FY 2022 RAISE Grant Application

Benefit Cost Analysis Technical Appendix

BASTROPTX
Heart of the Lost Pines / Est. 1832

Old Iron Bridge Deck Park

Bastrop, Texas

Table of Contents

1.0 Executive Summary

The Benefit-Cost Analysis (BCA) conducted for this grant application weighs the costs (capital and maintenance) and benefits (safety, recreational and health benefits) that would accrue during construction and over a 20-year evaluation period after completion of the project. The BCA developed for the Old Iron Bridge project considers the build alternative (rehabilitation of the Old Iron Bridge) and the no build alternative. To the extent possible, benefits have been monetized. A qualitative discussion is also provided in this memorandum when a benefit is anticipated to be generated but is not easily monetized or quantified.

The project for which this RAISE grant is requested is the rehabilitation of the Old Iron Bridge located parallel to the State Loop (SL) 150 bridge spanning over the Colorado River in Bastrop County, Texas. The Old Iron Bridge and SL 150 connects to the west end of the historic downtown business district of the city of Bastrop. The project will reopen the bridge to bicycle and pedestrian traffic and will include deck park amenities.

The Old Iron Bridge is 21.5 feet wide. The bridge is in poor condition and is rated as structurally deficient. The bridge has been load posted, and in 2018, the load restrictions were further increased after cracks were discovered; therefore, it was determined unsafe for public use and was closed to pedestrian and bicycle traffic. It is anticipated that if no action is taken, the bridge will be closed permanently to all traffic and potential demolition would be required for safety purposes.

The project will rehabilitate the Old Iron Bridge to carry bicycle and pedestrian traffic while preserving its historic integrity. The bridge is currently closed to all traffic due to structural deficiencies, particularly in the bridge superstructure. The bridge is currently rated 3 out of 10 per the National Bridge Inventory (NBI) rating system which indicates serious condition. The City of Bastrop proposes to replace and/or strengthen key components of the truss, replace the deck with lightweight concrete, repair the substructure, and remove the existing lead paint and recoat the bridge. The 21.5-foot-width will sufficiently accommodate striped bicycle/pedestrian paths as well as deck park amenities such as seating, plantings, local wayfinding displays, and public art.

The period of analysis used in the estimation of benefits and costs is 24 years, including approximately 4 years of project development and construction and 20 years of operation. Total project development and construction costs are estimated at $15.3 million in 2022 dollars. For the BCA, costs were de-escalated to 2020 dollars using the Gross Domestic Product (GDP) deflator. The total (undiscounted) project costs adjusted in this way are estimated at $14.7 million. Incremental operations and maintenance are estimated at $0.4 million in 2020 dollars.

All relevant data and calculations used to derive the benefits and costs of the project are shown in the BCA model that accompanies this grant application. Based on the analysis presented in the rest of this document, using a real discount rate of 7 percent, the project is expected to generate $9.9 million in benefits (including lifecycle cost savings) and $9.9 million in capital costs. Therefore, the project is expected to generate a net present value of $0.06 million and a benefit-cost ratio of 1.01 as shown in the table below. Using a real discount rate of 3 percent, the net present value of the project is $7.4 million, and the benefit-cost ratio is 1.62.

Table 1: Summary of BCA Outcomes, in Millions of Dollars of 2020

Project Evaluation Metric	Undiscounted	Present Value at 7% Discount Rate	Present Value at 3% Discount Rate
Total Benefits	$33.0	$9.9	$19.2
Total Costs	$14.7	$9.9	$11.8
Net Present Value	$18.3	$0.06	$7.4
Benefit - Cost Ratio	2.25	1.01	1.62

In addition to the monetized benefits, the project is expected to generate benefits that are more difficult to quantify and are considered qualitatively. A brief description of those benefits is provided below. These benefits are well aligned with the primary selection criteria stated in the RAISE Notice of Funding Opportunity.

- **Environmental Sustainability:** The project will remove the existing lead paint from the Old Iron Bridge, which is failing and threatening the water quality in the Colorado River. The project will repaint the bridge with an approved material safe for the environment. The project also has the potential to reduce emissions. As traffic volumes continue to increase on SL-150 and congestion worsens, some travelers may elect to shift their mode of travel to either walking or cycling.
- **Economic Competitiveness:** Reopening the Old Iron Bridge will create a destination for residents and tourists alike. Attracting more people to the bridge will likely increase economic activity in downtown Bastrop. Similarly, film studios will also be able to use the bridge for TV and movie productions. Additionally, with the SL 150 bridge nearing peak hour vehicular capacity, short distance bicycle trips could offer a travel time advantage over vehicle trips.
- **Quality of Life:** The Old Iron Bridge will create an affordable, non-vehicular choice for travel. The bridge is a critical link on the city's trail network and provides access across the Colorado River. The Project will increase connectivity and mobility for lower-carbon modes of travel.
- **State of Good Repair:** The project involves rehabilitation of a historic resource that is currently out of service. The Project will revive the bridge's capabilities as a transportation and recreational facility.

2.0 Introduction

This document provides detailed technical information on the economic analyses conducted in support of the grant application for the Old Iron Bridge Deck Park project. The remainder of this document is organized as follows:

- Section 3, Methodological Framework, introduces the conceptual framework used in the BCA.
- Section 4, Project Overview, provides an overview of the project, including a description of the existing conditions and proposed alternatives, a summary of cost estimates and schedule, and a description of the types of benefits that the project is expected to generate.
- Section 5, General Assumptions, discusses the general assumptions used in the estimation of the project costs and benefits.
- Section 6, Benefits Measurement, Data and Assumptions, outlines specific data elements and assumptions pertaining to the long-term outcome selection criteria along with the associated benefit estimates.

- Section 7, Summary of Findings and BCA Outcomes presents estimates of the project's Net Present Value (NPV), it's Benefit/Cost ratio (BCR) and other project evaluation metrics.
- Section 8, BCA Sensitivity Analysis, provides results of the sensitivity analysis.
- Section 9, Sources, lists resources referenced for the analyses.

3.0 Methodological Framework

The BCA conducted for this Project includes the monetized benefits and costs measured using USDOT guidance, as well as the quantitative and qualitative merits of the Project. The BCA provides estimates of the benefits that are expected to accrue from a Project over a specified period and compares them to the anticipated costs of the Project. Costs include both the resources required to develop the Project and the costs of maintaining the new or improved asset over time. Estimated benefits are based on the projected impacts of the Project on both users and non-users of the facility, valued in monetary terms[1].

The specific methodology adopted for this application is based on the BCA guidance developed by USDOT and is consistent with the RAISE program guidelines.

4.0 Project Overview

4.1 Project Description, Current Conditions and Challenges

The Old Iron Bridge is located parallel to SL 150 spanning the Colorado River in Bastrop, Texas. The bridge was constructed in 1923 and is one of the earliest surviving examples of the Parker Truss in Texas. It is listed in the National Register of Historic Places for association with the Camino Real de los Tejas and Bastrop's history, as well for its engineering significance embodying the design and construction technology of the early period of highway construction in Texas. The Camino Real de los Tejas is also part of the National Historic Trail system. The Old Iron Bridge is deeply woven into Bastrop's community character, serving as a link to the past while also a gateway to Bastrop's future economic growth.

The existing pedestrian and bicycle network in Bastrop is constrained by limited crossings of the Colorado River. Since the 2018 closure of the Old Iron Bridge, the only existing crossing is on SL-150, and consists of a 6-foot-wide sidewalk[2]. While adequate for pedestrians, this does not meet current design standards for safe two-way bicycle traffic, is constrained by barrier on either side, and is adjacent to a state highway carrying nearly 19,000 vehicles per day. Reopening the Old Iron Bridge will provide a safe bicycle and pedestrian crossing of the Colorado River separate from the highway bridge, and will connect to proposed multi-modal improvements on SL-150 through downtown Bastrop.

The Old Iron Bridge is 21.5 feet wide. The bridge is in poor condition and is rated as structurally deficient. The bridge has been load posted, and in 2018, the load restrictions were further increased after cracks were discovered; therefore, it was determined unsafe for public use and was closed to pedestrian and bicycle traffic. It is anticipated that if no action is taken, the bridge will be closed permanently and demolition would be required for safety purposes.

The project will rehabilitate the Old Iron Bridge to carry bicycle and pedestrian traffic while preserving its historic integrity. The City of Bastrop proposes to replace and/or strengthen key components of the truss,

[1] USDOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, March 2022
[2] Sidewalks are included in TxDOT's improvements to SH-71 over the Colorado River, currently under construction.

replace the deck with lightweight concrete, repair the substructure, and remove the existing lead paint and recoat the bridge. The project also includes creation of a deck park allowing a space for bridge users to further enjoy the historic bridge, the Colorado River, public art, and community gatherings. Amenities such as lighting, plantings, and benches are planned.

The project will provide a new safe bicycle and pedestrian crossing of the Colorado River. This important link in the city's trail network is currently closed and users are forced to use a narrow crossing on a high-volume highway. The Project will provide an affordable, lower-carbon transportation choice, increasing equity and accessibility for travelers. The Old Iron Bridge deck park will attract residents and tourists to this iconic structure, preserve and enhance the unique historic character of the community and support economic growth.

4.2 Base Case and Alternatives

The Base Case for the Old Iron Bridge project is defined as the No-Build Scenario. The No-Build scenario reflects the continuation of current conditions. The bridge is currently closed to all traffic due to structural deficiencies, particularly in the bridge superstructure. The Old Iron Bridge continued to carry pedestrian and bicycle traffic until 2018, when structural concerns forced the city to close the bridge to all traffic. The bridge is currently rated 3 out of 10 per the National Bridge Inventory (NBI) rating system which indicates serious condition. The city currently expends a nominal amount on maintenance and would continue to do so each year with this scenario.

With the No Build scenario, the bridge would continue to deteriorate causing potential lead-paint contamination to the Colorado River and a safety hazard. Due to its age and fracture-critical configuration, over time the bridge would be expected to fail and potentially collapse, causing damage to the surrounding property including the Colorado River. Additionally, the city would not regain the additional crossing over the Colorado River, and pedestrians and bicycles would continue to use a narrow sidewalk adjacent to SL 150 for crossing.

The Build scenario assumes that the Old Iron Bridge will be rehabilitated as planned and discussed above, avoiding further deterioration, environmental contamination, and collapse. The Build scenario would restore and provide a more safe and comfortable facility for pedestrians and bikes to cross the Colorado River. The Build scenario would also include deck park features, making the bridge a recreational and community destination.

4.3 Types of Impacts

The Old Iron Bridge is an iconic structure for the city and its residents, and the project will restore its transportation function in addition to preserving its historic and cultural significance. The project will provide a critical crossing of the Colorado River, which is a natural barrier separating the downtown business district from the city's west side. The project will provide additional multi-modal transportation choices to connect users to Bastrop's downtown businesses, neighborhoods, and recreational amenities. The Old Iron Bridge will reduce barriers, increase mobility for non-motorized users, increase use of lower carbon travel modes, and increase equity and accessibility for travelers. The Old Iron Bridge deck park will attract residents and tourists to this iconic structure, enhancing the unique historic character of the community and promoting economic growth. Rehabilitating the bridge will also protect the Colorado River from potential lead-based paint contamination caused by further deterioration of the bridge.

4.4 Project Cost and Schedule

4.4.1 Capital Costs

The total cost for rehabilitation of the Old Iron Bridge is estimated at approximately $15.9 million in 2022 dollars, which includes a 15 percent contingency for design and construction. The capital costs were deflated to 2020 dollars using a GDP deflator ratio of 1.0405[3], resulting in a 2020 capital cost of $14.7 million. The No Build alternative would not require any capital costs; however, demolition would be considered as part of the operations and maintenance of the structure due to the deteriorating condition of the bridge and hazard it presents to the adjacent SL-150 bridge if it were to fail. This demolition is estimated at $1 million.

4.4.2 Operation and Maintenance Costs

Since closing to the public in 2018, no maintenance has been performed to the bridge. Assuming that no rehabilitation, operational and maintenance activities would be performed, demolition would be required for the bridge to avoid potential damage to the adjacent SL-150 bridge in the event of a failure and potential contamination of the Colorado River from the release of lead-based paint. An estimated $1,000,000 total cost for demolition of the structure was assumed. No additional maintenance costs would be required once demolition was complete.

For the Build alternative, an annual maintenance cost of $5,000 is included for future years following construction of the bridge rehabilitation project. Other general rehabilitation may be required every 5 years such as deck work and painting, estimated to be approximately $75,000 every 5 years. Design and engineering work is expected to start later this year and continue into 2025. Construction is expected to start in 2025 and be complete in 2027, which is assumed as the first year of full Project benefits.

4.5 Alignment with Merit Criteria

The main benefit categories associated with the project are aligned with the selection criteria set forth by USDOT in the Notice of Funding Opportunity. Table 2 summarizes the anticipated benefits of the Project in terms of the Merit Criteria for the RAISE grant program.

Table 2. Benefit Categories and Expected Effects on Primary Selection Criteria

Selection Criteria	Benefit or Impact Categories	Description	Monetized	Qualitative
Safety	Reduce pedestrian and bicycle related crashes on SL-150	The Project will remove bicycle and pedestrian traffic from the narrow sidewalk adjacent to traffic on SL-150.	Yes	Yes
Environmental Sustainability	Preserve the historic resource of the Old Iron Bridge	The Project will rehabilitate the Old Iron Bridge according to Secretary of Interior's Standards for Rehabilitation.		Yes

[3] The adjustment involved dividing 2022 costs by the deflator index of 1.0405 based on the GPD deflator for the years 2020-2022 (Office of Management and Budget of the White House, Table 10.1, https://www.whitehouse.gov/omb/historical-tables/)

Selection Criteria	Benefit or Impact Categories	Description	Monetized	Qualitative
	Protection of water quality and lead contamination	The Project will remove the failing lead paint on the bridge in a safe and contained manner. The bridge will be repainted with a safe material.		Yes
	Reduction of emissions from traffic on SL-150	With SL150 near peak hour capacity, some users may shift to non-vehicular modes as a way to improve travel times. While this could be theoretically monetized, no data was available to support numbers of shifts or distance of travel.		Yes
Quality of Life	Improved recreational opportunities	The Project will provide opportunity for recreation as well as transportation. The deck park will be a recreational destination and will attract visitors.	Yes	Yes
	Improved pedestrian comfort, safety, mobility, and connectivity	The Project will improve pedestrian comfort and safety while also improving mobility and connectivity to a range of destinations.	Yes	Yes
	Health benefits of increased activity	Providing more opportunity for walking and cycling will lead to improved health outcomes for the community.	Yes	Yes
Economic Competitiveness	Increased economic activity in downtown Bastrop	The Bridge will attract both residents and tourists alike, encouraging additional patronage of downtown businesses.		Yes
	Increased economic opportunity for film and TV productions	Reopening the bridge will restore the ability to stage film and TV productions to support Bastrop's growing film industry.		Yes
State of Good Repair	Rehabilitation of a deficient bridge	Rehabilitation of a deficient bridge to a safe and historically consistent design. Avoidance of demolition.	Yes	Yes

5.0 General Assumptions

The BCA measures benefits against costs throughout a period of analysis starting at 2027 and including 20 years of operations.

The monetized benefits and costs are estimate in 2020 dollars with future dollars discounted in compliance with the RAISE requirements using a 7 percent real rate, and sensitivity testing at 3 percent.

The methodology makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. Assumptions include the following:

- Input prices are expressed in 2020 dollars;
- The period of analysis begins in 2020 and ends in 2046. It includes project development and construction years (2020 – 2027) and 20 years of operations (2027 – 2046);
- A constant 7 percent real discount rate is assumed throughout the period of analysis. A 3 percent real discount rate is used for sensitivity analysis;

- Opening year demand and benefits are inputs to the BCA and assumed to be fully realized starting in 2027; and
- The results shown in this document correspond to the effects of the full rehabilitation, as proposed, of the Old Iron Bridge.

6.0 Benefits Measurement, Data and Assumptions

This section describes the measurement approach used for each quantifiable benefit or impact category identified in the BCA and provides an overview of the associated methodology, assumptions, and estimates.

6.1 Reduction in Accident Costs

The Old Iron Bridge Deck Park Project will provide improved safety for bicyclists and pedestrians. Currently, the only non-vehicular crossing of the Colorado River in Bastrop is a six-foot wide sidewalk adjacent to vehicle traffic on SL150. The sidewalk is separated from traffic by a concrete barrier. The location, width, and layout of the current sidewalk pose safety and comfort issues for pedestrians and bicyclists. The current width is not sufficient for two-way bicycle traffic. Even with a barrier, walking or cycling next to vehicular traffic creates a noisy, uncomfortable environment for bicycles and pedestrians.

A 2019 TxDOT corridor study identified 377 crashes along SL 150, including eight bicycle and pedestrian crashes. Crashes related to pedestrians consisted of one percent of crashes and crashes associated with bicycles also consisted of one percent of crashes. Given the provision of a completely separated facility for pedestrian and bicycle traffic, It is assumed from this data that the proposed project would potentially reduce crashes by two percent. This calculation was included and reflected in the BCA using the two percent crash reduction potential for the proposed project.

6.2 Pedestrian and Cyclist Benefits

Providing a separate facility for pedestrians and cyclists is anticipated to increase the comfort, convenience, and safety of the facility for pedestrian and bicycle use. The Old Iron Bridge will allow for distance between pedestrian/cyclists and traffic, leading to improved safety, decreased noise exposure, and increased comfort.

These benefits were estimated using unit values of benefits from facility improvements expressed in dollars per person-mile walked and bicycle-mile traveled, provided in Tables A-8 and A-9 of the USDOT BCA guidance and shown here in Tables 3 and 4. The unit value of the new multi-use trail improvement was multiplied by the number of users, the increased width of the new path on the Old Iron Bridge over the existing sidewalk on SL-150, and the ¼ mile length of the bridge.

Table 3: Assumptions Used in Estimation of Pedestrian Benefits

Variable Name	Unit	Value	Source
Number of Pedestrian Trips on the Old Iron Bridge			
2027 Build	Annualized number	42,621	Based on sample pedestrian counts taken in March 2022, escalated by 5.5 % annual growth rate
Average Annual Rate of Growth	%	5.5%	Rate of growth assumed equal to rate of growth in population based on City of Bastrop projections and

Variable Name	Unit	Value	Source
			consistent with Building Bastrop Block code to emphasize growth in multimodal modes.
Annualization Factor for Pedestrian Traffic	Number	269	Annualization factor is equal to 80% of total year as an assumption for days suitable for pedestrian/bicycle trips.
Measures of Pedestrian Benefits			
Width of Sidewalk to be Installed	feet	15	Difference from 21' path on Old Iron Bridge and existing 6' sidewalk
Unit Monetary Benefit of Improved Sidewalk	$/foot per person-mile	$0.10	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grants Program, March 2022, Table A-8
Total Benefit of Improved Sidewalk	$ per person-mile	$1.50	Calculated from inputs above.
Average pedestrian trip length	miles per person	0.25	Total length of bridge

Table 4: Assumptions Used in Estimation of Cycling Benefits

Variable Name	Unit	Value	Source
Number of Cyclists on the Old Iron Bridge			
2027 Build	Annual Number	9,391	Based on counts taken in March 2022, escalated by 5.5% annual growth rate
Average Annual Rate of Growth	%	5.5%	Rate of growth assumed equal to rate of growth in population based on City of Bastrop projections and consistent with Building Bastrop Block code to emphasize growth in multimodal modes.
Annualization Factor for Pedestrian Traffic	Number	269	Annualization factor is equal to 80% of total year as an assumption for days suitable for pedestrian/bicycle trips.
Measures of Pedestrian Benefits			
Unit Monetary Benefit of Improved Cycling Path	$ per cycling mile	$1.78	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grants Program, March 2022, Table A-9
Average cycling trip length	miles per person	0.25	Total length of bridge

6.3 Recreational Benefits

The Old Iron Bridge is anticipated to be used by pedestrians and cyclists for both commuting and recreational use. Pedestrian and cyclist counts were made on March 3, 2022 and used to determine potential daily use for the Old Iron Bridge. Based on the pedestrian counts, 108 pedestrians and 12 cyclists are estimated to use the SL 150 bridge on a daily basis. Using these counts, an average daily count of pedestrians and cyclists for the Old Iron Bridge was estimated and multiplied with an annual growth rate of 5.5 percent, the approximate growth rate of the City of Bastrop. Recreational trips are assumed to comprise 50% of all trips. Recreational users are expected to double in 2027 when the bridge is opened due to adjacent recreational opportunities, route attractiveness, the lack of the current facility to support two-way traffic, and to align with the Bastrop's B3 land use plan to increase density. The recreational benefit was calculated using a $10 value per day of recreation based on the National Cooperative Highway Research Program (NHCRP) Report 552 and applied to the number of recreational days per year, assumed at 80 percent of the year, or 269 days.

6.4 Health Benefits

Using the same pedestrian and cyclist counts referenced in the recreational benefits, health benefits were calculated assuming a 5.5 percent annual growth rate. Because health benefits accrue per new user rather than per trip, the number of new users were estimated from the yearly demand with the assumption that the daily composition of users would turnover once per month. In addition, it was assumed that the number of cyclists would double (to 24 trips per day) upon bridge opening due to the current SL-150 sidewalk offering narrow operating conditions and preventing two-way operation. An annual health benefit of $128 per new cyclist or pedestrian is estimated using the NHCRP Report 552.

6.5 Agency Cost Savings / State of Good Repair

The existing Old Iron Bridge is in poor condition and is closed to all traffic. Without significant maintenance, the Old Iron Bridge will have to be demolished within the next 20 years due to continuing deterioration. Without rehabilitation, the bridge poses a safety risk to the adjacent SL 150 bridge were it to fail or collapse. The bridge also poses an environmental risk to the Colorado River with its failing lead paint.

Estimated maintenance costs were developed for the Build and No Build scenarios over the next 20 years. As described in Section 4.4.2, today's maintenance costs are nominal (estimated at $500/year). However, demolition of the bridge ($1 million) would be required in 2030. Under the Build scenario, these costs represent effective cost savings to the City which will offset rehabilitation costs of the new bridge. In this BCA, these cost savings were assumed to begin in 2023 and accrue for 30 years according to the estimated schedule.

7.0 Summary of Findings and BCA Outcomes

Table 5 summarizes the overall outcomes of the BCA with project performance metrics. Annual costs and benefits are estimated over the lifecycle of the project (from 2022 to 2046). As stated earlier, construction is expected to be completed in 2027. Benefits accrue during the operation of the project (over the years 2027-2046).

Table 5: Summary of BCA Results in Millions of 2020 dollars

Category	Undiscounted Estimate	7 Percent Discounted Estimate	3 Percent Discounted Estimate
Reduction in Accident Costs	$4.35	$1.54	$2.71
Ped Facility Benefits	$0.55	$0.17	$0.33
Cycling Facility Benefits	$0.15	$0.05	$0.09
Recreational Benefits	$20.31	$5.58	$11.36
Health Savings	$7.07	$2.02	$4.18
Agency Cost Savings	$0.61	$0.39	$0.52
Total Capital Costs	$14.70	$9.88	$12.34
Benefit-Cost Ratio	2.25	**1.01**	1.62

8.0 BCA Sensitivity Analysis

The BCA outcomes presented in previous sections rely on assumptions and long-term projections, both of which are subject to uncertainty. The primary purpose of the sensitivity analysis is to help identify the variables and model parameters whose variations have the greatest impact on the BCA outcomes: the "critical variables."

The sensitivity analysis was conducted with respect to the capital cost estimate, health savings, and recreational savings from new pedestrian and bicycle users. The outcomes of this analysis are presented in Table 6 below. The table provides new NPV associated with variations in variables or parameter assumptions (listed by row) and the new BC ratio. Because the project's current BC ratio is currently so close to 1, increasing the costs or decreasing the benefits to any degree would decrease the ratio.

Table 6: Quantitative Assessment of Sensitivity (7% Discounted Values)

Parameters	Change in Parameter Value	New NPV (in $millions)	New BC Ratio
Capital Cost Estimate	20% Increase	-$1.93	0.84
	20% Reduction	$2.05	1.26
Health Savings	20% Increase	$0.51	1.03
	20% Reduction	-$0.38	0.96
Recreational Savings	20% Increase	-$1.18	1.01
	20% Reduction	-$1.05	0.89

9.0 Sources

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