Appendix C: Benefit-Cost Analysis (BCA) Documentation

FY 23-26 US-81 UPRR Bridge Replacement Project (NBI 16159 & 16167)

BCA Narrative

US-81 UPRR Bridge Replacement Project (NBI 16159 & 16167)

OKLAHOMA Transportation

FY 23-26 BRIDGE INVESTMENT PROGRAM GRANT APPLICATION
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A. Introduction

This memo summarizes the methodology and key inputs used to prepare the benefit-cost analysis (BCA) for ODOT's US-81 UPRR Bridge Replacement Project (NBI 16159 and 16167) application for USDOT Bridge Improvement Program (BIP) funding. The full set of inputs, calculations, and results is provided in the BIP BCA tool spreadsheet, which will be submitted to USDOT with the project application. The analysis results are also summarized in the required Project Narrative.

B. Overview

ODOT used the BIP BCA Tool to evaluate the proposed bridge replacement project. The analysis was prepared in accordance with the 2026 USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs and the requirements identified in the BIP NOFO. The benefit calculations generally rely on the values and factors provided in the Guidance; however, localized or project-specific data were used where available to better reflect expected project conditions. Where modified values were used, they are documented with the applicable referenced data sources. The analysis applies conservative benefit assumptions and identifies additional qualitative or difficult-to-quantify benefits in the Project Narrative. Because the analysis follows USDOT guidance and uses conservative assumptions, actual project benefits are expected to exceed the quantified results.

Construction is anticipated to begin in 2027 and be completed in 2029. The total anticipated project cost including design, right of way, and construction, is $25.9 million. Discounted to 2024 dollars, the total anticipated cost for design, right of way, and construction is $19.7 million. These discounted costs, excluding inflation, are used in the benefit-cost analysis. Project benefits are expected to begin in 2030 and continue over a 30-year analysis period through 2059, with total benefits estimated at $441.3 million. Using the recommended discount rate for both benefits and costs, the planned improvements result in a benefit-cost ratio of 22.42:1.

C. Methodology

The baseline scenario assumes the project would not be constructed, allowing existing safety and operational issues to persist or worsen over time. Under this no-build condition, the anticipated benefits of the proposed roadway improvements would not be realized. The preferred alternative was compared against this baseline scenario to quantify the project's benefits and costs.

A BCA model was developed to estimate the project's future benefits. Benefits were evaluated over a 30-year analysis period beginning in 2030 and extending through 2059. The base year for the analysis is 2024, and all values were discounted to that year. The project is assumed to be completed in 2029, with benefits beginning to accrue

in the first full year after completion.

Costs are presented in constant 2024 dollars, which avoids the need to forecast future inflation or escalate future benefit and cost values. Because constant-dollar values are used, a real discount rate is applied to convert future benefits and costs to present value. The expected discount rate of 7 percent was used, and all benefits and costs were discounted to the 2024 base year. Net present value, or net benefits, is calculated as total benefits minus total costs by comparing the no-build baseline scenario with the full project completion alternative. Table 1 summarizes the baseline condition, anticipated baseline changes, impact categories, and estimated project benefits and costs.

CATEGORY	TOTAL	PERCENT OF TOTAL BENEFITS
Safety	$179,946,228	41%
Travel Time	$123,647,594	28%
VOC	$129,334,372	29%
Emissions	$3,279,865	1%
Other Environmental	$147,839	0%
Maintenance	$3,461,417	1%
Residual Value	$1,457,956	0%
Total Benefits	$441,275,271	100%
Total Discounted Costs	$19,682,909	N/A
BCR	22.42	N/A
Net Present Value (NVP)	$421,592,362	N/A

Table 1: Benefit-Cost Analysis Summary

D. Benefit-Cost Analysis Details

1. Assumptions

The primary BCA inputs are summarized in Table 2. In addition to the recommended values applied throughout the analysis, the following assumptions were used for project design, construction, operations, and benefit timing:

- Design activities are assumed to occur in 2026.
- Construction and related construction expenditures are assumed to begin in 2027. The project is assumed to be open to traffic following completion of construction in 2029, with project benefits beginning in 2030. A 30-year analysis period was applied, although the expected useful life of the improvements is anticipated to extend beyond that period.

- The average useful life for the bridge and other new facility improvements is assumed to be 75 years. A residual value is included in the analysis at the end of the thirty-year period.
- Recommended 2024 monetized values from the 2026 BCA Guidance were used where available.

INPUT	VALUE	SOURCE
Discount Rate	7%	2026 BCA Guidance
Analysis Period (Years)	30	2026 BCA Guidance
Base Year	2024	2026 BCA Guidance

Table 2: Benefit-Cost Analysis Inputs

2. Traffic Volumes

Current traffic volume data was obtained from the ODOT Traffic Viewer tool. AADT on this segment of US Highway 81 was 8,900 vehicles per day. In order to analyze the two bridges individually, a 50/50 directional split was assumed. Trucks make up 15 percent of the total traffic volume. Future traffic volumes were forecast using a compound annual growth rate of 3 percent per year, which results in a projected AADT of 16,073 vehicles per day on US-81 in 2046.

3. Current Bridge Conditions

The Oklahoma Department of Transportation (ODOT) proposes to replace two parallel National Highway System bridges carrying northbound and southbound US-81 over the Union Pacific Railroad (UPRR) in Kingfisher County, Oklahoma (NBI Nos. 16159 and 16167). Built in 1964, the bridges have exceeded their 50-year design life and now exhibit substantial structural deficiencies and other at-risk conditions that increase risk for roadway users and freight rail operations.

Both existing structures are six-span steel I-beam bridges with fracture-critical members affected by corrosion, section loss, fatigue-prone details, and general deterioration. The bridges also fail to meet current geometric and vertical clearance standards over the UPRR corridor. Their high skew and curvature further contribute to complex load behavior, accelerated deterioration, and recurring maintenance needs.

4. Costs

The total future eligible project cost for the ODOT Project is estimated at $24.8 million. Consistent with USDOT's 2026 BCA Guidance, all costs and benefits are presented in 2024 dollars. Capital costs were entered as year-of-expenditure costs and adjusted to 2024 dollars using the Bridge Investment Program BCA Tool, consistent with the sample calculations provided in the USDOT BCA spreadsheet template. Estimated project costs and funding sources are summarized in Table 3.

MILESTONE	NON-FEDERAL FUNDS	OTHER FEDERAL SOURCES	BIP	TOTAL
Construction	$3,943,502 (20%)	$0	$15,774,007 (80%)	$19,717,509
Construction Management, Inspection, and Oversite	$236,610 (20%)	$0	$946,441 (80%)	$1,183,051
Contingency	$788,701 (20%)	$0	$3,154,801 (80%)	$3,943,502
Total	**$4,968,813**	**$0**	**$19,875,249**	**$24,844,062**

Table 3: Total Future Eligible Project Costs (Undiscounted and Rounded)

The previous incurred cost is $1,099,244 (Non-Federal Sources: $44,959; Federal Sources: $1,054,285). The total anticipated project cost, including both previous incurred cost and future project cost, is $25,943,306. Discounted to 2024 dollars, the total anticipated cost is $19,682,909.

5. Maintenance Benefit

Maintenance benefits were calculated by estimating the costs of maintaining the current structures and the proposed new structures. For consistency, historical maintenance activities were used for the expected bridge maintenance and repair activities. The BCA shows a considerable benefit of $3.46 million by reducing the cost of maintenance throughout the analysis period.

	EXISTING	PROPOSED
16159 Annual Maintenance	$7,500	$1,000
16159 Silane Bridge Deck Year After Built	N/A	$40,000
16159 Year 5 Repair	$2,700,000	$0
16167 Annual Maintenance	$7,500	$1,000
16167 Silane Bridge Deck Year After Built	N/A	$40,000
16167 Year 5 Repair	$2,700,000	$0

Table 4: Maintenance Costs

6. Travel Time Savings Benefit

If the bridges on US-81 over the railroad are not replaced, they will need to be closed to traffic in 2054. This would require traffic to divert to other routes that would add travel time. The alternate route options are limited by the Cimarron River which is about 1.5 miles north and has a limited number of crossings. The nearest alternate routes are

narrow, unpaved roads that would not be sufficient to accommodate US-81 traffic. If the bridges were closed, through traffic would be diverted to Highway 33, Highway 74, and Highway 51. This would add about 40 minutes of travel time.

7. Vehicle Operation Costs Benefit

If the bridges are closed and traffic must divert to alternate routes, travelers would also incur additional operating costs from the additional distance traveled. The alternate route between Kingfisher and Hennessey following Highways 33, 74, and 51 is about 36.6 miles longer than making the trip on US-81.

8. Residual Value Benefit

This benefit represents the remaining useful life of the project assets at the end of the analysis period and results in a discounted residual value of $1.46 million in 2059. Residual value was estimated using a simplified linear depreciation approach, which assumes the original asset value depreciates evenly over the applicable service life. The BCA assumes a 75-year useful life for all the new project elements being constructed or installed as part of this project.

9. Safety Benefit

The reconstructed bridges will be designed to include elements that provide a higher level of safety than the existing bridges. Railings on the new bridges will be designed to better contain vehicles, reducing the risk of falling onto the railroad tracks below. Fencing will also be added to prevent objects from falling or being thrown off of the bridges. Increased vertical clearance over the railroad will reduce the risk of trains or maintenance vehicles striking the bridge from below. The horizontal clearance between the railroad tracks and the piers of the new bridges will also be increased, reducing the risk of a train derailment impacting the structures.

These benefits were not monetized because these bridges do not have a history of the types of crashes for which these elements would reduce risk. Other non-monetized safety benefits of the project include improved geometrics, advance warning signs, higher-visibility pavement markings, additional space beneath the bridge for wildlife crossings, and improved bridge deck conditions. These factors were not quantified in the BCA because of a lack of sufficient supporting data and source documentation. Because these elements were not included in the calculation, the actual safety benefits of replacing the bridges are expected to exceed the quantified BCA results.

An additional safety benefit was calculated for avoiding a detour during bridge closure conditions. The alternate route of Highways 33, 74, and 51 consists mainly of two-lane undivided roadways, which typically have higher crash rates per vehicle-miles traveled than four-lane divided roadways like US-81. In addition to the increased crash risk related to roadway design, the additional vehicle miles traveled on the detour route would increase exposure to crash risk. Because the detour would add about 36.6 miles to the travel distance for through trips, preventing the need for the detour by replacing the bridges reduces exposure to additional crash risk.