

BCA TECHNICAL MEMORANDUM

GRADY COUNTY, OKLAHOMA US-81 REALIGNMENT

Executive Summary

The Benefit Cost Analysis (BCA) was prepared for the Grady County, Oklahoma US-81 Realignment Project in accordance with the BCA Guidance for Discretionary Grant Programs dated June 2018. The BCA was prepared for the total project costs and benefits. The US-81 Realignment Project (Project) provides a benefit-cost ratio (BCR) of 4.48 (1.01 when discounted at seven percent). For every dollar invested in the project, 448 percent benefit will be received. Consequently, a \$277 million investment in the project would equal a positive net user benefit of about \$905 million to the public.

Over the life of the project, the travel time savings due to the realignment, removal of the at grade rail crossing and removal of delay from superloads result in the largest positive cash flow for this project, providing a positive net present value of \$114 million. The reduced vehicle operating costs due to the mileage saved contributes \$9 million in positive net present value. Safety improvements of the Project result in \$76 million in benefits (net present value).

Table 1: BCA Benefits & Cost Summary

Project	Grady County, US-81 Realignment
Description	US-81 Realignment around Chickasha
Total Capital Costs (2017 Dollars)	\$277,247,000
Total Project Costs (7% Discounted) (2017 Dollars)	\$200,459,640
Total Net Benefit (2017 Dollars)	\$905,112,619
Total Net Benefit (7% Discounted) (2017 Dollars)	\$203,211,104
Benefit Cost Ratio (2017)	4.48
Benefit Cost Ratio (7% Discounted)	1.01

Project Definition and Approach

The Project will extend US-81 from the US-81 and State Highway 19 (SH-19) junction to the US-81 and U.S. Highway 62 (US-62) junction, realigning US-81 on the west side of the City of Chickasha. The four-lane existing route through downtown Chickasha includes more than a dozen signalized intersections and two 90-degree right-angle turns that are difficult for freight to maneuver. Current average speeds on this segment of US-81 through Chickasha are 30 mph, compared to the posted and average speeds of 55 mph and 55 mph north and south of Chickasha. The project includes the construction of an access controlled four-lane divided facility with six grade separated interchanges and two grade separated rail crossings. This investment will transform this segment of the corridor into a seamless four-lane divided facility, matching the existing four-lane divided character of US-81 south of Chickasha.

Table 2: US-81 Realignment Project at a Glance

Existing Route through Chickasha CBD	US-81 Realignment Project
7.6 Miles	8.5 Miles
4-Lane Undivided Facility (with Center Turn	Access Controlled 4-Lane Divided Facility
14 Signalized Intersections	6 Grade Separated Interchanges
2 90-Degree Turns	2 Grade Separated Rail Crossings
30 mph Average	70 mph Average
14 Minutes Average Travel Time	7.5 Minutes Average Travel Time

The BCA for the project accounts for anticipated capital costs of the project (engineering and design, right-of-way acquisition costs, utility relocation, construction, and contingency), as well as, ongoing maintenance and operations costs of the realignment. The BCA compares these costs with the total project benefits over a thirty-year period as advised through the BCA Guidance for Discretionary Grant Programs dated June 2018. While the BCA uses a thirty-year period, the improvements have an anticipated lifecycle of fifty years and will extend well past a thirty-year period. These future benefits are not quantified or included in the Project benefits.

Project Costs

The project has a total capital cost of \$277,247,000 (2017\$) over a six-year construction period from September 2019 to November 2024. Number shown are in 2017 dollars to provide a uniform base year. All costs by year are shown in Table 3, the operations and maintenance (O&M) costs shown are the incremental increase over the no-build scenario.

Table 3: Summary of Estimated Capital Costs

Year	Capital Cost Allocation	Project Cost	O&M	Project Cost (NPV)
2019	9%	\$24,869,056	\$0	\$21,721,597
2020	10%	\$27,724,700	\$0	\$22,631,614
2021	18%	\$49,904,460	\$376,377	\$38,359,010
2022	24%	\$66,539,280	\$177,486	\$47,568,132
2023	21%	\$58,221,870	\$177,486	\$38,913,957
2024	18%	\$50,486,679	\$177,486	\$31,551,096
2025		\$0	\$177,486	\$103,299
2026		\$0	\$177,486	\$96,541
2027		\$0	\$4,864,206	\$2,472,716
2028		\$0	\$177,486	\$84,323
2029		\$0	\$177,486	\$78,806
2030		\$0	\$177,486	\$73,651
2031		\$0	\$177,486	\$68,832
2032		\$0	\$177,486	\$64,329
2033		\$0	\$177,486	\$60,121
2034		\$0	\$4,864,206	\$1,539,883
2035		\$0	\$177,486	\$52,512
2036		\$0	\$177,486	\$49,076
2037		\$0	\$177,486	\$45,866
2038		\$0	\$177,486	\$42,865
2039		\$0	\$177,486	\$40,061
2040		\$0	\$936,962	\$197,649
2041		\$0	\$9,550,926	\$1,882,933
2042		\$0	\$177,486	\$32,702
2043		\$0	\$177,486	\$30,562
2044		\$0	\$177,486	\$28,563
2045		\$0	\$177,486	\$26,694
2046		\$0	\$177,486	\$24,948
2047		\$0	\$177,486	\$23,316
2048		\$0	\$4,864,206	\$597,193
2049		\$0	\$177,486	\$20,365
2050		\$0	\$177,486	\$19,033
2051		\$0	\$177,486	\$17,788
2052		\$0	\$177,486	\$16,624
2053		\$0	\$177,486	\$15,536
2054		\$0	\$177,486	\$14,520
2055		\$(110,898,800)	\$4,864,206	\$(8,107,072)
Total	100%	\$166,847,245		\$200,459,641

Project Benefits

The following transportation system user project benefits are quantified in the following sections. The Project will provide substantial benefit by removing superloads from downtown Chickasha and grade separating all rail crossings along this segment of US-81. The benefits of the change in travel characteristics were quantified including reduced travel time, reduced vehicle operating costs, reduced crash costs, and reduced emissions costs.

Transportation System User Effects

The economic competitiveness category quantifies multiple benefits with its analysis. The benefits quantified here represent the difference of the reduced traffic on Existing US-81 through Chickasha. Benefits quantified are associated with the build realignment and also account for traffic which will remain on the existing portion of US-81. The quantified benefits in the “build” scenarios is compared to the future “no-build” scenario as if the existing condition remained until 2055. Today there are approximately two superloads per day which navigate US-81. These loads will be rerouted to the realignment eliminating the delay. In addition, the at-grade rail crossing north of Highway 62 will receive an overpass allowing for traffic to be unimpeded by trains, currently four trains per day utilize this crossing. The number of trains per day is anticipated to grow to eight by the year 2040. These two delay contributors along with the reducing the traffic through the city center of Chickasha represent substantial benefits of the realignment project. The following sub-sections describe the direct benefits in greater detail.

Reduced Travel Time

The benefit from reduced travel time was calculated by determining the change in travel time for the realigned route and eliminated delays due to super loads and trains compared to the current route. The additional time (29 million hours from automobiles and 3.4 million hours from trucks) was then multiplied by the value of time provided in the BCA guidance (\$14.80 per hour for passenger vehicles and \$28.60 per hour for truck drivers). Calculations resulted in \$114,231,298 in present value savings from travel time saved.

Reduced Vehicle Operating Costs

Reduced vehicle operating costs were calculated by determining the number of miles saved by moving traffic to the realigned US-81. These reduction in vehicle miles travelled (VMT) were found separately for automobile (69.7 million) and truck traffic (14.3 million). The VMTs were multiplied by the operating costs per mile provided in the BCA guidance (\$0.39 per mile for automobiles and \$0.90 per mile for trucks) to determine the additional costs to the user and the year in which they would occur. This resulted in a present value of \$9,624,547 savings from vehicle operating costs.

Reduced Crash Cost

Reduced crash costs assume that existing US-81 maintains the same crash rate as today but with lower volume of traffic it experiences less crashes. Then the realigned US-81 crashes were estimated utilizing the Grady County, Oklahoma crash rate to determine the number of crashes on the new facility. These two crash predictions were combined and subtracted from the projected no-build number of crashes to determine crash savings each year. The FHWA value of a crash per person or vehicle, vehicle occupancy (1.39), and number of vehicles per crash (1.87) data was used to determine the benefit to the public of

the reduced exposure to crashes. The benefit of the reduced crashes is \$76,591,766 over the thirty-year benefit period.

Reduced Emissions Damage

The reduction in emission damage from traffic diverted to the realigned US-81 were computed for Volatile Organic Compounds (VOCs), Nitrogen Oxides (NOx) and Particulate Matter (PM_{2.5}). Saving these emissions by reducing the miles driven over the thirty-year benefit analysis horizon has resulted in emissions damage savings of \$2,773,493.

Summary of Benefits

As summarized in the tables on the following page, the project benefits for the US-81 realignment over a thirty-year period result in approximately \$203,221,104 in present value with a 7 percent discount for an investment of \$200,459,640 also discounted at 7 percent. The numbers shown in Table 3 are shown in 2017 dollars for the year of expected benefit.

Table 3: Benefits Summary

Year	Economic Competitiveness		Environmental	Safety	Total	7% Discount
	Travel Time Savings	Operations Savings	Reduced Pollutants	Crash Savings		
2019	\$0	\$0	\$0	\$0	\$0	\$0
2020	\$0	\$0	\$0	\$0	\$0	\$0
2021	\$0	\$0	\$0	\$0	\$0	\$0
2022	\$0	\$0	\$0	\$0	\$0	\$0
2023	\$0	\$0	\$0	\$0	\$0	\$0
2024	\$0	\$0	\$0	\$0	\$0	\$0
2025	\$10,722,683	\$1,076,922	\$238,669	\$8,344,506	\$20,382,781	\$11,862,964
2026	\$10,999,101	\$1,093,861	\$246,248	\$8,697,393	\$21,036,603	\$11,442,518
2027	\$11,287,894	\$1,111,064	\$254,238	\$8,671,016	\$21,324,211	\$10,840,148
2028	\$11,590,076	\$1,128,536	\$262,674	\$8,930,511	\$21,911,797	\$10,410,137
2029	\$11,906,792	\$1,146,280	\$271,598	\$8,997,525	\$22,322,195	\$9,911,322
2030	\$12,239,334	\$1,164,302	\$281,057	\$9,051,349	\$22,736,042	\$9,434,649
2031	\$12,589,174	\$1,182,605	\$291,103	\$9,217,453	\$23,280,335	\$9,028,515
2032	\$12,957,990	\$1,201,194	\$301,799	\$9,570,341	\$24,031,323	\$8,710,058
2033	\$13,347,712	\$1,220,073	\$313,213	\$9,923,228	\$24,804,226	\$8,402,050
2034	\$13,760,571	\$1,239,247	\$325,427	\$9,504,395	\$24,829,640	\$7,860,428
2035	\$14,199,159	\$1,258,720	\$338,535	\$9,857,283	\$25,653,698	\$7,590,003
2036	\$14,666,511	\$1,278,497	\$352,648	\$9,911,107	\$26,208,764	\$7,246,942
2037	\$15,166,206	\$1,298,583	\$367,898	\$10,170,602	\$27,003,289	\$6,978,163
2038	\$15,702,502	\$1,318,982	\$384,439	\$10,224,428	\$27,630,351	\$6,673,091
2039	\$16,280,506	\$1,339,700	\$402,458	\$10,390,532	\$28,413,195	\$6,413,232
2040	\$16,906,404	\$1,360,740	\$422,183	\$10,823,621	\$29,512,947	\$6,225,664
2041	\$17,273,570	\$1,362,851	\$433,581	\$10,810,432	\$29,880,434	\$5,890,827
2042	\$17,659,853	\$1,364,942	\$445,661	\$10,690,662	\$30,161,118	\$5,557,161
2043	\$18,067,068	\$1,367,013	\$458,490	\$11,056,739	\$30,949,309	\$5,329,332
2044	\$18,497,279	\$1,369,062	\$472,143	\$11,123,753	\$31,462,237	\$5,063,229
2045	\$18,952,849	\$1,371,090	\$486,707	\$11,396,437	\$32,207,083	\$4,844,017
2046	\$19,436,492	\$1,373,097	\$502,283	\$11,276,667	\$32,588,539	\$4,580,737
2047	\$19,951,347	\$1,375,081	\$518,985	\$11,642,744	\$33,488,157	\$4,399,243
2048	\$20,501,063	\$1,377,043	\$536,947	\$11,709,757	\$34,124,810	\$4,189,606
2049	\$21,089,908	\$1,378,983	\$556,327	\$11,397,505	\$34,422,723	\$3,949,702
2050	\$21,722,913	\$1,380,899	\$577,310	\$11,576,799	\$35,257,920	\$3,780,872
2051	\$22,406,046	\$1,382,791	\$600,116	\$11,643,813	\$36,032,765	\$3,611,180
2052	\$23,146,451	\$1,384,659	\$625,007	\$11,710,826	\$36,866,943	\$3,453,066
2053	\$23,952,755	\$1,386,503	\$652,301	\$11,983,510	\$37,975,070	\$3,324,165
2054	\$24,835,475	\$1,388,323	\$682,386	\$11,863,741	\$38,769,924	\$3,171,722
2055	\$25,807,576	\$1,390,116	\$715,739	\$11,930,755	\$39,844,186	\$3,046,361
Total					\$905,112,619	\$203,221,104