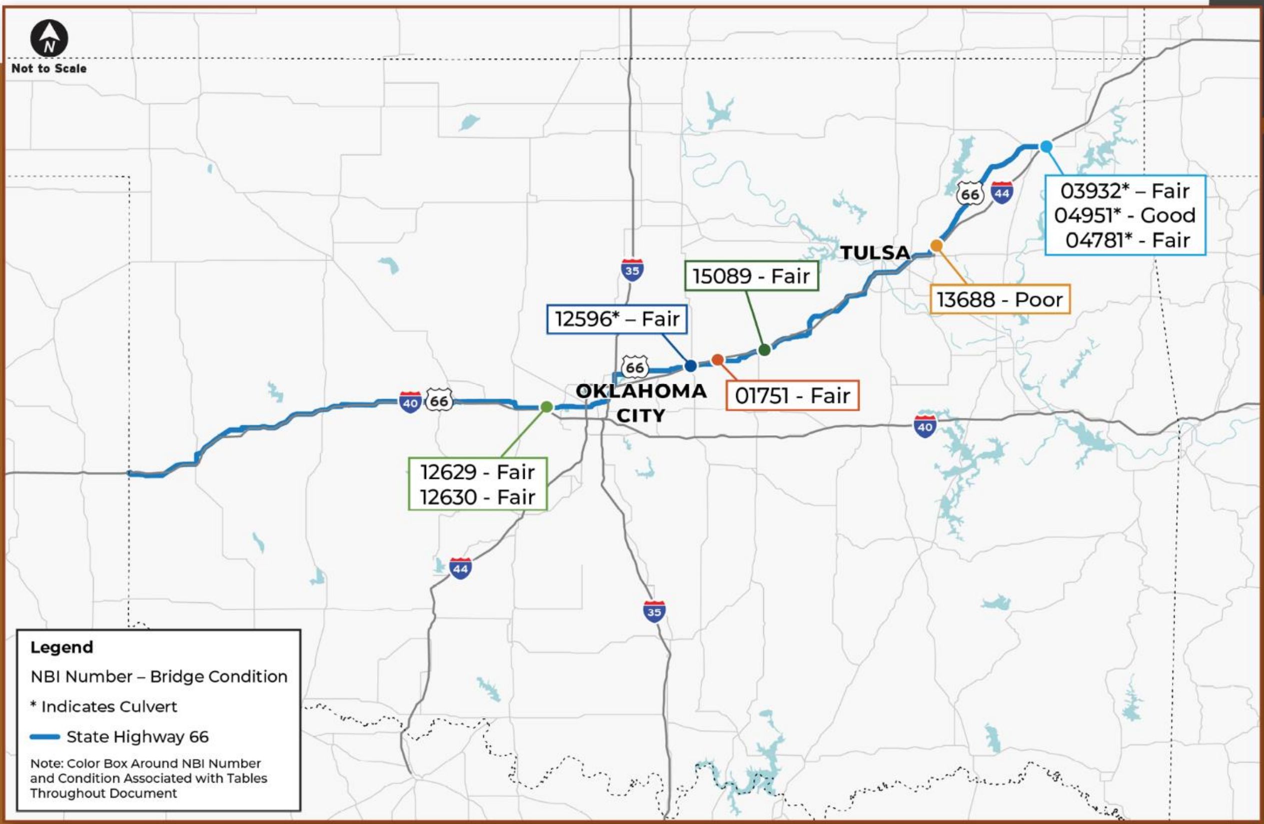

Bridge Investment Program Grant

Historic Route 66 Bridge Bundle

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Executive Summary

The **Historic Route 66 Bridge Bundle** is a program working to replace/rehabilitate five bridges and four culverts located in various parts of the state, but all on a historic United States corridor: U.S. Route 66 (Route 66).

The $19.7 million total capital project cost of the Program yields:

- Benefit-cost ratio (BCR) of 7.35
- Positive net user benefit of about $115.8 million (NPV) over 30 years

Over the life of the Program, these investments will produce (in NPV):

Benefits	Total
Safety	$17,965,225
Travel Time	$60,589,027
Vehicle Operating Cost	$33,465,240
Health & Amenity	$650,710
Emissions (CO2)	$9,912,785
Emissions (non-CO2)	$1,351,317
Other Environmental	$203,459
Maintenance	$5,528,782
Residual Value	$4,336,780
Total	**$134,003,326**

Over the life of each Improvement investment, these nine structures (five bridges and four culverts), will produce (in NPV):

Benefits	04951*	04781*	03932*	13688	15089	01751	12596*	12629	12630
Safety	$684,551	$0	$684,551	$9,692,626	$267,852	$118,918	$707,502	$2,096,528	$3,712,698
Travel Time	$0	$0	$0	$25,299,595	$1,609,237	$9,836,139	$0	$10,879,008	$12,965,048
Vehicle Operating Cost	$0	$0	$0	$17,223,604	$915,572	$445,906	$0	$6,713,838	$8,166,320
Health & Amenity	$0	$0	$0	$0	$0	$650,710	$0	$0	$0
Emissions (CO2)	$0	$0	$0	$4,292,432	$312,525	$177,756	$0	$2,313,031	$2,817,041
Emissions (non-CO2)	$0	$0	$0	$252,540	$49,817	$46,171	$0	$431,476	$571,314
Other Environmental	$0	$0	$0	$174,559	$1,455	$818	$0	$11,807	$14,820
Maintenance	$237,944	$111,974	$72,783	$2,827,703	$298,479	$668,337	$528,515	$391,524	$391,524
Residual Value	$167,725	$80,469	$53,323	$1,961,946	$229,492	$537,092	$389,926	$458,404	$458,404
Total Benefits	**$1,090,219**	**$192,443**	**$810,657**	**$61,725,004**	**$3,684,428**	**$12,481,848**	**$1,625,943**	**$23,295,616**	**$29,097,169**
Total Costs	**$720,442**	**$345,646**	**$229,042**	**$8,171,387**	**$958,331**	**$2,295,559**	**$1,681,994**	**$1,910,553**	**$1,910,553**
BCR	**1.51**	**0.56**	**3.54**	**7.55**	**3.84**	**5.44**	**0.97**	**12.19**	**15.23**
Net Present Value	**$369,777**	**-$153,203**	**$581,614**	**$53,553,617**	**$2,726,097**	**$10,186,288**	**-$56,051**	**$21,385,062**	**$27,186,616**

*Indicates Culverts

BCA Methodology

For the 2024 BIP application BCA model, the FHWA released a new tool (updated January of 2024) using the National Bridge Inventory in coordination with the National Bridge Investment Analysis System and Motor Vehicle Emission Simulator to pull in anticipated values for calculating the benefit-cost ratio of BIP projects/programs. This tool was used for the BCA analysis, which is based on this program eliminating the possibility of lane and bridge closures and thus avoiding the costs associated with detours. The model utilizes NBI, NBIAS, and EPA MOVES data, various region or corridor specific statistics, and global parameters provided by the United States Department of Transportation (USDOT) specifically for the purposes of completing BCAs in support of federal grant applications.

Using program-specific inputs, the BCA model calculates life-cycle costs, life-cycle benefits, annual benefits, the NPV of quantifiable costs and benefits, and the resulting B/C ratio, utilizing a methodology that aligns with the most recent USDOT guidance.

The BCA was prepared using total quantifiable program costs and benefits that are adjusted for inflation and then discounted to reflect the time value of money. In summary, the BCA was created by:

1. Identifying the Program's benefits and costs in terms of proposed improvements versus a no-build scenario;
2. Deriving current and forecasted use levels for the baseline and the "build case";
3. Denominating all benefits and costs in constant 2022 dollars;
4. Assuming inflation based on the Implicit Price Deflators for Gross Domestic Product;
5. Discounting dollar amounts by 3.1 percent to reflect the time value of money and discounting emissions at a 2 percent rate for all carbon pollutants and 3.1 percent for all non-carbon pollutants; and
6. Setting an appropriate analysis period of 20 or 30 years for the Program's development, construction, and subsequent operational service. (Conservatively assumed 20 years at the start of first full year of benefits.)

Program Overview

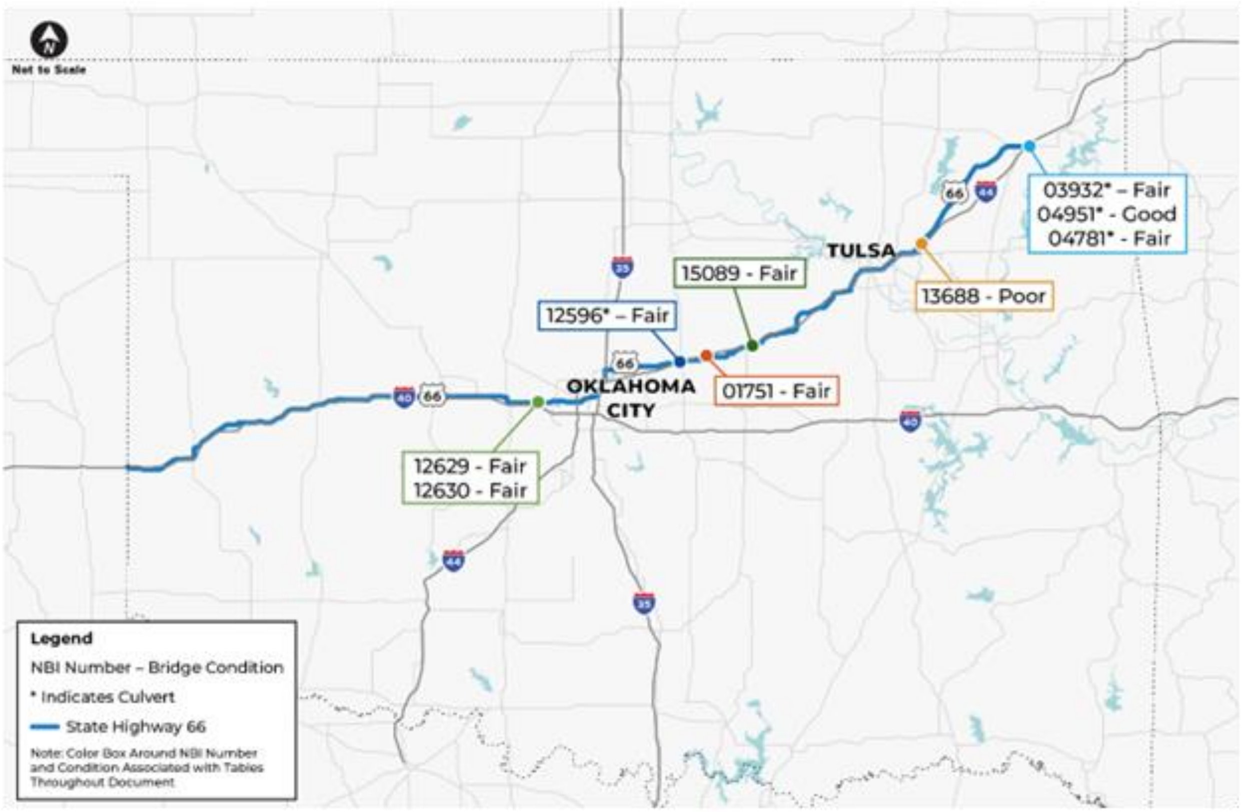
The Historic Highway 66 Bridge Bundle Program (Program) consists of six investment projects. The project, NBI number, and description of structures are shown below:

- Shell Creek – 12630, 12629 – Rehabilitation of 2 bridge structures
- Spring Creek – 12596 – Replacement of 1 culvert structure
- Stillwater Central RR – 01751 – Replacement of 1 bridge structure
- Salt Creek – 15089 – Replacement of 1 bridge structure
- Bird Creek – 13688 – Replacement of 1 bridge structure
- Little Cabin Creek – 03932, 04781, 04951 – Replacement of 3 culvert structure

The six improvements, aligns with the Administration's priorities to proactively prevent and significantly reduce the number of functionally obsolete and structurally deficient bridges while making the infrastructure safer, accessible for all, sustainable and a catalyst for economic development across the state of Oklahoma.

All six improvement projects in the Bridge Bundle Program can be seen below (**Figure 1**), and descriptions on the proceeding page.

Figure 1: Project Locations



Source: ODOT

Little Cabin Creek: 03932, 04781, 04951 (part of ODOT Project #33828(04))

These culverts are being replaced as part of a 7-mile overall corridor project. The corridor project will improve shoulders, grading, drainage, and condition of Route 66 just east of SH-2. ODOT is only seeking BIP funding to replace the three culverts.

Spring Creek: 12596 (part of ODOT Project #34318(04))

Like the project above, ODOT is improving a four-mile corridor of Route 66 from SH-102 to US-177. The existing facility consists of a two-lane roadway with 12-foot-wide driving lanes and 2-foot-wide shoulders. Proposed improvements include widening and resurfacing the roadway, adding shoulders, repairing the bridge at Captain Creek, and improving or replacing the existing culvert over Spring Creek. For this project, ODOT is exclusively seeking BIP funds to help replace the culvert in Spring Creek only.

Shell Creek: 12629 & 12630 (part of ODOT Project #32765(04))

This project will rehabilitate twin bridges on Route 66. The project will repair the substructures, piers and provide a full deck replacement. For added resiliency, ODOT will address the slope walls of the bridges and creek bed. These improvements will create a new clear approach roadway width on both bridges that will be 38 ft. wide, consisting of two 12-foot driving lanes, a 4-foot paved inside shoulder and 10-foot paved outside shoulder.

Bird Creek: 13688 (part of ODOT Project #20899(09))

The proposed improvement consists of constructing a new 38-ft wide bridge on the existing alignment. The new bridge will be a slab on girder bridge that consists of two 12-foot-wide travel lanes with 10-ft wide paved outside shoulder and 4-foot wide inside shoulder. The new bridge will be constructed within the existing right-of-way. Traffic will be maintained using the existing median crossovers.

Salt Creek: 15089 (part of ODOT Project #35601(04))

The proposed improvements will rehabilitate the structure. The existing superstructure will be replaced with a widened deck. The beams, diaphragm, and bearings in the superstructure will be replaced. The deck will be widened to 32 feet with new expansion joins at the piers and a new traffic railing will be installed. Additionally, abutments and piers will be repaired, and new rip rap will be installed to limit erosion impacts.

Stillwater Central Railroad: 01751 (part of ODOT Project #35217(04))

The proposed improvement will replace the existing bridge with a new two-lane bridge with 12-foot lanes on the same footprint over Stillwater Central Railroad (SLWC) rail tracks.

Program Cost

The Program's **total capital cost will be $19.8 million** in 2024 dollars, or $18.8 million in 2022 discounted dollars per federal guidance. This estimate includes total program delivery costs (construction, design, environmental analysis, and other program management costs). Annual program costs and timelines are shown in **Table 1**, which includes its Net Present Value (NPV) based on a discount rate of 3.1 percent.

Table 1: Project Costs

Bridge	NBI Structure #	Construct Start (Year)	Construct End (Year)	Total Project Cost (2024$)	Total Project Cost NPV (2022$)
Shell Creek EB	12630	2025	2025	$2,045,399	$1,910,553
Shell Creek WB	12629	2025	2025	$2,045,399	$23,295,616
Spring Creek	12596	2027	2029	$1,903,000	$1,625,943
Stillwater Central RR	01751	2027	2028	$2,330,679	$12,481,848
Salt Creek	15089	2025	2025	$958,678	$3,684,428
Bird Creek NB	13688	2025	2025	$8,955,128	$61,725,004
Little Cabin Creek 1	03932	2027	2029	$275,000	$810,657
Little Cabin Creek 2	04781	2027	2029	$415,000	$192,443
Little Cabin Creek 3	04951	2027	2029	$865,000	$720,442
Program Total		2025	2029	**$19,793,282**	**$18,223,508**

Note: Costs Rounded to Nearest Dollar

The residual values are shown in **Table 2** below. At the end of the analysis period, shown as 30 years, the corridor will have a **discounted residual value of $4.5 million** as calculated using the FHWA-recommended residual value calculation for the time before the improvement components will need to be replaced.

Table 2: Project Residual Value

Bridge	Residual Value NPV (2022$)
Shell Creek EB	$458,404
Shell Creek WB	$458,404
Spring Creek	$389,926
Stillwater Central RR	$537,092
Salt Creek	$229,492
Bird Creek NB	$1,961,946
Little Cabin Creek	$53,323
Little Cabin Creek	$80,469
Little Cabin Creek	$167,725
Total	**$ 4,336,780**

Program Benefits

The following benefits are quantified for this analysis:

- Safety cost savings from avoided crashes on the additional distance travelled on detour routes and safety improvements on primary route.
- Emissions savings from avoided additional distance travelled on detour routes.
- Travel time savings from avoided longer travel time on detour routes.
- Vehicle operating costs savings from avoided additional distance travelled on detour routes.
- Other Environmental benefits due to avoided load posting or closures.
- Operation and Maintenance cost savings from bridge condition improvements.

The Program will provide substantial benefits by improving safety, decreasing travel time, reducing emissions, reducing operating costs, and adding new multimodal amenities and health benefits. These benefits are quantified in the following subsections. Benefits were calculated using traffic and safety data provided by the City and other sources cited in the BCA Workbook included with the grant application.

Safety Benefit

$18.0M

CRASH SAVINGS (NPV)

The Program produces **safety savings of $18.0 million (NPV)** by reducing the number of collisions through the additions of general shoulder improvements at each of the project locations.

The reduction in crash costs for users in the Build scenario is estimated based on the crashes avoided by not travelling additional distance on detour routes. The Oklahoma crash rates are provided for each structure's respective county rates. These rates, additional VMT due to detours, and cost of each person killed or seriously injured are used to develop a portion of the safety cost savings.

Crash Data was provided by ODOT according to the (JP) project number. Due to the rural areas and minimal crash occurrences in the area, crashes within a 300ft radius were taken as bridge-related crashes. As a conservative measure, only 3 years of crash data were used. Due to the length and connection of Bird Creek bridge to the major Verdigris River, and location to the Port of Catoosa, a radius of 500ft was used for a 5-year crash period.

Travel Time Benefit

$60.6M

TRAVEL TIME COST (NPV)

The Program reduces potential detour total travel time, resulting in a benefit of **$60.6 million (NPV)** to travelers. Only vehicle impacts were calculated for each bridge. Conservatively, bike and pedestrian travel times were not included in the analysis due to minimal usership along the Historic Route 66 corridor. However, all bridge structures are along the US Bicycle Route 66, which was approved in Oklahoma just recently in 2022. This route recognition has the potential for increased cyclist users throughout the Bridge Bundle project areas.

Travel Time calculations were only calculated for structures that NBI deemed to fail within the assigned analysis period, hence the usage of detour routes. The FHWA LTBP InfoBridge Tool was used where applicable for the nice structures. Load posted, level 1 with 50% overall recution was assigned to the structure when the first of the three conditions (deck, superstructure, or substructure) dropped to a rating of 3. If the structure was not expected to fail within the given period, no ($0) benefit was calculated for that respective structure.

Avoided Operating Costs

$33.5M

VEHICLE OPERATING COSTS (NPV)

By providing more direct routes for travelers, the Program is projected to reduce vehicle operating costs by **$33.5 million dollars** over the period analyzed (30 years). Only vehicle operating costs were quantified in the benefit calculations. This was a conservative approach due to not including bike operations in the benefit calculation.

Operating cost calculations were only calculated for structures that NBI deemed to fail within the assigned analysis period, hence the usage of detour routes. The FHWA LTBP InfoBridge Tool was used where applicable for the nice structures. Load posted, level 1 with 50% overall recution was assigned to the structure when the first of the three conditions (deck, superstructure, or substructure) dropped to a rating of 3. If the structure was not expected to fail within the given period, no ($0) benefit was calculated for that respective structure.

Heath & Amenity Benefit

$651K

HEALTH & AMENITY SAVINGS (NPV)

The Program produces a total **health and amenity benefit of $651 thousand (NPV)**. Bike and pedestrian counts were only Stillwater Central RR Bridge (01751) for the BCA analysis due to the proximity to residential and educational facilityies (ex: schools), and had a consistent ridership count. Replica was used to collect count data. The filter for *Fall* *of 2022 on a Thursday* was used as the count source. Calculations used the assumptions:

- Counts grew at the same CAGR as the RR Bridge AADT
- Annualization Factor of 180 days was used due to rain, holidays, weekends, etc.
- Links for both directions of the bridge were added together
- Lower end of color range was used for counts

Emissions Benefit

$11.3M

EMISSIONS SAVINGS (NPV)

The Program produces a total **reduced damage of pollutant emissions of $11.3 million (NPV)**. Majority of the avoided emilssions came from strictly CO_2 emissions, which summed to $9.9 million dollars. All other non-carbon emissions (SO_x, $PM_{2.5}$, and NO_x) summed to an avoided benefit of $1.4 million dollars.

Emission calculations were only calculated for structures that NBI deemed to fail within the assigned analysis period, hence the usage of detour routes. The FHWA LTBP InfoBridge Tool was used where applicable for the nice structures. Load posted, level 1 with 50% overall recution was assigned to the structure when the first of the three conditions (deck, superstructure, or substructure) dropped to a rating of 3. If the structure was not expected to fail within the given period, no ($0) benefit was calculated for that respective structure.

Other Environmental Benefit

$203K

OTHER ENVIRONMENTAL SAVINGS (NPV)

In addition to the emissions savings resulting from the avoided detours, other environmental benefits were calculated. The Program benefits from increased noise due to avoided load posting or closure forecasting. The analysis estimates **$203 thousand (NPV)** in total noise related environmental benefits.

Other environmental calculations were only calculated for structures that NBI deemed to fail within the assigned analysis period, hence the usage of detour routes. The FHWA LTBP InfoBridge Tool was used where applicable for the nice structures. Load posted, level 1 with 50% overall recution was assigned to the structure when the first of the three conditions (deck, superstructure, or substructure) dropped to a rating of 3. If the structure was not expected to fail within the given period, no ($0) benefit was calculated for that respective structure

Maintenance Benefit

$5.5M

OPERATIONS & MAINTENANCE SAVINGS

The Program produces a total **Operation & Maintenance benefit of $5.5 million (NPV)**.

Operation & Maintenance (O&M) costs are calculated from the difference in the O&M costs in the Build and No-Build scenario. The O&M cost methodology was dependent on rehabilitation or replacement of the respective structure. ODOT conservatively indicated that if a bridge was unable to be replaced, half the cost would be put towards a major rehabilitation. For the BCA calculations, if the structure indicated the need for replacement, 50% of the total project cost was used at year 10 of the analysis period. If the structure indicated the need for a rehabilitation, the no-build scenario would include major bridge maintenance and surveillance costs at around $450 thousand every 5-years until bridge failure. ODOT anticipates the Build scenarios for each structure to include roughly $7,500 in annual maintenance due to minimal stripping, weather clearing, and other various baseline tasks.

Benefits Summary

7.35

BENEFIT-COST

The Program has a Benefit-Cost Ratio (BCR) of 7.35. This ratio was derived by dividing total discounted benefits by total discounted costs over a 30-year period. **Table 3** shows the breakdown of BCR per project, below. The results shown in **Table 4** and throughout this memo were derived based on the 2023 BCA Guidance - December Update and USDOT's 2024 updated guidance on the BIP BCA Tool.

Table 3: Project Improvements Benefits Summary

Benefits	04951*	04781*	03932*	13688	15089	01751	12596*	12629	12630
Safety	$684,551	$0	$684,551	$9,692,626	$267,852	$118,918	$707,502	$2,096,528	$3,712,698
Travel Time	$0	$0	$0	$25,299,595	$1,609,237	$9,836,139	$0	$10,879,008	$12,965,048
Vehicle Operating Cost	$0	$0	$0	$17,223,604	$915,572	$445,906	$0	$6,713,838	$8,166,320
Health & Amenity	$0	$0	$0	$0	$0	$650,710	$0	$0	$0
Emissions (CO2)	$0	$0	$0	$4,292,432	$312,525	$177,756	$0	$2,313,031	$2,817,041
Emissions (non-CO2)	$0	$0	$0	$252,540	$49,817	$46,171	$0	$431,476	$571,314
Other Environmental	$0	$0	$0	$174,559	$1,455	$818	$0	$11,807	$14,820
Maintenance	$237,944	$111,974	$72,783	$2,827,703	$298,479	$668,337	$528,515	$391,524	$391,524
Residual Value	$167,725	$80,469	$53,323	$1,961,946	$229,492	$537,092	$389,926	$458,404	$458,404
Total Benefits	**$1,090,219**	**$192,443**	**$810,657**	**$61,725,004**	**$3,684,428**	**$12,481,848**	**$1,625,943**	**$23,295,616**	**$29,097,169**
Total Costs	**$720,442**	**$345,646**	**$229,042**	**$8,171,387**	**$958,331**	**$2,295,559**	**$1,681,994**	**$1,910,553**	**$1,910,553**
BCR	**1.51**	**0.56**	**3.54**	**7.55**	**3.84**	**5.44**	**0.97**	**12.19**	**15.23**
Net Present Value	**$369,777**	**-$153,203**	**$581,614**	**$53,553,617**	**$2,726,097**	**$10,186,288**	**-$56,051**	**$21,385,062**	**$27,186,616**

*Indicates Culverts

Table 4: Program Benefits Summary

Total Benefits	Total	Total ($M)
Safety	$17,965,225	$18.0
Travel Time	$60,589,027	$60.6
Vehicle Operating Cost	$33,465,240	$33.5
Health & Amenity	$650,710	$0.7
Emissions (CO2)	$9,912,785	$9.9
Emissions (non-CO2)	$1,351,317	$1.4
Other Environmental	$203,459	$0.2
Maintenance	$5,528,782	$5.5
Residual Value	$4,336,780	$4.3
Total Benefits	**$134,003,326**	**$134.0**
Total Costs	**$18,223,508**	**$18.2**
BCR	**7.35**	**7.35**
Net Present Value	**$115,779,818**	**$115.8**

Unquantifiable Benefits

The Program has been conservatively evaluated using the methodology and assumptions described above. The cost effectiveness of the Program may be greater than indicated by the quantitative calculations because certain benefits were not included in the BCA analysis.

The span bridge structures that will undergo replacements and superstructure replacements will be constructed in accordance with ODOT's special provision for Longitudinal Deck Tining. This means that all replaced structures will incorporate a design aspect that's intended to reduce the noise of traffic on the newly constructed bridge decks. In addition, some of these bridges were originally built during the era where lead paint was commonly used on bridges. Due to aging, lead paint has been slowly chipping off these bridges and into the creeks and surrounding areas below. Due to lead paint's toxic characteristic, these project improvements will remove the ability for lead paint to find its way into the environment.

In response to increased seismicity during the 2010s, ODOT developed a Shakecast system to identify span bridge structures that would require inspection after triggering seismic events. This effort was coordinated with the USGS and implemented through a contract with the University of Oklahoma and consulting engineer partners. Utilizing elemental NBI bridge data, the researchers developed fragility curve models for their span bridges and subsequently modified these resistance parameters based on a more detailed seismic response analysis from a sample of representative bridges. These fragility curves were based on FEMA HAZUS models and are well accepted in the determination of seismic resistance. Part of the vulnerabilities that were taken into consideration on the bridge resistance side of the demand / resistance equation is the bridge condition state, the age of the structure, the beam bearing seat width, the beam bearing type, and the confinement of the column steel reinforcement. The span bridges over Shell Creek, Salt Creek, and the SLWC RR all are in areas of elevated seismic activity, perform poorly in an analysis of their seismic resistance, and therefore are at a greater level of risk to seismic activity. The proposed major rehabilitation and replacement of these structures would eliminate the associated seismic vulnerabilities and improve the system reliability to these environmental threats.

Although seismic activity reduced substantially after coordinated efforts were implemented in Oklahoma to monitor and limit saltwater disposal well pressures and volumes, earthquakes continue to occur and remain a threat to vulnerable bridge infrastructure. The areas of continued seismic activity have remained consistent over the past 15 years, and the expectation is that all structures within these geographic boundaries will continue to remain under the threat of induced seismic activity.

Safety benefits that were unquantified include the improvement of Route 66 to meet federal highway standards, improving clear zone criteria on the US 60 culverts and at Spring Creek, lane width widening at various structures, and improving safer sight distance at residential and commercial driveways directly connecting to Route 66.

For operational and travel time benefits, only vehicle benefits were accounted for in eight out of the nine structures. Stillwater Central RR bridge was the only structure to account for bike and ped users due to the bridge's proximity to residential areas, schools, and ridership. In an effort to be conservative, the other structures were included due to location and ridership factors. Bike and Pedestrian operational wear and tear on bikes will decrease if anticipated detour routes are avoided due to project improvements. Similarly, travel time will drastically increase for bike and ped users if a bridge were to fail and the detour route was used.