FY 2017/2018 INFRA Grant Application
Interstate 30 (U.S. Highway 70 – Sevier Street)

Benefit-Cost Analysis Memorandum

Overview

This Project proposes to improve approximately 5.8 miles of Interstate 30 in Saline County, Arkansas. Over the last 20 years, the Interstate 30 corridor west of Little Rock experienced tremendous population growth, which was accompanied by a significant increase in traffic volumes. Continued westward growth is anticipated, with major developments along Interstate 30 already planned or in progress. Additionally, freight volumes at this location are projected to increase significantly over the next two decades.

Given the existing and anticipated traffic demands on Interstate 30, the Arkansas Department of Transportation (ARDOT) is approaching this Project with urgency. The pavement and structures within the Project area are generally in poor condition – the pavement is distressed and four of the nine bridges are structurally deficient. Moreover, geometric issues and congestion contribute to crash rates that are significantly higher than the statewide average for similar facilities. To address these challenges, the Project would:

- Widen Interstate 30 from four lanes to six lanes;
- Improve alignments, signage and safety systems to meet modern safety standards;
- Modify four interchanges to improve ramp access, increase capacity and add traffic control devices; and
- Fully reconstruct the pavement and replace deficient structures.

The matrix of problems, alternatives, impacts and benefits of the Project is presented in **Table 1**. This document describes the methodology used to estimate the benefits and costs attributable to the Project. This analysis was conducted in accordance with the guidelines set forth in *Benefit-Cost Analysis Guidance for TIGER and INFRA Applications* (July 2017).

Table 1. Project Matrix

Problem	*Proposed Solution*	*Type of Impact*	*Economic Benefit*
Peak-hour congestion – delay	Widen from two to three mainlanes in each direction	Travel-time reduction	Monetized value of time
Peak-hour congestion – rear-end crashes		Crash reduction	Monetized value of crash reduction
Single-vehicle crashes	Widen shoulders and improve alignments	Crash reduction	Monetized value of crash reduction
Escalating maintenance costs	Reconstruction of existing facility and planned preservation	Reduction in maintenance costs	Net maintenance cost savings

These and other aspects of the Project are discussed at length below.

Development of Traffic Estimates

The traffic estimates that form the basis of this benefit-cost analysis (BCA) are reported in *Appendix A* of the application.[1] Though the Project is expected to improve operations and safety on minor streets within the Project area, the focus of this analysis is Interstate 30. Hence, the traffic estimates described below relate only to traffic on Interstate 30.

The traffic estimates developed for the Project distinguish between two scenarios:

- With Development Scenario – which assumes background growth in traffic plus additional traffic generated by a 500-acre planned development at the northwest quadrant of the U.S. Highway 67 interchange, as well as a now-opened community and recreational campus southwest of the South Street interchange.
- Without Development Scenario – which assumes background growth in traffic, but does not include any additional traffic generated by the major developments described above.

Initial (2018) and out-year (2038) traffic estimates were developed for both scenarios during the project-development process. For purposes of computing annual average daily traffic (AADT) estimates, it was assumed that the proposed development at the northwest quadrant of the U.S. Highway 67 interchange will still be in the planning phase in 2018 and will develop gradually through 2038. That is to say, it was assumed that traffic would grow linearly between the 2018 without-development volumes and the 2038 with-development volumes. After 2038, traffic volumes were grown by 2% per year for this analysis.

Daily vehicle miles traveled (VMT) were calculated by multiplying the AADT derived above by segment length. VMT was separated and summed by vehicle class using class fractions developed from traffic counts collected for the Project. Annual VMT was calculated by multiplying daily VMT by 365 days. As discussed below, VMT is the traffic basis for estimating the safety benefits of the Project.

Daily vehicle hours traveled (VHT) was estimated as followed: Balanced, peak-hour traffic volumes for 2018 and 2038 were obtained from *Appendix A*. A two-percent annual growth rate was applied to obtain 2022 and 2041 peak-hour traffic estimates. Interim-year estimates were developed using linear interpolation. The capacity of each mainlane segment was estimated using the number of lanes and an assumed capacity of 1800 vehicles/hour/lane. A volume delay function[2] was applied to estimate the impact of congestion on travel speeds. As discussed below VHT is the basis for estimating the travel time benefits of the project.

[1] *See, e.g.*, pp. A31-A36 (ADT with development), A37-A42 (ADT without development), A43-A48 (opening year 2018 peak-hour forecasts), A49-A54 (design year 2038 peak-hour forecasts).
[2] NCHRP (2012), *Report 716: Travel Demand Forecasting*.

Project Benefits

As discussed below, the benefits of the Project are expected to be derived primarily from travel time savings, safety improvements, and reduction in net maintenance costs.

Travel Time Savings

Travel time savings were estimated as follows: VHT was derived for each of the directional peak hours – four in total – and separated by vehicle classes (passenger vehicles and trucks) using the methods described above. Multipliers were then applied to the peak-hour VHT estimates to account for additional congestion that is expected to occur given the presence of similar traffic volumes either before or after the true peak hour. Class-based VHT were then monetized using standard occupancy and value of time (VOT) figures. The resulting travel time savings are summarized in **Table 2**.

As the nominal values in **Table 2** suggest, under the No-Build scenario, congestion is expected to intensify quickly as the land adjacent to the Project area continues to develop. Congestion under the No-Build scenario is expected to be particularly intense for westbound traffic during the PM peak period, during which time congestion in the project area is expected to result in queueing upstream of the project area. The travel time savings reported below are conservative in the sense that they do not include these upstream travel time impacts of the No-Build scenario. It should also be noted that the values reported in **Table 2** do not reflect the anticipated delay reduction at side streets as a result of added capacity and traffic control improvements.

Table 2. Summary of Travel Time Savings

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ 1,134,452	$ 755,933	$ 950,086
2023	$ 1,508,282	$ 939,283	$ 1,226,372
2024	$ 1,989,607	$ 1,157,969	$ 1,570,614
2025	$ 2,604,345	$ 1,416,591	$ 1,996,013
2026	$ 3,383,406	$ 1,719,952	$ 2,517,572
2027	$ 4,363,407	$ 2,073,023	$ 3,152,218
2028	$ 5,587,455	$ 2,480,897	$ 3,918,928
2029	$ 7,105,999	$ 2,948,737	$ 4,838,839
2030	$ 8,977,758	$ 3,481,729	$ 5,935,356
2031	$ 11,270,723	$ 4,085,029	$ 7,234,248
2032	$ 14,063,236	$ 4,763,704	$ 8,763,744
2033	$ 16,402,269	$ 5,192,538	$ 9,923,643
2034	$ 18,515,402	$ 5,478,039	$ 10,875,847
2035	$ 20,988,793	$ 5,803,576	$ 11,969,615
2036	$ 23,881,943	$ 6,171,548	$ 13,222,853
2037	$ 27,262,311	$ 6,584,205	$ 14,654,835
2038	$ 30,907,583	$ 6,976,248	$ 16,130,436
2039	$ 33,785,174	$ 7,126,877	$ 17,118,669
2040	$ 37,111,737	$ 7,316,453	$ 18,256,515
2041	$ 40,870,924	$ 7,530,434	$ 19,520,181
TOTAL	**$ 311,714,803**	**$ 84,002,767**	**$ 173,776,583**

Safety Improvements

The safety benefits of the Project were calculated as follows: Annual VMT for each year of the analysis was calculated using the methods described above. Annual VMT was multiplied by crash rates by accident type (developed using the last five years of crash data for Interstate 30 within the Project area), to estimate the predicted number of crashes by crash type, by year for the No-Build scenario. The number of crashes by crash type by year was then monetized using standard values by KABCO injury level and summed by year. Crash modification factors (CMFs) for curve straightening (CMF varies)[3], adding directional lanes (CMF ranges from 0.70 to 0.90)[4] and widening shoulders (CMF of 0.80)[5] were identified. The estimated annual No-Build crash costs were then multiplied by a proposed cumulative crash reduction factor (CRF) of 0.25 to arrive at the crash savings for the Project.

The monetized safety benefits of the project are summarized in **Table 3**. It should be noted that the estimated crash savings of the Project are expected to be conservative in the sense that this analysis does not account for crash reductions as a result of non-freeway improvements (*e.g.*, changes to interchange ramp terminals), for which robust safety data are not available. As expected, the safety benefits of the Project are considerable, with safety benefits trending positively with increases in VMT.

[3] Pratt, et al (2014), *Evaluating the Need for Surface Treatments to Reduce Crash Frequency on Horizontal Curves.*
[4] VDOT (2016), *Expected Roadway Project Crash Reductions for SMART SCALE Safety Factor Evaluation.*
[5] NCHRP (2009), *Report 633: Impact of Shoulder Width and Median Width on Safety*, Table S-1.

Table 3. Summary of Safety Benefits

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ 7,420,382	$ 4,944,514	$ 6,214,453
2023	$ 7,701,986	$ 4,796,410	$ 6,262,419
2024	$ 7,983,590	$ 4,646,522	$ 6,302,320
2025	$ 8,265,194	$ 4,495,718	$ 6,334,583
2026	$ 8,546,799	$ 4,344,759	$ 6,359,621
2027	$ 8,828,403	$ 4,194,311	$ 6,377,826
2028	$ 9,110,007	$ 4,044,952	$ 6,389,576
2029	$ 9,391,611	$ 3,897,185	$ 6,395,230
2030	$ 9,673,216	$ 3,751,440	$ 6,395,135
2031	$ 9,954,820	$ 3,608,085	$ 6,389,620
2032	$ 10,236,424	$ 3,467,431	$ 6,379,001
2033	$ 10,518,028	$ 3,329,738	$ 6,363,580
2034	$ 10,799,633	$ 3,195,222	$ 6,343,646
2035	$ 11,081,237	$ 3,064,054	$ 6,319,475
2036	$ 11,362,841	$ 2,936,374	$ 6,291,330
2037	$ 11,644,446	$ 2,812,286	$ 6,259,463
2038	$ 11,926,050	$ 2,691,866	$ 6,224,116
2039	$ 12,207,654	$ 2,575,167	$ 6,185,518
2040	$ 12,489,258	$ 2,462,215	$ 6,143,888
2041	$ 12,770,863	$ 2,353,021	$ 6,099,435
TOTAL	**$ 201,912,442**	**$ 71,611,269**	**$ 126,030,235**

Net Operations and Maintenance Costs

Operations, maintenance and preservation costs for each scenario were estimated as follows:

- Build Scenario
  - Pavement – Based on customary life-cycle cost estimation practices, it was assumed that pavement maintenance activities for the Build Scenario would primarily consist of rehabilitation activities (*e.g.*, full depth patching, minor drainage and base repairs, shoulder work and other maintenance typical of a continuously reinforced concrete pavement) in 2036.
  - Bridges – The bridge maintenance strategy for the Build scenario emphasizes preventative maintenance as a method for reducing the frequency of, and costs associated with, maintenance activities. This strategy assumes: polymer deck coats (every 12 years), hydrodemolition (every 20 years), paint (every 25 years), joint cleaning as needed, and regular inspection. After 50 years of preservation, bridge structures would be permitted to run their course, assuming anticipated replacement after 75 years of service. The costs for the first 20 of the 50 years of bridge preservation activities are annualized as maintenance costs. The cost for the remaining 30 years of bridge preservation activities were deducted from the residual value of bridge structures.

- No-Build Scenario
  - Pavement – Pavement maintenance for the No-Build scenario would consist of regular milling and 4 inch overlays with geosynthetic tape reinforcement at joints. This work is consistent with the maintenance work that was performed in 2012, which was intended to be a short-term solution. The objective of this work is to maintain an acceptable condition of pavement surface, not address underlying structural deficiencies.
  - Bridges – The bridge maintenance strategy for the No-Build scenario would emphasize the performance of routine maintenance to keep structures in service through 2041. Currently, four of the nine bridges within the project area are structurally deficient with respect to either deck or superstructure. The anticipated maintenance activities include a combination of steel painting, hydrodemolition and polymer coatings.

Net maintenance costs for the Project are summarized in **Table 4**. As would be expected, the net maintenance costs are favorable to the Project.

Table 4. Summary of Operations and Maintenance Costs

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ 7,114,175	$ 5,807,286	$ 6,510,478
2020	$ 325,892	$ 248,622	$ 289,551
2021	$ 325,892	$ 232,357	$ 281,118
2022	$ 27,783	$ 18,513	$ 23,268
2023	$ 27,783	$ 17,302	$ 22,590
2024	$ 6,816,066	$ 3,967,012	$ 5,380,665
2025	$ 27,783	$ 15,112	$ 21,294
2026	$ 27,783	$ 14,124	$ 20,673
2027	$ 27,783	$ 13,200	$ 20,071
2028	$ 27,783	$ 12,336	$ 19,487
2029	$ 6,816,066	$ 2,828,425	$ 4,641,409
2030	$ 27,783	$ 10,775	$ 18,368
2031	$ 27,783	$ 10,070	$ 17,833
2032	$ 27,783	$ 9,411	$ 17,314
2033	$ 27,783	$ 8,796	$ 16,809
2034	$ 6,816,066	$ 2,016,628	$ 4,003,720
2035	$ 27,783	$ 7,682	$ 15,844
2036	$ (6,452,217)	$ (1,667,375)	$ (3,572,436)
2037	$ 27,783	$ 6,710	$ 14,935
2038	$ 27,783	$ 6,271	$ 14,500
2039	$ 6,816,066	$ 1,437,828	$ 3,453,644
2040	$ 27,783	$ 5,477	$ 13,668
2041	$ 27,783	$ 5,119	$ 13,270
TOTAL	**$ 28,994,758**	**$ 15,031,681**	**$ 21,258,075**

Other Project Impacts and Benefits

In addition to the benefits discussed, above, this BCA also quantified the work zone impacts of both alternatives and the residual value of assets under the Build scenario. Impacts related to emissions and vehicle operating costs were not quantified, but are discussed qualitatively below.

Work Zone Impacts

Work zone impacts were calculated for both the Build and No-Build scenarios, as follows:

- Build Scenario – From the Project schedule and preliminary maintenance of traffic plans, it was assumed that a reduced-speed work zone would be established for the entire length of the Project area for a period of approximately three years. It is expected that two lanes of travel would be maintained in each direction on Interstate 30 for the duration of the construction period. The posted speed for the Project area is 70 mph, and the proposed posted speed for the work zone is 60 mph. From VMT calculated using the methods described above, the increase in VHT due to the work zone was calculated for each vehicle class and then monetized using standard values to time (VOT). The resulting increases in travel costs are treated as disbenefits of the Project.
- No-build Scenario – The maintenance schedule for the No-build scenario calls for an overlay to be performed every five years to maintain acceptable pavement conditions within the Project area. Based on a similar job that was performed at this location in 2012, it is estimated that each overlay would take approximately four months to complete, and that a reduced-speed work zone would be established for the entire length of the project area for each maintenance cycle. The posted speed for the Project area is 70 mph, and the proposed posted speed for each overlay work zone would be 60 mph. Using VMT calculated using the methods described above, the increase in VHT due to each maintenance cycle was calculated for each vehicle class and then monetized using standard VOT values. The resulting increases in travel costs are treated as benefits of the project.

The monetized work zone impacts of the Project are summarized in **Table 5**. The values for 2020 and 2021 represent the disbenefits associated with construction activities under the Build Scenario. The values for 2024, 2029, 2034 and 2039 represent the benefits associated with avoided maintenance activities under the No-Build scenario. The value for 2019 is the net of the disbenefits associated with the Build scenario and the benefits associated with No-Build scenario.

Table 5. Summary of Work Zone Impacts

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ (4,691,276)	$ (3,829,478)	$ (4,293,182)
2020	$ (7,338,303)	$ (5,598,356)	$ (6,519,987)
2021	$ (7,639,693)	$ (5,446,995)	$ (6,590,066)
2022	$ -	$ -	$ -
2023	$ -	$ -	$ -
2024	$ 2,847,954	$ 1,657,535	$ 2,248,201
2025	$ -	$ -	$ -
2026	$ -	$ -	$ -
2027	$ -	$ -	$ -
2028	$ -	$ -	$ -
2029	$ 3,350,269	$ 1,390,243	$ 2,281,370
2030	$ -	$ -	$ -
2031	$ -	$ -	$ -
2032	$ -	$ -	$ -
2033	$ -	$ -	$ -
2034	$ 3,852,585	$ 1,139,841	$ 2,262,988
2035	$ -	$ -	$ -
2036	$ -	$ -	$ -
2037	$ -	$ -	$ -
2038	$ -	$ -	$ -
2039	$ 4,339,527	$ 915,410	$ 2,198,802
2040	$ -	$ -	$ -
2041	$ -	$ -	$ -
TOTAL	**$ (5,278,937)**	**$ (9,771,802)**	**$ (8,411,874)**

Residual Value

This BCA analyzes the stream of benefits and costs for the first 20 years of Project life. However, it is anticipated that each of the major bridge structures will be designed for 75 years of service. The remaining value of bridge structures has been captured as follows: The initial value of bridge structures was assumed to be the total construction cost of those structures. That value was linearly depreciated for the first 20 of the 75 years of design life. After deducting for anticipated maintenance, the remaining service life (55 years) was recaptured in the final year of the analysis (2041). The residual value of the Project is summarized in **Table 6**.

Table 6. Summary of Residual Value

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -
2023	$ -	$ -	$ -
2024	$ -	$ -	$ -
2025	$ -	$ -	$ -
2026	$ -	$ -	$ -
2027	$ -	$ -	$ -
2028	$ -	$ -	$ -
2029	$ -	$ -	$ -
2030	$ -	$ -	$ -
2031	$ -	$ -	$ -
2032	$ -	$ -	$ -
2033	$ -	$ -	$ -
2034	$ -	$ -	$ -
2035	$ -	$ -	$ -
2036	$ -	$ -	$ -
2037	$ -	$ -	$ -
2038	$ -	$ -	$ -
2039	$ -	$ -	$ -
2040	$ -	$ -	$ -
2041	$ 26,822,502	$ 4,942,024	$ 12,810,576
TOTAL	**$ 26,822,502**	**$ 4,942,024**	**$ 12,810,576**

Emissions

Emissions impacts were not quantified for the Project. However, given the extensive peak-hour congestion predicted toward the design year of the Project (particularly during the PM period in the westbound direction), it is expected that the Project will provide flat to modestly positive benefits with respect to emissions reductions. It is noted that technological and regulatory reductions in vehicle emissions are expected to result in significant reductions in criteria pollutants, even for scenarios with increasing VMT.

Vehicle Operating Costs

Changes in vehicle operating costs were not calculated for the project. However, given the extensive peak-hour congestion predicted toward the design year of the Project (particularly during the PM period in the westbound direction), it is expected that the Project will provide flat to modestly positive benefits due to reduction in fuel consumption related to idling. Moreover, improved pavement conditions as a result of the Project are expected to provide modestly positive benefits due to reduction in vehicle wear and tear.

Project Costs

Unadjusted and discounted capital costs are summarized in **Table 7**. As itemized in **Table 8**, development activities for the project were initiated in 2013, and, to date, have included preliminary engineering, surveys, right of way acquisition, and utility relocation. With the exception of the recent, minor scope expansion at the west end of the Project area (expected to account for less than 10% of Project costs), all construction costs are based on 90% design documents.

Table 7. Summary of Capital Costs

Year	*Without Discount*	*7% Discount*	*3% Discount*
2013	$ 618,926	$ 618,926	$ 618,926
2014	$ 738,939	$ 738,939	$ 738,939
2015	$ 1,184,128	$ 1,184,128	$ 1,184,128
2016	$ 864,576	$ 864,576	$ 864,576
2017	$ 6,697,639	$ 6,259,475	$ 6,502,562
2018	$ 1,549,420	$ 1,353,323	$ 1,460,476
2019	$ 58,716,297	$ 47,929,989	$ 53,733,730
2020	$ 58,716,297	$ 44,794,382	$ 52,168,670
2021	$ 58,716,297	$ 41,863,909	$ 50,649,194
2022	$ -	$ -	$ -
2023	$ -	$ -	$ -
2024	$ -	$ -	$ -
2025	$ -	$ -	$ -
2026	$ -	$ -	$ -
2027	$ -	$ -	$ -
2028	$ -	$ -	$ -
2029	$ -	$ -	$ -
2030	$ -	$ -	$ -
2031	$ -	$ -	$ -
2032	$ -	$ -	$ -
2033	$ -	$ -	$ -
2034	$ -	$ -	$ -
2035	$ -	$ -	$ -
2036	$ -	$ -	$ -
2037	$ -	$ -	$ -
2038	$ -	$ -	$ -
2039	$ -	$ -	$ -
2040	$ -	$ -	$ -
2041	$ -	$ -	$ -
TOTAL	**$ 187,802,519**	**$ 145,607,646**	**$ 167,921,200**

Table 8. Schedule of Undiscounted Capital Costs

Calendar Year	*Activity*							*Construction Costs without 2013-2015 Inflation*	*Capital Costs*
	Preliminary Engineering	*Surveys*	*Right of Way*	*Utilities*	*Construction Engineering and Inspections*	*Roadway Construction*	*Bridge Construction*		
2013	$ 15,006	$ 578,745	$ -	$ -	$ -	$ -	$ -	$ 593,751	$ 618,926
2014	$ 721,620	$ -	$ -	$ -	$ -	$ -	$ -	$ 721,620	$ 738,939
2015	$ 1,168,701	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,168,701	$ 1,184,128
2016	$ 842,490	$ -	$ 22,086	$ -	$ -	$ -	$ -	$ 864,576	$ 864,576
2017	$ 1,059,531	$ -	$ 4,652,914	$ 985,194	$ -	$ -	$ -	$ 6,697,639	$ 6,697,639
2018	$ 564,226	$ -	$ -	$ 985,194	$ -	$ -	$ -	$ 1,549,420	$ 1,549,420
2019	$ -	$ -	$ -	$ -	$ 5,382,964	$ 37,076,164	$ 16,257,170	$ 58,716,297	$ 58,716,297
2020	$ -	$ -	$ -	$ -	$ 5,382,964	$ 37,076,164	$ 16,257,170	$ 58,716,297	$ 58,716,297
2021	$ -	$ -	$ -	$ -	$ 5,382,964	$ 37,076,164	$ 16,257,170	$ 58,716,297	$ 58,716,297
2022	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2023	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2024	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2025	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2026	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2027	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2028	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2029	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2030	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2031	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2032	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2033	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2034	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2035	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2036	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2037	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2038	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2039	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2040	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2041	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
								TOTAL	**$ 187,802,519**

Results of Benefit-Cost Analysis

The results of this BCA are summarized in **Table 9**.

Table 9. Summary of Benefit-Cost Analysis

Cost-Effectiveness Indicator	*Discounted 3%*	*Discounted 7%*
NET PRESENT VALUE = (B) - (C) =	**$157,425,674**	**$20,161,998**
BENEFIT-COST RATIO = (B) / (C) =	**1.94**	**1.14**
Project Costs	***Discounted 3%***	***Discounted 7%***
Capital Costs	$167,921,200	$145,607,646
Total Costs (C) =	**$167,921,200**	**$145,607,646**
Project Benefits/Disbenefits	***Discounted 3%***	***Discounted 7%***
Travel Time Savings	$173,776,583	$84,002,767
Safety Improvements	$125,913,513	$71,564,974
Net Operations and Maintenance	$21,258,075	$15,031,681
Work Zone Impacts	($8,411,874)	($9,771,802)
Residual Value	$12,810,576	$4,942,024
Total Benefits (B) =	**$325,346,874**	**$165,769,644**

As indicated in **Table 9**, with a benefit cost ratio ranging from 1.14 to 1.94 (depending upon discount rate), the Project is expected to be cost effective.

Economic Impacts

The short-term economic impact of the project was estimated using published Federal guidance on short-term job creation.[6] The results are summarized in **Table 10**.

Table 10. Summary of Short-Term Impacts

Construction Cost[1]	$160,000,000
Expenditure per Job-Year[2]	$76,900
Job-Year Creation Attributable to Construction Expenditures	2081

The long-term impact of the Project was evaluated as a widening project using the American Association of State Highway and Transportation Officials' (AASHTO) EconWorks Assess My Project tool.[7] Because the tool does not allow for fine distinctions between projects with respect to some inputs, three combinations of area type and AADT were evaluated and the results averaged. The findings of the EconWorks analysis are summarized in **Table 11**.

Table 11. Summary of Long-Term Impacts

Jobs	*Wages (millions)*	*Output (millions)*
8707	$396	$1,224

[6] *TIGER Benefit-Cost Analysis (BCA) Resource Guide* (Updated 3/27/15), pg. 18.
[7] AASHTO, *EconWorks Assess My Project Tool*, https://planningtools.transportation.org/13/econworks.html.