$6,000	\$14,000	-\$8,000	-\$8,742
2017	\$6,000	\$14,000	-\$8,000	-\$9,004
2018	\$6,000	\$14,000	-\$8,000	-\$9,274
2019	\$6,000	\$14,000	-\$8,000	-\$9,552
2020	\$6,000	\$14,000	-\$8,000	-\$9,839
2021	\$6,000	\$14,000	-\$8,000	-\$10,134
2022	\$6,000	\$14,000	-\$8,000	-\$10,438
2023	\$6,000	\$14,000	-\$8,000	-\$10,751
2024	\$6,000	\$14,000	-\$8,000	-\$11,074
2025	\$6,000	\$14,000	-\$8,000	-\$11,406
2026	\$6,000	\$14,000	-\$8,000	-\$11,748
2027	\$6,000	\$14,000	-\$8,000	-\$12,101
2028	\$6,000	\$14,000	-\$8,000	-\$12,464
2029	\$6,000	\$14,000	-\$8,000	-\$12,838
2030	\$6,000	\$14,000	-\$8,000	-\$13,223
2031	\$6,000	\$14,000	-\$8,000	-\$13,619
2032	\$6,000	\$14,000	-\$8,000	-\$14,028
2033	\$6,000	\$14,000	-\$8,000	-\$14,449
Average maintenance costs are annualized				
Costs from user delay are assumed to be negligible because bridges will be built on adjacent new location.				

## ATTACHMENT 2

<b>Value of Time (2013 Base Year Analysis)</b>	
	<b>380 Total Trucks</b>
	<b>Value of Time: 2010 BCA Manual, Table 5-2, 3% Annual Inflation (2000-2011)</b>
	<b>100 Trucks related to Timber Industry</b>
<b>Route 1 Detour</b>	
\$28.00	Total Compensation per hour per person
1.00	Occupancy (Passengers per truck)
0.63	Time saved per Truck (Hours, 38 minutes)
75	Number of Trucks per Day (75% of Total)
200	Working Days per year
\$266,029	Total Value of Time Savings per year ( $\$28.00 \times 1.00 \times 0.63 \times 285 \times 200$ )
<b>Route 2 Detour</b>	
\$28.00	Total Compensation per hour per person
1.00	Occupancy (Passengers per truck)
1	Time saved per Truck (Hours)
25	Number of Trucks per Day (25% of Total)
200	Working Days per year
\$140,015	Total Value of Time Savings per year ( $\$28.00 \times 1.00 \times 01 \times 95 \times 200$ )
	Travel Time Savings (Prim, Arkansas to Morrilton, Arkansas)
	Time of Travel along Highway 92 Corridor
	2 hours, 12 minutes
	Time of Travel along Detour Route 1
	2 hours, 50 minutes -- 38 minutes longer than Highway 92 Corridor
	Time of Travel along Detour Route 2
	3 hours, 12 minutes -- 1 hour longer than Highway 92 Corridor

### ATTACHMENT 3

Worksheet 5-2: Operating and Ownership Cost			
General Information		Site Information	
Analyst	AJW/VHP	Facility	Hwy 92 bridges
Agency/Company	AHTD	Segment	---
Project	TIGER III	Analysis Time Period	annual
Date Performed	10/25/2011	Analysis Year	2013
		Segment Length (mi.)	---
Inputs			
Finance Rate:		3.0%	
Autos		Trucks	
Speed (mph):		Speed (mph):	
without improvement	N/A	without improvement	55
with improvement	N/A	with improvement	55
Fuel Cost Per Gallon	N/A	Fuel Cost Per Gallon	\$3.00
Consumption per Mile (Table 5-5):		Fuel Consumption per Mile (Table 5-5):	
without improvement	N/A	without improvement	0.163
with improvement	N/A	with improvement	0.163
Operating Costs per Mile (Table 5-4) (tires, maintenance, etc.)	N/A	Other Operating Costs per Mile (tires, maintenance, etc.)	\$0.050
Vehicle Life (years)	N/A	Vehicle Life (years)	8
Vehicle Cost	N/A	Vehicle Cost	\$60,000
Salvage Value at End of Life	N/A	Salvage Value at End of Life	\$5,000
Miles per Year	N/A	Miles per Year	50,000
		Cargo Value	\$0
Insurance per Year (Table 5-3)	N/A	Insurance per Year	\$1,500
Calculations			
Autos		Trucks	
Fuel Cost per VMT (Equation 5-3):		Fuel Cost per VMT (Equation 5-3):	
without improvement	N/A	without improvement	\$0.4890
with improvement	N/A	with improvement	\$0.4890
(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	N/A	without improvement	\$0.5390
with improvement	N/A	with improvement	\$0.5390
(fuel cost per VMT + other oper. cost)		(fuel cost per VMT + other oper. cost)	
Amortized Vehicle Cost Per Year:	N/A	Amortized Vehicle Cost Per Year:	\$7,985
	(Equation 5-6)		(Equation 5-6)

### ATTACHMENT 3

			Inventory Cost per Hour	\$0.0000
				(Equation 5-10)
			Inventory Cost per Mile:	
			without improvement	\$0.0000
			with improvement	\$0.0000
			(cost per hour / miles per hour)	
Amortized Vehicle Cost per VMT	N/A		Vehicle Cost per VMT	\$0.1597
Insurance Cost per VMT	N/A		Insurance Cost per VMT	\$0.0300
Ownership Cost per VMT			Ownership Cost per VMT	
without improvement	N/A		without improvement	\$0.7287
with improvement	N/A		with improvement	\$0.7287
(vehicle + insurance)			(vehicle + insurance + inventory)	
Oper. and Ownership Cost per VMT			Oper. and Ownership Cost per VMT	
without improvement	N/A		without improvement	\$1.2677
with improvement	N/A		with improvement	\$1.2677
(operating + ownership)			(operating + ownership)	
Oper. and Ownership Savings / VMT	N/A		Oper. and Ownership Savings / VMT	\$0.0000
(without - with)			(without - with)	
			Detour 1	
			\$1.2677 Owner and Operating Cost per VMT	
			29 Miles Saved by Truck	
			75 Number of Trucks per Day	
			200 Working Days per year	
			<b>\$551,450</b> TOTAL SAVINGS PER YEAR	
			Detour 2	
			\$1.2677 Owner and Operating Cost per VMT	
			56 Miles Saved by Truck	
			25 Number of Trucks per Day	
			200 Working Days per year	
			<b>\$354,957</b> TOTAL SAVINGS PER YEAR	

## ATTACHMENT 4

<b>Safety Benefit Calculations</b>						
<b>Accident Costs</b>						
Fatal		\$6,200,000				
Non-Fatal		\$85,408				
<b>Statewide Average Crash Rates (2007-2009 Average, Crashes per MVM)</b>						
		All Crashes	Fatal	Non-Fatal		
Rural 2 Lane		1.03	0.00247	1.02753		
Urban 2 Lane		3.30	0.00152	3.29848		
Rural 4-Lane		1.01	0.00255	1.00745		
Urban 4-Lane		5.19	0.00143	5.18857		
Rural 4-Lane Freeway		0.39	0.00090	0.38910		
Urban 4-Lane Freeway		0.93	0.00081	0.92919		
<b>Costs per VMT</b>						
		Fatal	Non-Fatal			
Rural 2 Lane		\$0.0153	\$0.0878			
Urban 2 Lane		\$0.0094	\$0.2817			
Rural 4-Lane		\$0.0158	\$0.0860			
Urban 4-Lane		\$0.0089	\$0.4431			
Rural 4-Lane Freeway		\$0.0056	\$0.0332			
Urban 4-Lane Freeway		\$0.0050	\$0.0794			
<b>Mileage of Alternate Routes</b>						
		Detour 1	Detour 2	Highway 92	Detour 1 Increase	Detour 2 Increase
Rural 2 Lane		93.3	76.19	73.44	19.86	2.75
Urban 2 Lane		8.51	6.46	2.65	5.86	3.81
Rural 4-Lane		7.24	14.27	0	7.24	14.27
Urban 4-Lane		10.31	6.61	0.09	10.22	6.52
Rural 4-Lane Freeway		0	26.33	0	0	26.33
Urban 4-Lane Freeway		0	28.27	0	0	28.27

## ATTACHMENT 4

<b>Total Number of Miles:</b>		
	Detour 1	Detour 2
Trucks per Day	75	25
Work days per year	200	200
<b>Miles Saved Per Year:</b>		
Rural 2 Lane	297900	13750
Urban 2 Lane	87900	19050
Rural 4-Lane	108600	71350
Urban 4-Lane	153300	32600
Rural 4-Lane Freeway	0	131650
Urban 4-Lane Freeway	0	141350
<b>Cost Saved per Year</b>		
Rural 2 Lane	\$30,706	\$1,417
Urban 2 Lane	\$25,591	\$5,546
Rural 4-Lane	\$11,061	\$7,267
Urban 4-Lane	\$69,293	\$14,736
Rural 4-Lane Freeway	\$0	\$5,110
Urban 4-Lane Freeway	\$0	\$11,927
<b>TOTAL ANNUAL SAVINGS</b>	<b>\$182,655</b>	

## ATTACHMENT 4

<b>Estimation of Accident Costs</b>		
\$6,200,000	Value of a Statistical Life (VSL)	
	<a href="http://ostpxweb.dot.gov/policy/reports/vsl_guidance_072911.pdf">http://ostpxweb.dot.gov/policy/reports/vsl_guidance_072911.pdf</a>	
<b>Disutility Factors by Injury Severity Level</b>		
Severity	Fraction of VSL	
MAIS 1	0.003	
MAIS 2	0.047	
MAIS 3	0.105	
MAIS 4	0.266	
MAIS 5	0.593	
MAIS 6	1	
<b>KABCO-AIS Conversion Table</b>		
	Unknown if	
	Injured	Fatal
AIS 0	0.43676	0
AIS 1	0.41739	0
AIS 2	0.08872	0
AIS 3	0.04817	0
AIS 4	0.00617	0
AIS 5	0.00279	0
Fatality (6)	0	1
<b>Cost of Accident</b>		
Non-Fatal	<b>\$85,408</b>	
Fatal	<b>\$6,200,000</b>	

## Appendix B - Wage Rate Certification Statement

<p style="text-align: center;"><b>WAGE RATE CERTIFICATION FOR THE CONTINUING APPROPRIATIONS ACT OF 2011</b></p>
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Pursuant to the Fiscal Year 2011 Continuing Appropriations Act (Pub. Law 112-010 (April 15, 2011), I, Scott E. Bennett, Director of Highways and Transportation for the State of Arkansas, hereby certify that all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the federal government pursuant to the Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code, the Davis-Bacon Act.

I understand that the Arkansas State Highway and Transportation Department may not receive ARRA infrastructure investment funding unless this certification is made and posted.

  
\_\_\_\_\_  
Scott E. Bennett  
Director of Highways and Transportation

10-26-2011  
\_\_\_\_\_  
Date