FY 2011 Continuing Appropriations Act

TIGER Discretionary Grant Program

Highway 167 Improvement Project

Appendices

A – Benefit Cost Analysis
B – Federal Wage Rate Certifications

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

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 improving Highway 167. The BCA compared the cost of improving Highway 167 within the limits of this project 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 standard features of 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 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 south central Arkansas industries, such as the timber industry to the network of high type highways or connecting Dallas County residents to the central Arkansas labor market cannot be easily quantified, although making Economically Distressed Areas competitive is stated as a primary goals 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 widening of Highway 167 is $34,900,000. 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 Incentive/Disincentive Bidding, may be added to enhance the benefits of the project. 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 (widening Highway 167 versus No-Build) are different in the method by which routine maintenance is addressed. Under the no-build scenario, routine maintenance is scheduled to occur in 2015 and then again in 2025. With the improvements to Highway 167, in 2013 as proposed, maintenance is scheduled for 2025 on the widened facility. These costs have been taken into account and brought to present value. These schedule 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 Benefit		Safety Benefit	
		Non-Disc.	Discounted	Non-Disc.	Discounted	Non-Disc.	Discounted	Non-Disc.	Discounted
2013	(Construction)	$40,120,000	$40,120,000	$0	$0	$122,290	$122,290	$0	$0
2014		$0	$0	$819,757	$795,881	$125,907	$122,240	$81,949	$79,562
2015		-$1,221,096	-$1,151,000	$846,316	$797,734	$129,986	$122,524	$84,604	$79,747
2016		$0	$0	$873,736	$799,592	$134,197	$122,810	$87,345	$79,933
2017		$0	$0	$904,515	$803,650	$138,925	$123,433	$90,421	$80,338
2018		$0	$0	$931,269	$803,320	$143,034	$123,382	$93,096	$80,305
2019		$0	$0	$961,440	$805,191	$147,668	$123,670	$96,112	$80,492
2020		$0	$0	$992,590	$807,066	$152,452	$123,958	$99,226	$80,680
2021		$0	$0	$1,027,556	$811,162	$157,823	$124,587	$102,721	$81,089
2022		$0	$0	$1,057,948	$810,829	$162,491	$124,536	$105,760	$81,056
2023		$0	$0	$1,092,224	$812,718	$167,755	$124,826	$109,186	$81,245
2024		$0	$0	$1,127,611	$814,610	$173,190	$125,116	$112,724	$81,434
2025		$1,367,305	$959,000	$1,167,333	$818,744	$179,291	$125,751	$116,695	$81,847
2026		$0	$0	$1,201,861	$818,409	$184,594	$125,700	$120,146	$81,814
2027		$0	$0	$1,240,799	$820,314	$190,575	$125,992	$124,039	$82,004
2028		$0	$0	$1,280,999	$822,225	$196,749	$126,286	$128,057	$82,195
2029		$0	$0	$1,326,125	$826,397	$203,680	$126,927	$132,569	$82,612
2030		$0	$0	$1,365,349	$826,059	$209,704	$126,875	$136,490	$82,578
2031		$0	$0	$1,409,584	$827,982	$216,499	$127,170	$140,912	$82,771
2032		$0	$0	$1,455,253	$829,910	$223,513	$127,466	$145,477	$82,963
2033		$0	$0	$1,506,517	$834,122	$231,386	$128,113	$150,602	$83,385
TOTAL			$39,928,000		$16,285,916		$2,623,649		$1,628,051
			$20,537,617	Dicounted Benefit					
			$39,928,000	Discounted Costs					
			0.51	Overall B/C					

The BCA Value of Time analysis quantifies the road user impacts that the Highway 167 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 have several purposes, including work and pleasure, with a value of time at 70% of the standard wage rate in the area for work and a value of time at 70% of the standard wage rate in the area for pleasure. A vehicle occupancy rate of 1.1 persons per passenger car vehicle was used. Detailed worksheets showing factors considered for the Value of Time are included in Attachment 2.

The BCA Ownership and Operating Cost analysis quantifies the monetary costs of owning and operating a vehicle (aside from travel time costs). Included in this analysis are such factors as vehicle depreciation, fuel costs, maintenance, and insurance. Also included for trucks is an inventory cost that represents the value of the cargo that is being transported. Detailed worksheets that demonstrate the ownership and operating cost calculations are also included in Attachment 3.

The Value of Safety Improvements considers statistical cost savings that can be attributed to safety features of a multilane facility as compared to that of a two-lane facility. The safety analysis discusses specific existing safety conditions within the corridor. For the purposes of the Benefit Cost Analysis, the project is broken into two segments, North and South of Highway 48, to account for the varied impacts of a four-lane versus a five-lane cross-section. These detailed worksheets are included in Attachment 4.

When examined as a single segment of improvements made within this corridor, the proposed 5.50-mile widening of Highway 167 does not exhibit a net positive economic impact. As mentioned before, as part of a larger corridor there are many intangible factors that cannot be quantified for a benefit-cost calculation.

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

Construction and Maintenance Costs for Highway 167								
	Build			No-Build			DIFFERENCE	DIFFERENCE
	Activity	Const.	User Delay	Activity	Const	User Delay	(2013)	(Future Year)
2013	Const	$39,400,000	$720,000		$0		$40,120,000	$40,120,000
2014		$0			$0		$0	$0
2015		$0		Maint	$1,001,000	$150,000	-$1,151,000	-$1,221,096
2016		$0			$0		$0	$0
2017		$0			$0		$0	$0
2018		$0			$0		$0	$0
2019		$0			$0		$0	$0
2020		$0			$0		$0	$0
2021		$0			$0		$0	$0
2022		$0			$0		$0	$0
2023		$0			$0		$0	$0
2024		$0			$0		$0	$0
2025	Maint	$2,002,000	$126,000	Maint	$1,001,000	$168,000	$959,000	$1,367,305
2026		$0			$0		$0	$0
2027		$0			$0		$0	$0
2028		$0			$0		$0	$0
2029		$0			$0		$0	$0
2030		$0			$0		$0	$0
2031		$0			$0		$0	$0
2032		$0			$0		$0	$0
2033		$0			$0		$0	$0
(Next Maintenance in 2035)								
Construction is assummed to require 300 work days								
Periodic Maintenance includes 30 days to overlay 2 lanes or 60 days to overlay four lanes								

ATTACHMENT 1

JOB: 070291 — **2013 Construction User Delay Costs**

Operating Cost

4,500	ADT	
5.50	mile project length	
25%	Trucks	
$0.003	Car	Value of Operating Cost per VMT
$0.026	Truck	

Operating Cost = ADT x Project Length x $ per VMT

Cars	$56	Operating Cost
Trucks	$158	
	$214	

$$\Delta OC(S) = \Delta C(S)_{fuel} + \Delta I(S)$$ Change in Operating Costs

$$\Delta C(S)_{fuel} = (gal_{speed\_during} - gal_{speed\_before}) \times P$$ Change in Fuel Costs

$$\Delta I(S) = 100 \times \frac{r}{8760} \times \left(\frac{1}{S_{before}} - \frac{1}{S_{during}} \right) \times P_{cargo}$$ Change in Inventory Costs

Car

ΔOC(S)	0.3	cents per vehicle-mile		$0.003
$\Delta C(S)_{fuel}$	0.3	cents per vehicle-mile		per veh-mile
ΔI(S)	0	cents per vehicle-mile		
$gal_{speed\ before}$	0.041	gallons per mile		
$gal_{speed\ during}$	0.042	gallons per mile		
P	300	cents	price for gas	

Truck

ΔOC(S)	2.56	cents per vehicle-mile		$0.026
$\Delta C(S)_{fuel}$	2.10	cents per vehicle-mile		per veh-mile
ΔI(S)	0.46	cents per vehicle-mile		
$gal_{speed\ before}$	0.163	gallons per mile		
$gal_{speed\ during}$	0.170	gallons per mile		
P	300	cents	price for diesel	
r	0.1			
S_{before}	55	mph		
S_{during}	45	mph		
P_{cargo}	100000	dollar value of avg cargo		

Speed (mph)	Gallons per Mile	
	Auto	Truck
5	0.117	0.503
10	0.075	0.316
15	0.061	0.254
20	0.054	0.222
25	0.050	0.204
30	0.047	0.191
35	0.045	0.182
40	0.044	0.176
45	0.042	0.170
50	0.041	0.166
55	0.041	0.163
60	0.040	0.160
65	0.039	0.158
70	0.038	0.156

ATTACHMENT 1

2013 Construction User Delay Costs

User Cost for Delay Through Workzone (Auto)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (peak)	40.00	mph
D	Speed before construction phase (peak)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$10.97	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.16	
I = G*E/F	Value of time per person per hour ($)	$14.47	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.37	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.31	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.07	
M = I*H/C	Value of time per VMT during construction (peak)	$0.42	
N = I*H/D	Value of time per VMT before construction (peak)	$0.34	
P =M-N	Change in Value of Time per VMT (peak)	$0.08	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Auto Volume
Off-Peak	1:00	$6.37	94	17
Off-Peak	2:00	$5.26	78	14
Off-Peak	3:00	$4.01	59	11
Off-Peak	4:00	$7.75	114	21
Off-Peak	5:00	$16.74	247	45
Off-Peak	6:00	$33.63	496	90
Off-Peak	7:00	$53.69	792	144
Off-Peak	8:00	$62.68	924	168
Off-Peak	9:00	$77.91	1149	209
Off-Peak	10:00	$77.08	1137	207
Off-Peak	11:00	$77.49	1143	208
Off-Peak	12:00	$77.84	1148	209
Off-Peak	13:00	$69.95	1032	188
Off-Peak	14:00	$80.54	1188	216
Peak	15:00	$111.48	1329	242
Peak	16:00	$102.83	1226	223
Peak	17:00	$131.00	1561	284
Peak	18:00	$119.53	1424	259
Off-Peak	19:00	$65.59	967	176
Off-Peak	20:00	$44.00	649	118
Off-Peak	21:00	$30.58	451	82
Off-Peak	22:00	$23.66	349	63
Off-Peak	23:00	$14.53	214	39
Off-Peak	0:00	$7.20	106	19
		$1,301.32	**Total Daily Road User Cost for Delay (Auto)**	
		$1,300.00	**Rounded**	

Rounded TOTAL $2,400

User Cost for Delay Through Workzone (Truck)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (peak)	40.00	mph
D	Speed before construction phase (peak)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$21.93	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.00	
I = G*E/F	Value of time per person per hour ($)	$28.92	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.64	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.53	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.12	
M = I*H/C	Value of time per VMT during construction (peak)	$0.72	
N = I*H/D	Value of time per VMT before construction (peak)	$0.58	
P =M-N	Change in Value of Time per VMT (peak)	$0.14	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Truck Volume
Off-Peak	1:00	$10.25	88	16
Off-Peak	2:00	$10.25	88	16
Off-Peak	3:00	$11.45	98	18
Off-Peak	4:00	$13.59	116	21
Off-Peak	5:00	$20.99	180	33
Off-Peak	6:00	$28.62	245	45
Off-Peak	7:00	$37.44	320	58
Off-Peak	8:00	$46.02	394	72
Off-Peak	9:00	$49.84	427	78
Off-Peak	10:00	$48.41	414	75
Off-Peak	11:00	$51.51	441	80
Off-Peak	12:00	$59.74	511	93
Off-Peak	13:00	$53.66	459	83
Off-Peak	14:00	$50.08	429	78
Peak	15:00	$65.51	453	82
Peak	16:00	$59.46	411	75
Peak	17:00	$62.27	431	78
Peak	18:00	$38.95	269	49
Off-Peak	19:00	$26.47	227	41
Off-Peak	20:00	$28.14	241	44
Off-Peak	21:00	$26.47	227	41
Off-Peak	22:00	$17.41	149	27
Off-Peak	23:00	$18.12	155	28
Off-Peak	0:00	$11.92	102	19
		$846.58	**Total Daily Road User Cost for Delay (Truck)**	
		$850.00	**Rounded**	

ATTACHMENT 1

JOB: 070291 — **2025 Maintenance User Delay Costs (Multilane)**

Operating Cost

5,100	ADT	
5.50	mile project length	
25%	Trucks	
$0.006	Car	Value of Operating Cost per VMT
$0.018	Truck	

Operating Cost = ADT x Project Length x $ per VMT

Cars	$126	Operating Cost
Trucks	$128	
	$254	

$$\Delta OC(S) = \Delta C(S)_{fuel} + \Delta I(S)$$ Change in Operating Costs

$$\Delta C(S)_{fuel} = (gal_{speed\_during} - gal_{speed\_before}) \times P$$ Change in Fuel Costs

$$\Delta I(S) = 100 \times \frac{r}{8760} \times \left(\frac{1}{S_{before}} - \frac{1}{S_{during}} \right) \times P_{cargo}$$ Change in Inventory Costs

Car

ΔOC(S)	0.6	cents per vehicle-mile		$0.006
$\Delta C(S)_{fuel}$	0.6	cents per vehicle-mile		per veh-mile
ΔI(S)	0	cents per vehicle-mile		
$gal_{speed\ before}$	0.039	gallons per mile		
$gal_{speed\ during}$	0.041	gallons per mile		
P	300	cents	price for gas	

Truck

ΔOC(S)	1.82	cents per vehicle-mile		$0.018
$\Delta C(S)_{fuel}$	1.50	cents per vehicle-mile		per veh-mile
ΔI(S)	0.32	cents per vehicle-mile		
$gal_{speed\ before}$	0.158	gallons per mile		
$gal_{speed\ during}$	0.163	gallons per mile		
P	300	cents	price for diesel	
r	0.1			
S_{before}	65	mph		
S_{during}	55	mph		
P_{cargo}	100000	dollar value of avg cargo		

Speed (mph)	Gallons per Mile	
	Auto	Truck
5	0.117	0.503
10	0.075	0.316
15	0.061	0.254
20	0.054	0.222
25	0.050	0.204
30	0.047	0.191
35	0.045	0.182
40	0.044	0.176
45	0.042	0.170
50	0.041	0.166
55	0.041	0.163
60	0.040	0.160
65	0.039	0.158
70	0.038	0.156

ATTACHMENT 1

2025 Maintenance User Delay Costs (Multilane)

User Cost for Delay Through Workzone (Auto)

A	Speed during construction phase (off-peak)	55.00	mph
B	Speed before construction phase (off-peak)	65.00	mph
C	Speed during construction phase (peak)	45.00	mph
D	Speed before construction phase (peak)	55.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$10.97	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.16	
I = G*E/F	Value of time per person per hour ($)	$14.47	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.31	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.26	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.05	
M = I*H/C	Value of time per VMT during construction (peak)	$0.37	
N = I*H/D	Value of time per VMT before construction (peak)	$0.31	
P =M-N	Change in Value of Time per VMT (peak)	$0.07	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Auto Volume
Off-Peak	1:00	$4.99	106	19
Off-Peak	2:00	$4.13	88	16
Off-Peak	3:00	$3.15	67	12
Off-Peak	4:00	$6.08	130	24
Off-Peak	5:00	$13.14	280	51
Off-Peak	6:00	$26.38	562	102
Off-Peak	7:00	$42.13	897	163
Off-Peak	8:00	$49.18	1048	191
Off-Peak	9:00	$61.13	1302	237
Off-Peak	10:00	$60.47	1288	234
Off-Peak	11:00	$60.80	1295	235
Off-Peak	12:00	$61.07	1301	237
Off-Peak	13:00	$54.88	1169	213
Off-Peak	14:00	$63.19	1346	245
Peak	15:00	$102.09	1506	274
Peak	16:00	$94.17	1389	253
Peak	17:00	$119.97	1769	322
Peak	18:00	$109.46	1614	294
Off-Peak	19:00	$51.46	1096	199
Off-Peak	20:00	$34.53	736	134
Off-Peak	21:00	$23.99	511	93
Off-Peak	22:00	$18.57	396	72
Off-Peak	23:00	$11.40	243	44
Off-Peak	0:00	$5.65	120	22
		$1,082.02	**Total Daily Road User Cost for Delay (Auto)**	
		$1,100.00	**Rounded**	Rounded TOTAL $2,100

User Cost for Delay Through Workzone (Truck)

A	Speed during construction phase (off-peak)	55.00	mph
B	Speed before construction phase (off-peak)	65.00	mph
C	Speed during construction phase (peak)	45.00	mph
D	Speed before construction phase (peak)	55.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$21.93	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.00	
I = G*E/F	Value of time per person per hour ($)	$28.92	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.53	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.44	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.08	
M = I*H/C	Value of time per VMT during construction (peak)	$0.64	
N = I*H/D	Value of time per VMT before construction (peak)	$0.53	
P =M-N	Change in Value of Time per VMT (peak)	$0.12	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Truck Volume
Off-Peak	1:00	$8.05	99	18
Off-Peak	2:00	$8.05	99	18
Off-Peak	3:00	$8.98	111	20
Off-Peak	4:00	$10.67	132	24
Off-Peak	5:00	$16.47	204	37
Off-Peak	6:00	$22.45	278	50
Off-Peak	7:00	$29.38	363	66
Off-Peak	8:00	$36.11	446	81
Off-Peak	9:00	$39.11	483	88
Off-Peak	10:00	$37.98	470	85
Off-Peak	11:00	$40.42	500	91
Off-Peak	12:00	$46.87	579	105
Off-Peak	13:00	$42.10	520	95
Off-Peak	14:00	$39.29	486	88
Peak	15:00	$60.00	513	93
Peak	16:00	$54.46	466	85
Peak	17:00	$57.03	488	89
Peak	18:00	$35.68	305	56
Off-Peak	19:00	$20.77	257	47
Off-Peak	20:00	$22.08	273	50
Off-Peak	21:00	$20.77	257	47
Off-Peak	22:00	$13.66	169	31
Off-Peak	23:00	$14.22	176	32
Off-Peak	0:00	$9.36	116	21
		$693.92	**Total Daily Road User Cost for Delay (Truck)**	
		$700.00	**Rounded**	

ATTACHMENT 1

JOB: 070291 — **2015 Maintenance User Delay Costs (Two Lane)**

Operating Cost

4,600	ADT	
5.50	mile project length	
25%	Trucks	
$0.009	Car	Value of Operating Cost per VMT
$0.047	Truck	

Operating Cost = ADT x Project Length x $ per VMT

Cars	$171	Operating Cost
Trucks	$296	
	$467	

$$\Delta OC(S) = \Delta C(S)_{fuel} + \Delta I(S)$$ Change in Operating Costs

$$\Delta C(S)_{fuel} = (gal_{speed\_during} - gal_{speed\_before}) \times P$$ Change in Fuel Costs

$$\Delta I(S) = 100 \times \frac{r}{8760} \times \left(\frac{1}{S_{before}} - \frac{1}{S_{during}} \right) \times P_{cargo}$$ Change in Inventory Costs

Car

ΔOC(S)	0.9	cents per vehicle-mile		$0.009
$\Delta C(S)_{fuel}$	0.9	cents per vehicle-mile		per veh-mile
ΔI(S)	0	cents per vehicle-mile		
$gal_{speed\ before}$	0.041	gallons per mile		
$gal_{speed\ during}$	0.044	gallons per mile		
P	300	cents	price for gas	

Truck

ΔOC(S)	4.68	cents per vehicle-mile		$0.047
$\Delta C(S)_{fuel}$	3.90	cents per vehicle-mile		per veh-mile
ΔI(S)	0.78	cents per vehicle-mile		
$gal_{speed\ before}$	0.163	gallons per mile		
$gal_{speed\ during}$	0.176	gallons per mile		
P	300	cents	price for diesel	
r	0.1			
S_{before}	55	mph		
S_{during}	40	mph		
P_{cargo}	100000	dollar value of avg cargo		

Speed (mph)	Gallons per Mile	
	Auto	Truck
5	0.117	0.503
10	0.075	0.316
15	0.061	0.254
20	0.054	0.222
25	0.050	0.204
30	0.047	0.191
35	0.045	0.182
40	0.044	0.176
45	0.042	0.170
50	0.041	0.166
55	0.041	0.163
60	0.040	0.160
65	0.039	0.158
70	0.038	0.156

ATTACHMENT 1

2015 Maintenance User Delay Costs (Two Lane)

User Cost for Delay Through Workzone (Auto)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (flagging)	30.00	mph
D	Speed before construction phase (flagging)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$10.97	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.16	
I = G*E/F	Value of time per person per hour ($)	$14.47	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.37	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.31	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.07	
M = I*H/C	Value of time per VMT during construction (flagging)	$0.56	
N = I*H/D	Value of time per VMT before construction (flagging)	$0.34	
P =M-N	Change in Value of Time per VMT (flagging)	$0.22	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Auto Volume
Off-Peak	1:00	$6.51	96	17
Off-Peak	2:00	$5.38	79	14
Off-Peak	3:00	$4.10	60	11
Off-Peak	4:00	$7.92	117	21
Off-Peak	5:00	$17.12	252	46
Off-Peak	6:00	$34.37	507	92
Off-Peak	7:00	$54.88	809	147
Off-Peak	8:00	$64.08	945	172
Flagging	9:00	$262.80	1175	214
Flagging	10:00	$260.00	1162	211
Flagging	11:00	$261.40	1168	212
Flagging	12:00	$262.57	1173	213
Flagging	13:00	$235.96	1055	192
Flagging	14:00	$271.67	1214	221
Flagging	15:00	$303.88	1358	247
Flagging	16:00	$280.31	1253	228
Off-Peak	17:00	$108.21	1596	290
Off-Peak	18:00	$98.73	1456	265
Off-Peak	19:00	$67.05	989	180
Off-Peak	20:00	$44.98	663	121
Off-Peak	21:00	$31.26	461	84
Off-Peak	22:00	$24.19	357	65
Off-Peak	23:00	$14.85	219	40
Off-Peak	0:00	$7.36	108	20
		$2,729.58	**Total Daily Road User Cost for Delay (Auto)**	
		$2,750.00	**Rounded**	Rounded TOTAL $5,000

User Cost for Delay Through Workzone (Truck)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (flagging)	30.00	mph
D	Speed before construction phase (flagging)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$21.93	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.00	
I = G*E/F	Value of time per person per hour ($)	$28.92	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.64	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.53	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.12	
M = I*H/C	Value of time per VMT during construction (flagging)	$0.96	
N = I*H/D	Value of time per VMT before construction (flagging)	$0.58	
P =M-N	Change in Value of Time per VMT (flagging)	$0.39	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Truck Volume
Off-Peak	1:00	$10.48	90	16
Off-Peak	2:00	$10.48	90	16
Off-Peak	3:00	$11.70	100	18
Off-Peak	4:00	$13.89	119	22
Off-Peak	5:00	$21.45	184	33
Off-Peak	6:00	$29.25	250	46
Off-Peak	7:00	$38.27	328	60
Off-Peak	8:00	$47.05	403	73
Flagging	9:00	$168.13	436	79
Flagging	10:00	$163.30	423	77
Flagging	11:00	$173.76	451	82
Flagging	12:00	$201.51	523	95
Flagging	13:00	$181.00	469	85
Flagging	14:00	$168.93	438	80
Flagging	15:00	$178.59	463	84
Flagging	16:00	$162.10	420	76
Off-Peak	17:00	$51.44	440	80
Off-Peak	18:00	$32.18	275	50
Off-Peak	19:00	$27.06	232	42
Off-Peak	20:00	$28.76	246	45
Off-Peak	21:00	$27.06	232	42
Off-Peak	22:00	$17.80	152	28
Off-Peak	23:00	$18.53	159	29
Off-Peak	0:00	$12.19	104	19
		$1,794.91	**Total Daily Road User Cost for Delay (Truck)**	
		$1,800.00	**Rounded**	

ATTACHMENT 1

JOB: 070291 — **2025 Maintenance User Delay Costs (Two Lane)**

Operating Cost

5,100	ADT	
5.50	mile project length	
25%	Trucks	
$0.009	Car	Value of Operating Cost per VMT
$0.047	Truck	

Operating Cost = ADT x Project Length x $ per VMT

Cars	$189	Operating Cost
Trucks	$328	
	$517	

$$\Delta OC(S) = \Delta C(S)_{fuel} + \Delta I(S)$$ Change in Operating Costs

$$\Delta C(S)_{fuel} = (gal_{speed\_during} - gal_{speed\_before}) \times P$$ Change in Fuel Costs

$$\Delta I(S) = 100 \times \frac{r}{8760} \times \left(\frac{1}{S_{before}} - \frac{1}{S_{during}} \right) \times P_{cargo}$$ Change in Inventory Costs

Car

ΔOC(S)	0.9	cents per vehicle-mile		$0.009
$\Delta C(S)_{fuel}$	0.9	cents per vehicle-mile		per veh-mile
ΔI(S)	0	cents per vehicle-mile		
$gal_{speed\ before}$	0.041	gallons per mile		
$gal_{speed\ during}$	0.044	gallons per mile		
P	300	cents	price for gas	

Truck

ΔOC(S)	4.68	cents per vehicle-mile		$0.047
$\Delta C(S)_{fuel}$	3.90	cents per vehicle-mile		per veh-mile
ΔI(S)	0.78	cents per vehicle-mile		
$gal_{speed\ before}$	0.163	gallons per mile		
$gal_{speed\ during}$	0.176	gallons per mile		
P	300	cents	price for diesel	
r	0.1			
S_{before}	55	mph		
S_{during}	40	mph		
P_{cargo}	100000	dollar value of avg cargo		

Speed (mph)	Gallons per Mile	
	Auto	Truck
5	0.117	0.503
10	0.075	0.316
15	0.061	0.254
20	0.054	0.222
25	0.050	0.204
30	0.047	0.191
35	0.045	0.182
40	0.044	0.176
45	0.042	0.170
50	0.041	0.166
55	0.041	0.163
60	0.040	0.160
65	0.039	0.158
70	0.038	0.156

ATTACHMENT 1

2025 Maintenance User Delay Costs (Two Lane)

User Cost for Delay Through Workzone (Auto)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (flagging)	30.00	mph
D	Speed before construction phase (flagging)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$10.97	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.16	
I = G*E/F	Value of time per person per hour ($)	$14.47	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.37	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.31	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.07	
M = I*H/C	Value of time per VMT during construction (flagging)	$0.56	
N = I*H/D	Value of time per VMT before construction (flagging)	$0.34	
P =M-N	Change in Value of Time per VMT (flagging)	$0.22	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Auto Volume
Off-Peak	1:00	$7.21	106	19
Off-Peak	2:00	$5.96	88	16
Off-Peak	3:00	$4.55	67	12
Off-Peak	4:00	$8.78	130	24
Off-Peak	5:00	$18.98	280	51
Off-Peak	6:00	$38.11	562	102
Off-Peak	7:00	$60.85	897	163
Off-Peak	8:00	$71.04	1048	191
Flagging	9:00	$291.37	1302	237
Flagging	10:00	$288.26	1288	234
Flagging	11:00	$289.82	1295	235
Flagging	12:00	$291.11	1301	237
Flagging	13:00	$261.61	1169	213
Flagging	14:00	$301.20	1346	245
Flagging	15:00	$336.91	1506	274
Flagging	16:00	$310.78	1389	253
Off-Peak	17:00	$119.97	1769	322
Off-Peak	18:00	$109.46	1614	294
Off-Peak	19:00	$74.34	1096	199
Off-Peak	20:00	$49.87	736	134
Off-Peak	21:00	$34.66	511	93
Off-Peak	22:00	$26.82	396	72
Off-Peak	23:00	$16.47	243	44
Off-Peak	0:00	$8.15	120	22
		$3,026.27	Total Daily Road User Cost for Delay (Auto)	
		$3,050.00	Rounded	

Rounded TOTAL $5,600

User Cost for Delay Through Workzone (Truck)

A	Speed during construction phase (off-peak)	45.00	mph
B	Speed before construction phase (off-peak)	55.00	mph
C	Speed during construction phase (flagging)	30.00	mph
D	Speed before construction phase (flagging)	50.00	mph
E	Current CPI	226.96	9/2011
F	Avg. 2000 CPI	172.10	
G	Table 5-1 & Table 5-2	$21.93	
	from pg 5-4 in User and Non-User Benefit Analysis for Highways		
H	Average vehicle occupancy	1.00	
I = G*E/F	Value of time per person per hour ($)	$28.92	
J = I*H/A	Value of time per VMT during construction (off-peak)	$0.64	
K = I*H/B	Value of time per VMT before construction (off-peak)	$0.53	
O = J-K	Change in Value of Time per VMT (off-peak)	$0.12	
M = I*H/C	Value of time per VMT during construction (flagging)	$0.96	
N = I*H/D	Value of time per VMT before construction (flagging)	$0.58	
P =M-N	Change in Value of Time per VMT (flagging)	$0.39	
L	Analysis Segment Length	5.50	miles

	End Time	S = R*(O *or* P) User Delay Cost	R = Q*L VMT per Hour	Q Truck Volume
Off-Peak	1:00	$11.62	99	18
Off-Peak	2:00	$11.62	99	18
Off-Peak	3:00	$12.97	111	20
Off-Peak	4:00	$15.41	132	24
Off-Peak	5:00	$23.78	204	37
Off-Peak	6:00	$32.43	278	50
Off-Peak	7:00	$42.43	363	66
Off-Peak	8:00	$52.16	446	81
Flagging	9:00	$186.40	483	88
Flagging	10:00	$181.05	470	85
Flagging	11:00	$192.65	500	91
Flagging	12:00	$223.42	579	105
Flagging	13:00	$200.67	520	95
Flagging	14:00	$187.30	486	88
Flagging	15:00	$198.00	513	93
Flagging	16:00	$179.71	466	85
Off-Peak	17:00	$57.03	488	89
Off-Peak	18:00	$35.68	305	56
Off-Peak	19:00	$30.00	257	47
Off-Peak	20:00	$31.89	273	50
Off-Peak	21:00	$30.00	257	47
Off-Peak	22:00	$19.73	169	31
Off-Peak	23:00	$20.54	176	32
Off-Peak	0:00	$13.51	116	21
		$1,990.00	Total Daily Road User Cost for Delay (Truck)	
		$2,000.00	Rounded	

ATTACHMENT 2

Value of Time - Existing Route - No Build versus Build

General Information		Site Information	
Analyst	KKR	Facility	Hwy 167 - Dallas Co.
Agency/Company	AHTD	Segment	Cleveland Co. Line - Saline River
Project	Hwy 167	Analysis Time Period	Peak Hour
Date Performed	8/30/2011	Analysis Year	2013
		Segment Length (mi.)	3.91

Inputs

Autos		Trucks	
Percentage of hourly wage (Table 5-1)	70%	Percentage of compensation (Table 5-1)	100%
Average hourly wage (Table 5-2)	$25.24	Average hourly compensation (Table 5-2)	$27.51
Average vehicle occupancy	1.1	Average vehicle occupancy	1.05
Speed without Improvement (mph)	55	Speed without Improvement (mph)	55
Speed with Improvement (mph)	65	Speed with Improvement (mph)	65
or		or	
Delay without improvement (min.)	0.5	Delay without improvement (min.)	0.5
Delay with improvement (min.)	0	Delay with improvement (min.)	0

Calculations

Autos		Trucks	
Value of time per hour (wage X percentage X occupancy)	$19.43	Value of time per hour (wage X percentage X occupancy)	$28.89
For speed change:		For speed change:	
Time without improvement (min.)	4.265	Time without improvement (min.)	4.265
Time with improvement (min.)	3.609	Time with improvement (min.)	3.609
(1 / speed) X length X 60		(1 / speed) X length X 60	
Travel time saved per vehicle (min.):	0.656	Travel time saved per vehicle (min.):	0.656
or		or	
For delay change:		For delay change:	
Travel time saved per vehicle (min.): (delay without - delay with)	0.500	Travel time saved per vehicle (min.): (delay without - delay with)	0.500
Value of time saved per vehicle (VOT per hour * time saved / 60)	$0.3745	Value of time saved per vehicle (VOT per hour * time saved / 60)	$0.5566
Value of time saved per VMT (VOT per vehicle / length)	$0.0958	Value of time saved per VMT (VOT per vehicle / length)	$0.1424

ATTACHMENT 2

Value of Time						
Year	TOTAL VMT		Benefit per Auto VMT	Benefit per Truck VMT	TOTAL COST (2013)	TOTAL COST (Future Year)
	Auto	Truck				
2013	5558625	1852875	0	0	$0	$0
2014	5556346.5	1852115.5	$0.096	$0.142	$795,881	$819,757
2015	5569285.7	1856428.6	$0.096	$0.142	$797,734	$846,316
2016	5582254.9	1860751.6	$0.096	$0.142	$799,592	$873,736
2017	5610583.8	1870194.6	$0.096	$0.142	$803,650	$904,515
2018	5608284.1	1869428	$0.096	$0.142	$803,320	$931,269
2019	5621344.1	1873781.4	$0.096	$0.142	$805,191	$961,440
2020	5634434.6	1878144.9	$0.096	$0.142	$807,066	$992,590
2021	5663028.3	1887676.1	$0.096	$0.142	$811,162	$1,027,556
2022	5660707	1886902.3	$0.096	$0.142	$810,829	$1,057,948
2023	5673889.2	1891296.4	$0.096	$0.142	$812,718	$1,092,224
2024	5687102	1895700.7	$0.096	$0.142	$814,610	$1,127,611
2025	5715963	1905321	$0.096	$0.142	$818,744	$1,167,333
2026	5713620	1904540	$0.096	$0.142	$818,409	$1,201,861
2027	5726925.4	1908975.1	$0.096	$0.142	$820,314	$1,240,799
2028	5740261.7	1913420.6	$0.096	$0.142	$822,225	$1,280,999
2029	5769392.5	1923130.8	$0.096	$0.142	$826,397	$1,326,125
2030	5767027.6	1922342.5	$0.096	$0.142	$826,059	$1,365,349
2031	5780457.4	1926819.1	$0.096	$0.142	$827,982	$1,409,584
2032	5793918.4	1931306.1	$0.096	$0.142	$829,910	$1,455,253
2033	5823321.4	1941107.1	$0.096	$0.142	$834,122	$1,506,517

ATTACHMENT 2

Calcuation of VMT										
	North	South								
2013 ADT	4500	4500								
2033 ADT	5500	5500								
Growth Ra	1.01%	1.01%								
	ADT		Truck		Length		North Annual VMT		South Annual VMT	
Year	Notth	South	Percent	Days in Year	North	South	Passenger	Trucks	Passenger	Trucks
2013	4500	4500	25%	366	1.41	3.09	1741702.5	580567.5	3816922.5	1272308
2014	4545	4545	25%	365	1.41	3.09	1754459.2	584819.7	3844878.6	1281626
2015	4591	4591	25%	365	1.41	3.09	1772151.2	590717.1	3883650.5	1294550
2016	4638	4638	25%	365	1.41	3.09	1790021.6	596673.9	3922813.4	1307604
2017	4684	4684	25%	366	1.41	3.09	1813025.9	604342	3973227	1324409
2018	4732	4732	25%	365	1.41	3.09	1826305	608768.3	4002327.9	1334109
2019	4779	4779	25%	365	1.41	3.09	1844721.5	614907.2	4042687.5	1347563
2020	4827	4827	25%	365	1.41	3.09	1863323.7	621107.9	4083454.1	1361151
2021	4876	4876	25%	366	1.41	3.09	1887270	629090	4135932.2	1378644
2022	4925	4925	25%	365	1.41	3.09	1901092.9	633697.6	4166224.8	1388742
2023	4975	4975	25%	365	1.41	3.09	1920263.6	640087.9	4208237.2	1402746
2024	5025	5025	25%	365	1.41	3.09	1939627.6	646542.5	4250673.2	1416891
2025	5076	5076	25%	366	1.41	3.09	1964554.5	654851.5	4305300.3	1435100
2026	5127	5127	25%	365	1.41	3.09	1978943.4	659647.8	4336833.4	1445611
2027	5179	5179	25%	365	1.41	3.09	1998899.1	666299.7	4380566.2	1460189
2028	5231	5231	25%	365	1.41	3.09	2019056.1	673018.7	4424740	1474913
2029	5284	5284	25%	366	1.41	3.09	2045003.8	681667.9	4481604	1493868
2030	5337	5337	25%	365	1.41	3.09	2059981.9	686660.6	4514428.4	1504809
2031	5391	5391	25%	365	1.41	3.09	2080754.8	693584.9	4559952.1	1519984
2032	5445	5445	25%	365	1.41	3.09	2101737.2	700579.1	4605934.8	1535312
2033	5500	5500	25%	366	1.41	3.09	2128747.5	709582.5	4665127.5	1555043

ATTACHMENT 3

Worksheet 5-2: Operating and Ownership Cost					
			Site Information		
Analyst	AJW/VHP		Facility	Highway 167 - Sect. 8/9	
Agency/Company	AHTD		Segment	Dallas/Cleveland Co.	
Project	TIGER III		Analysis Time Period		
Date Performed	10/26/2011		Analysis Year	2013	
			Segment Length (mi.)	5.5	
		Inputs			
	Finance Rate:	3.0%			
Autos			**Trucks**		
Speed (mph):			Speed (mph):		
without improvement	55		without improvement	55	
with improvement	65		with improvement	65	
Fuel Cost Per Gallon	$3.00		Fuel Cost Per Gallon	$3.00	
Fuel Consumption per Mile (Table 5-5):			Fuel Consumption per Mile (Table 5-5):		
without improvement	0.041		without improvement	0.166	
with improvement	0.039		with improvement	0.158	
Other Operating Costs per Mile (Table 5-4)	$0.040		Other Operating Costs per Mile	$0.050	
(tires, maintenance, etc.)			(tires, maintenance, etc.)		
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	$200,000	
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	$0.1230		without improvement	$0.4980	
with improvement	$0.1170		with improvement	$0.4740	
(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	$0.1630		without improvement	$0.5480	
with improvement	$0.1570		with improvement	$0.5240	
(fuel cost per VMT + other oper. cost)			(fuel cost per VMT + other oper. cost)		
Amortized Vehicle Cost Per Year:	$2,170		Amortized Vehicle Cost Per Year:	$7,985	
	(Equation 5-6)			(Equation 5-6)	
			Inventory Cost per Hour	$0.6849	
				(Equation 5-10)	
			Inventory Cost per Mile:		
			without improvement	$0.0125	
			with improvement	$0.0105	
			(cost per hour / miles per hour)		
Amortized Vehicle Cost per VMT	$0.1447		Vehicle Cost per VMT	$0.1597	
Insurance Cost per VMT	$0.0667		Insurance Cost per VMT	$0.0300	
Ownership Cost per VMT			Ownership Cost per VMT		
without improvement	$0.2113		without improvement	$0.7377	
with improvement	$0.2113		with improvement	$0.7137	
(vehicle + insurance)			(vehicle + insurance + inventory)		
Oper. and Ownership Cost per VMT			Oper. and Ownership Cost per VMT		
without improvement	$0.3743		without improvement	$1.2857	
with improvement	$0.3683		with improvement	$1.2377	
(operating + ownership)			(operating + ownership)		
Oper. and Ownership Savings / VMT	$0.0060		Oper. and Ownership Savings / VMT	$0.0480	
(without - with)			(without - with)		

ATTACHMENT 4

Worksheet 5-3: Accident Cost (North of Highway 48)

General Information		Site Information	
Analyst	AJW	Facility	Highway 167
Agency/Company	AHTD	Segment	Section 8/9
Project	TIGER III	Analysis Time Period	
Date Performed	9/12/2011	Analysis Year	2013
		Segment Length (mi.)	1

Inputs

Accident Cost (net of insurance reimbursement):		From Table 5-17
	Fatal	$6,200,000
	Non-Fatal	$85,408

Without Improvement		With Improvement	
(Unit Vehicle)	1	(Unit Vehicle)	1

Calculations

(Unit Vehicle)	1	(Unit Vehicle)	1
Accidents per Million VMT:		Accidents per Million VMT:	
Fatal	0.0021	Fatal	0.0025
Non-Fatal	0.4000	Non-Fatal	0.4100
(accidents per year*1000000/VMT)		(accidents per year*1000000/VMT)	
Accident Cost per VMT		Accident Cost per VMT	
Fatal	$0.0129	Fatal	$0.0157
Non-Fatal	$0.0342	Non-Fatal	$0.0350
(acc. per mm #VMT * cost / 1000000)		(acc. per mm #VMT * cost / 1000000)	
Accident Cost per VMT (all types) (fatal + injury + P.D.O.)	$0.0471	Accident Cost per VMT (all types) (fatal + injury + P.D.O.)	$0.0508

Accident Cost Savings per VMT:	
Fatal	-$0.0029
Non-Fatal	-$0.0009
All Accidents (without - with)	-$0.0037

ATTACHMENT 4

Worksheet 5-3: Accident Cost (South of Highway 48)

General Information		Site Information	
Analyst	AJW	Facility	Highway 167
Agency/Company	AHTD	Segment	Section 8/9
Project	TIGER III	Analysis Time Period	
Date Performed	9/12/2011	Analysis Year	2013
		Segment Length (mi.)	

Inputs

Accident Cost (net of insurance reimbursement):		From Table 5-17
	Fatal	$6,200,000
	Non-Fatal	$85,408

Without Improvement		With Improvement	
(Unit Vehicle)	1	(Unit Vehicle)	1

Calculations

Accidents per Million VMT:		Accidents per Million VMT:	
Fatal	0.0021	Fatal	0.0008
Non-Fatal	0.4000	Non-Fatal	0.2900
(accidents per year*1000000/VMT)		(accidents per year*1000000/VMT)	
Accident Cost per VMT		Accident Cost per VMT	
Fatal	$0.0129	Fatal	$0.0050
Non-Fatal	$0.0342	Non-Fatal	$0.0248
(acc. per mm #VMT * cost / 1000000)		(acc. per mm #VMT * cost / 1000000)	
Accident Cost per VMT (all types) (fatal + injury + P.D.O.)	$0.0471	Accident Cost per VMT (all types) (fatal + injury + P.D.O.)	$0.0297

Accident Cost Savings per VMT:		
Fatal		$0.0079
Non-Fatal		$0.0094
All Accidents (without - with)		$0.0173

ATTACHMENT 4

SAFETY BENEFIT						
Year	TOTAL VMT		Benefit per North VMT	Benefit per South VMT	TOTAL BENEFIT (2011)	TOTAL BENEFIT (Future Year)
	North	South				
2013	2322270	5089230	-$0.004	$0.017	$79,594	$79,594
2014	2321318.1	5087144	-$0.004	$0.017	$79,562	$81,949
2015	2326723.8	5098990.4	-$0.004	$0.017	$79,747	$84,604
2016	2332142	5110864.5	-$0.004	$0.017	$79,933	$87,345
2017	2343977.2	5136801.2	-$0.004	$0.017	$80,338	$90,421
2018	2343016.4	5134695.6	-$0.004	$0.017	$80,305	$93,096
2019	2348472.6	5146652.8	-$0.004	$0.017	$80,492	$96,112
2020	2353941.6	5158637.9	-$0.004	$0.017	$80,680	$99,226
2021	2365887.4	5184817	-$0.004	$0.017	$81,089	$102,721
2022	2364917.6	5182691.8	-$0.004	$0.017	$81,056	$105,760
2023	2370424.8	5194760.8	-$0.004	$0.017	$81,245	$109,186
2024	2375944.8	5206857.8	-$0.004	$0.017	$81,434	$112,724
2025	2388002.3	5233281.7	-$0.004	$0.017	$81,847	$116,695
2026	2387023.5	5231136.6	-$0.004	$0.017	$81,814	$120,146
2027	2392582.2	5243318.4	-$0.004	$0.017	$82,004	$124,039
2028	2398153.8	5255528.5	-$0.004	$0.017	$82,195	$128,057
2029	2410324	5282199.4	-$0.004	$0.017	$82,612	$132,569
2030	2409336	5280034.2	-$0.004	$0.017	$82,578	$136,490
2031	2414946.6	5292329.9	-$0.004	$0.017	$82,771	$140,912
2032	2420570.3	5304654.2	-$0.004	$0.017	$82,963	$145,477
2033	2432854.3	5331574.3	-$0.004	$0.017	$83,385	$150,602

ATTACHMENT 4

Estimation of Accident Costs

$6,200,000	Value of a Statistical Life (VSL)					
	http://ostpxweb.dot.gov/policy/reports/vsl_guidance_072911.pdf					
Disutility Factors by Injury Severity Level						
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					
KABCO-AIS Conversion Table						
	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				
Cost of Accident						
Non-Fatal	**$85,408**					
Fatal	**$6,200,000**					

Appendix B - Wage Rate Certification Statement

WAGE RATE CERTIFICATION
FOR
THE CONTINUING APPROPRIATIONS ACT OF 2011

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, herby 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