Bridging the Gap: Multimodal Connections on I-35 over the Oklahoma River

Oklahoma Department of Transportation RAISE Grant Application
February 28, 2023

Rendering of the I-35 multimodal path over the Oklahoma River

BENEFIT COST NARRATIVE

OKLAHOMA
Transportation

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Executive Summary

This Benefit Cost Analysis (BCA) supports Oklahoma Department of Transportation's (ODOT's) 2023 RAISE grant application to construct a 10-foot separated multimodal path on the southbound (SB) I-35 bridge located 1.5 miles east and 0.5 miles south of downtown Oklahoma City (the Project). Since the 10-foot multimodal path does not have independent utility as it is part of the design for the new I-35 NB and SB bridges, ODOT is also submitting relevant information about the I-35 bridge replacement project (I-35 Bridge Component).

The I-35 bridge replacement will provide new, safer, and geometrically improved bridges over the Oklahoma River. The main vehicular bridge replacement will deliver major safety benefits to a very high crash-prone river crossing, while adding vehicular capacity through travel lane expansion and the provision of safety lanes in both directions, which are currently functionally obsolete on the existing bridge.

The new multimodal path on the I-35 bridges and enhancements to existing bike-ped trails along the Oklahoma River will provide multimodal access to nearby disadvantaged populations, while providing much enhanced access to the full regional bike and ped network. It will provide a much needed and currently absent downtown river crossing for active transportation users.

The BCA captures and monetizes four categories of benefits arising from the vehicular bridge project: life cycle cost savings, travel time savings, crash reduction benefits, and emissions benefits. Other benefits that have not been monetized (but are discussed below) include travel reliability and freight (truck) logistics/supply chain benefits. Economic benefits such as enhanced labor and business productivity (over and above those embodied in travel time savings) are also not included. However, the overall improvements in regional accessibility may generate benefits.

Benefits monetized in the BCA from the multimodal path improvements include benefits to existing and new bike commuters and recreational users and similar benefits to existing and new pedestrian commuters and recreational users. These benefits reflect populations within a one-mile radius of the bridge. In addition, a one-time option value benefit for nearby residents has been estimated, reflecting consistent research showing that proximity to a greenway or recreational trail generates an increase in house values relative to similar houses without proximity to such a facility.

Results: The Project and I-35 Bridge Component yields an overall Benefit-Cost Ratio (BCR) of 2.40 and a Net Present Value of $120.4 million (**Table 10**). The preponderance of benefits is from crash reductions, with smaller but still significant shares due to life cycle cost savings, emissions reductions, and active transportation benefits (cyclist and pedestrian benefits) arising from the Project, as well as riverfront connections to the existing Oklahoma City Trail system.

While the BCR for the Project is less than 1.0, this result is expected given the relatively high cost (over $17 million) to construct the Project. In this context, the total construction costs obscure the significant monetizable benefits – close to $5 million in present value terms – that arise from and were estimated for the multimodal elements.

Overview

This Benefit Cost Analysis (BCA) supports Oklahoma Department of Transportation's (ODOT's) 2023 RAISE grant application to construct a 10-foot multimodal path project on the south bound (SB) I-35 bridge located 1.5 miles east and 0.5 miles south of downtown Oklahoma City (the Project). The BCA has been conducted following the USDOT's Benefit-Cost Analysis Guidance for Discretionary Grant Programs (January 2023.) The following general parameters and assumptions were used in the BCA:

- A real discount rate of 7 percent is applied to all costs and benefits except for carbon emissions reductions, which are discounted at 3 percent.
- Because of the unique provision of both a new vehicular bridge and a new traffic-separated multimodal path for active transportation uses, BCA results have been estimated separately for both the vehicular bridge improvements (I-35 Bridge Component) and for the multimodal path and other active transportation enhancements (the Project). In addition, a total project BCA is calculated, combining both vehicular and active transportation elements.
- Because the Project and I-35 Bridge Component together involves a mix of new infrastructure (new replacement bridges) and upgraded infrastructure (approach road improvements) the analysis covers a 25-year period of operation, midway between the 20-year period for improved or rehabbed projects and 30 years for new facilities.
- A residual value is assumed at the close of the 25 years of operation, based on a full 50-year useful life of the Build project.
- Construction is assumed to commence in 2028 and end in 2030 with operation commencing in 2030 and extending to 2054.
- All costs and benefits are in 2021 constant dollars.
- The year 2021 was used as the base year for discounting; that is, 2021 is considered year zero for discounting.

Project Description

The Project and I-35 Bridge Component, centrally located in downtown Oklahoma City, will provide a new, safer, and geometrically improved bridge over the Oklahoma River. The new I-35 bridges (northbound and southbound structures) would provide six 12-foot lanes in each direction, 12-foot inside shoulders, and outside shoulders varying between 12-foot-0-inches and 18-foot-10-inches. In addition, the Project includes the addition of a completely traffic-separated 10-foot multimodal path for active transportation users.

The I-35 Bridge Component infrastructure will deliver major safety benefits to a very high crash-prone crossing while adding vehicular capacity through travel lane expansion and the provision of safety lanes in both directions, which are currently functionally obsolete on the existing bridge. The bridge is an essential connecting link along I-35, a major north-south interstate route that provides passenger and truck freight connectivity from the Texas-Mexico border through the Dallas metro area, to Oklahoma City, and on to points north.

The Project on the I-35 bridge will provide unique and needed access to the largely Hispanic Capitol Hill district, located on the south side of the Oklahoma River. For non-automobile owners located in this Historically Disadvantaged Community and Area of Persistent Poverty adjacent to and near the Project, the new multimodal path will provide walking and biking access to jobs, healthcare, and increased transit options on both sides of the river.

The Project will help complete the Oklahoma River trails network located north and south of I-35, connecting this rich cultural and recreational area of Oklahoma City to the entire Oklahoma City trails system that offers a network of 10 inter-connected trails that cover over 80 miles and can access almost every point in Oklahoma City. The Project will also provide a viewing area so spectators can have a bird's eye view of the events on the Oklahoma River.

Costs

Capital Cost (Capitol Cost Tab)

ODOT estimated costs based on estimated quantities and recent similar projects. The capital cost of the I-35 Bridge Component and associated road improvements has been estimated to total $142.6 million in 2022 dollars (**Table 1**). The cost of the Project on the bridge and trail additions on the riverbank, plus associated minor costs for active transportation infrastructure is estimated to total $17.6 million in 2022 dollars. The total cost is $160.2 million in 2022 dollars.

Table 2 provides the cost of just the Project with the cost breakdown of the anticipated components, which does not include any previously incurred costs. A 30 percent contingency was used to develop the Project budget.

Design and engineering are expected to take place in 2024 and 2025. Future year costs have been de-escalated from 2022 dollars to 2021 dollars based on the 2021-2022 July-over-July change in the Producer Price Index for Construction Final Demand, as reported by the Bureau of Labor Statistics and the Federal Reserve.[1]

[1] https://fred.stlouisfed.org/series/PPIDCS

Table 1: Capitol Costs – I-35 Bridges (2022 $s)

Major Items							
Roadway							
		Payitem	Quantity		Price per Unit		Total
202(D)	0184	Unclassified Borrow	13,690	CY	$ 8.50	$	116,365.00
303(A)	2100	Aggregate Base Type A	30,380	CY	$ 67.00	$	2,035,460.00
307(K)	4300	Stabilized Subgrade	144,410	SY	$ 7.00	$	1,010,870.00
317	4270	Cement Treated Base	128,960	SY	$ 18.00	$	2,321,280.00
325	5271	Separator Fabric	144,410	SY	$ 2.00	$	288,820.00
408	5774	Prime Coat	80,080	GAL	$ 4.00	$	320,320.00
414(B)	5725	Dowel Jointed P.C.C. Pvt. (Placement)	121,000	SY	$ 29.00	$	3,509,000.00
414(G)	5275	P.C. Concrete for Pavement	40,340	CY	$ 175.00	$	7,059,500.00
					Roadway Total:	$	16,661,615.00
Earthwork							
		Preliminary Earthwork Estimate (50%)				$	8,330,807.50
					Earthwork Totals:	$	8,330,807.50
Bridge							
		I-35 SB over Oklahoma River				$	47,428,095.00
		I-35 NB over Oklahoma River				$	33,640,145.00
		I-35 Ramp over Oklahoma River				$	20,535,295.00
		Pedestrian Bridge over Oklahoma River				$	17,641,910.00
					Bridge Totals:	$	119,245,445.00
					Major Items Total:	$	144,237,867.50
						$	24,992,422.50
Minor Items							
		Erosion Control				$	460,386.73
		Clearing & Grubbing & Removals				$	427,501.96
		Misc. Pipe Underdrain, Guardrail, Etc.				$	328,847.66
		Mobilization, Field Office, Staking				$	1,183,851.59
		SWPPP Doc. & Management, Contr. Quality Control				$	197,308.60
		Construction Traffic Control				$	1,249,621.13
		Storm Sewer, Drainage				$	1,315,390.66
		Traffic Control				$	690,580.10
		Signing & Marking				$	657,695.33
					Minor Items Total:	$	6,511,183.76
					Major Items + Minor Items Total:	$	150,749,051.26
					30% Contengency (Does Not Include Bridge)	$	9,451,081.88
					Grand Total:	$	160,200,133.13

Source: ODOT and Poe Engineering

Table 2: Capital Costs – the Project Multimodal Path on Bridge (2022 $s)

Description	Total Cost
Approach Slab	$23,000
42” Shared Parapet	$200,600
Structural Steel	$6,900,000
Stainless Steel Fixed Bearing Assembly Stainless Steel Expansion Bearing Assembly	$22,500
Class AA Concrete	$210,000
Class A Concrete	$46,200
Epoxy Coated Reinforcing Steel	$171,000
Type I-A Plain Riprap	$7,200
Vertical Abutment (North Bank)	$754,600
MSE Retaining Wall (North Bank)	$3,400,000
Multimodal Trail (North Bank)	$244,000
Multimodal Ramp (North Bank)	$650,000
Multimodal Trail (South Bank)	$97,600
Multimodal Ramp (South Bank)	$650,000
Multimodal Ramp (South Bank OKANA Extension)	$109,800
Handrailing	$84,000
Construction Total	$13,570,700
30% Contingency	$4,071,210
Multimodal Bridge Project Total	**$17,641,910**

Source: ODOT and Poe Engineering

Operations and Maintenance Costs

Routine maintenance costs for the No Build and Build are expected to be minor. However, significant additional major maintenance and rehab costs would be incurred under the No Build through the year 2060. These are avoided costs under the Build and are included in the analysis as Build benefits.

Vehicular Bridge Benefits

Four categories of benefits arising from the I-35 bridge replacement project have been captured and monetized in the BCA: life cycle cost savings, travel time savings, crash reduction benefits, and emissions benefits. Other benefits that have not been monetized (but are discussed below) include travel reliability and freight (truck) logistics/supply chain benefits. Economic benefits such as enhanced labor and business productivity (over and above those embodied in travel time savings) are also not included. However, the overall improvements in regional accessibility may generate benefits.

Life Cycle Cost Savings (Maintenance $ Cost Savings Tab)

As noted previously, the No Build bridge will require significant major rehabilitation and damage repair maintenance spending in the next 30 years. Much lower costs would be incurred under the Build. The basis of these savings is summarized in **Table 3**, below.

Table 3: Major Rehabilitation and Repair Costs (2022 $s)

Year	No-Build			Build	
	Major Bridge Rehab Costs	Bridge Damage Repair	TOTAL	Major Bridge Rehab Costs	TOTAL
2016	$0	$0	$0	$0	$0
2017	$0	$9,252	$9,252	$0	$0
2018	$0	$0	$0	$0	$0
2019	$0	$0	$0	$0	$0
2020	$0	$84,087	$84,087	$0	$0
2021	$0	$50,000	$50,000	$0	$0
2022	$0	$4,500	$4,500	$0	$0
2023	$0	$0	$0	$0	$0
2024	$0	$0	$0	$0	$0
2025	$0	$0	$0	$0	$0
2026	$2,000,000	$0	$2,000,000	$0	$0
2028	$0	$0	$0	$0	$0
2030	$0	$0	$0	$0	$0
2032	$0	$0	$0	$0	$0
2034	$0	$0	$0	$0	$0
2036	$0	$0	$0	$0	$0
2038	$0	$0	$0	$0	$0
2040	$3,000,000	$0	$3,000,000	$0	$0
2042	$0	$0	$0	$0	$0
2044	$0	$0	$0	$0	$0
2046	$0	$0	$0	$0	$0
2048	$0	$0	$0	$0	$0
2050	$0	$0	$0	$1,000,000	$1,000,000
2052	$0	$0	$0	$0	$0
2054	$0	$0	$0	$0	$0
2056	$0	$0	$0	$0	$0
2058	$0	$0	$0	$0	$0
2060	$3,000,000	$0	$3,000,000	$1,000,000	$1,000,000
TOTAL	**$8,000,000**	**$147,839**	**$8,147,839**	**$2,000,000**	**$2,000,000**

Source: ODOT and Poe Engineering

Crash Reductions (tab Crash Reduction $ Benefit)

Project Area Crash Data

Crash data were obtained from the ODOT Highway System Collision Listing Data to determine the nature and frequency of collisions along the interstates and ramps. Collision history was evaluated for the entire interchange area, extending 2 miles north of the bridges and 1.5 miles south of the bridges along I-35, 0.75 miles north of the interchange along I-235, 1.25 miles west of the interchange along I-40, and 1 mile west of the interchange along Oklahoma City Boulevard. The collision information was collected and analyzed over a 10-year period from January 1, 2012, to December 31, 2021, which is the latest available data.

As shown in **Table 4**, a total of 4,371 collisions were recorded involving 1,686 injured persons and 24 fatalities. This is the equivalent of 1.2 collisions per day over 10 years. Of those injuries, 110 were of sufficient severity that the injured person was incapacitated.

The most prevalent collision type within the interchange was rear-end (front to rear) collisions, accounting for over half (2,305 of the 4,371 total) of all collisions. These types of crashes are commonly observed with congested roadways where stopped traffic occurs in the driving lanes and sudden deceleration from vehicles traveling at higher rates of speed is required. The limited bridge travel lane capacity, reduced shoulders, and merging of travel lanes directly south lead to conditions that cause traffic stopping and weaving.

Table 4: I-35/I-40 Interchange Collisions

Type of Collision	Fatality	Injury	Property Damage	Total
Rear-End	3	646	1,656	2,305
Head-On	4	4	1	9
Right Angle	1	64	81	146
Angle Turning	1	54	149	204
Other Angle		1	3	4
Sideswipe Same Direction	1	137	934	1,072
Sideswipe Opposite Direction	1	5	4	10
Fixed Object	6	143	226	375
Pedestrian	2	6		8
Pedal Cycle		1		1
Animal			1	1
Overturn/Rollover	1	38	23	62
Other Single Vehicle Crash		7	29	36
Other		24	114	138
Total	**20**	**1,130**	**3,221**	**4,371**
Source: ODOT				

The replacement bridges for I-35 NB and SB would have six lanes each as well as adequate shoulder widths. This would allow for the I-35 NB bridge to have a dedicated lane for I-40 WB and the I-35 SB bridge to have an additional lane from I-40 WB. South of the I-35 SB bridge, the

proposed roadway would narrow to four lanes instead of three; this is an additional lane from the current configuration. The additional lane should help reduce the number of rear-end collisions by reducing the backup at the interchange during peak hours which, in turn, increases the capacity of the interchange. The addition of a SB through-lane would lessen some of the weave movements which occur today.

The next most common collision type found was sideswipe same direction at nearly 25 percent. The reduction of the five-lane bridge to three lanes south of the bridge causes a weaving movement on both sides of the roadway for I-35 SB and causes a significant number of sideswipe collisions as drivers seek to merge. The I-35 bridge replacement would provide an additional lane and would eliminate the weaving movement on the inside of the roadway and help reduce the number of sideswipe collisions.

Additionally, the I-35 bridge replacement would restore the inside and outside shoulders to adequate widths. Full shoulders are important for the safety of a bridge because they allow for broken-down cars to pull off to the shoulder rather than blocking a lane of traffic. The shoulders also permit emergency vehicles to bypass stopped traffic to access the scene of a crash or incident more quickly, allowing injured persons to receive medical attention sooner.

Crash Reduction Factors

The FHWA Desktop Reference for Crash Reduction Factors (CRF) was used to determine how each of the proposed safety improvements would impact crash rates.

Lane Increase: The CRF for increasing the number of travel lanes on a bridge is .25, meaning that after the improvement, crashes would be at 75 percent (the equivalent CMF) of their pre-improvement level. However, increasing the number of lanes has a greater impact on rear-end and sideswipe collisions reducing them by approximately 40 percent and 35 percent respectively. As shown above, these are the two most common accident types making up over 75 percent of the total collisions found on the roadway extent. Accordingly, the CRF for adding lanes, given the prevalence of rear end crashes, is estimated to be .35 due to the lane increase.[2]

Shoulder Widening: Based on additional research from the CRF Desktop Reference, it was found that widening the shoulders on the bridge from 4’ to 12’ will result in a CRF of .20. This means that the application of shoulder widening will result in a post-application crash level equal to 80 percent of the pre-application condition.[3]

Combined CRF: Utilizing the FHWA’s recommended multiplicative method of combining CRF factors applied to a common location result in a combined CRF of 0.48. This is derived as follows:

Combined CRF = 1-((1-.35) x (1-.20)) = (1-.52) = .48

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[2] FHWA Desktop Reference pages.61, 62, all areas and all types, 0,25 CRF multiple citations. Microsoft Word - Divider Pages with Intro_Desktop Reference 09102007.doc (dot.gov)

[3] FHWA Desktop Reference, p. 68, for all areas, widen shoulder initially less than 3 ft. Microsoft Word - Divider Pages with Intro_Desktop Reference 09102007.doc (dot.gov)

Where several safety improvements are applied at the same time to a given traffic environment, the combined impact would be multiplicative as confirmed by the following FHWA guidance[4] for combining CMFs: "*In these cases (*i.e., where more than one countermeasure is employed in the same location*), the CMFs are typically multiplied to estimate the combined effect of independent countermeasures such as adding pedestrian signals and left-turn lane at a signalized intersection. The HSM recommends that practitioners multiply no more than 3 CMFs to estimate the combined effect of multiple safety improvements*."

In summary, the I-35 bridge replacements would help enhance safety and operation, protecting motorized travelers by reducing the number of accidents in the I-35/I-40 interchange area by almost 50 percent.

Crash Reduction

Estimated crash reductions in 2030 (first year of operation) are shown in **Table 5**.

Table 5: 2030 Crash Reductions

Year		2030
Average Project-wide No Build Crashes (grow at rate of AADT growth from Look Up		
PDO		322.10
Serious Injury		11.30
Non Capacitating Injury		33.90
Possible Injury		67.80
Fatal		2.00
Projected Annual Crashes (Build)		
PDO		167.49
Serious Injury		5.88
Non Capacitating Injury		17.63
Possible Injury		35.26
Fatal		1.04
Crashes Reduced		
PDO		154.61
Serious Injury		5.42
Non Capacitating Injury		16.27
Possible Injury		32.54
Fatal		0.96

Source: EBP

[4] USDOT, FHWA, Local and Rural Briefing Papers: Crash Modification Factors (CMFs) https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/cmf.pdf

The Project will generate very significant savings in the human costs of crashes. Over the 25 years, it is estimated that 30 lives will be saved, and another 1,700 injury-crashes will be avoided.

Travel Delay Savings (TT $ Benefits Tab)

Table 6 summarizes current and projected AADT for the I-35 bridge-interchange complex and provides the estimated per trip times across the approximately 2-mile bridge and approach road span under the No Build and Build scenarios. Trip times are anticipated to improve with the new bridge by between one and two minutes per crossing during peak congested periods. In the first year of operation, there will be an estimated 187,000 person hours saved and another 7,900 truck hours saved.

Table 6: Current and Forecast AADT for the I-35 Bridge

AADT - Current and Forecast (I-35)												
		Daily	AM			Daily	PM					
		NB Daily	AM NB peak	SB Daily	AM SB peak	NB Daily	PM NB peak	SB Daily	PM SB peak	peak trip time No Build	peak trip time Build	time savings per trip (minutes)
2022 AADT	autos	64,384	4,024	59,670	3,729	64,384	4,024	59,670	3,729			
	trucks	4,846	282	4,177	261	4,846	282	4,177	261			
2030 AADT	autos	74,894	4,681	69,411	4,338	74,894	4,681	69,411	4,338	3.4286	2.1818	**1.247**
	trucks	5,243	328	4,859	304	5,243	328	4,859	304			
2040 AADT	autos	90,500	5,656	78,000	4,875	90,500	5,656	78,000	4,875	4.0000	2.1818	**1.818**
	trucks	6,812	396	5,460	341	6,812	396	5,460	341			
truck share	7.00%											

Source: ODOT, EBP

Air Emissions Reductions (Emissions $ Benefits Tab)

Vehicle hour savings derived from above were multiplied by vehicle emissions rates per delay hour for each pollutant type (as calibrated by INCOG utilizing the MOVES3 model) to estimate emissions reductions. Emissions forecasts also assume significant growth in the electric vehicle (EV) share between now and 2051. A consensus of reviewed EV market forecasts led to an assumption that the EV share would grow from the current level of about 2 percent to 40 percent by 2051. Because of the assumed growth in the EV share consistent in the No-Build and Build scenarios, and because the Project results in no change in VMT, the emissions savings are relatively small over time.

Active Transportation Benefits (tabs Bike and Ped Lane $ Benefits)

Because this grant application is only requesting funding for the multimodal path on the I-35 SB bridge Project ($17.6 million total capital cost), we sought to separately measure the BCR for just the multimodal facilities, based on a conceptual estimate of active transportation benefits. The ability to fully measure those benefits is limited by a lack of current and comprehensive bike and pedestrian utilization data, as well as by limited methods to fully estimate the new demand. However, to the extent possible, this analysis endeavors to capture those benefits based on techniques available in the NCHRP literature related to prospective bike and pedestrian use of new and/or improved bike-ped facilities. The analysis also considers the nature of the facilities being developed as part of the I-35 bridge replacement project,

connectivity to the overall regional Oklahoma City Trail system, proximity to downtown and nearby cultural and commercial centers of activity, and the width and length of the new facilities.

Pedestrian and Cycling Benefits

To begin our analysis, we obtained data on the potential market for bike-ped facilities, comprised of the residential population in Census tracts located within an approximately one-mile radius of the bridge. Those data are shown below in **Table 7**.

Table 7: Active Transportation -Eligible Population by Census Tracts

POPULATION ELIGIBLE FOR INDUCED HEALTH BENEFIT	CENSUS TRACT 1039	CENSUS TRACT 1053	CENSUS TRACT 1073.05	CENSUS TRACT 1095	CENSUS TRACT 1097	TOTAL
WALKING (AGES 20-74)	2,465	2,044	806	2,519	1,666	**9,500**
CYCLING (AGES 20-64)	2,299	1,970	742	2,237	1,376	**8,624**
	CENSUS TRACT 1039	CENSUS TRACT 1053	CENSUS TRACT 1073.05	CENSUS TRACT 1095	CENSUS TRACT 1097	TOTAL
TOTAL WALKING POPULATION	2,465	2,044	806	2,519	1,666	
TOTAL CYCLING POPULATION	2,299	1,970	742	2,237	1,376	
NO-BUILD WALKING RATE (CENSUS TRACT RATES)	2.70%	0.40%	0.90%	1.10%	8.7%	
NO-BUILD CYCLING RATE (CENSUS TRACT RATES)	0.00%	0.00%	0.00%	0.00%	0.5%	
NO-BUILD EXISTING COMMUTER PEDESTRIANS	67	8	7	28	145	**255**
NO-BUILD EXISTING COMMUTER CYCLISTS	-	-	-	-	7	**7**
ANNUAL TRIPS (52 WEEKS * 5 ROUND TRIPS)	520	520	520	520	520	
NO-BUILD WALKING TRIPS	34,609	4,252	3,772	14,409	75,370	**132,411**
NO-BUILD CYCLING TRIPS	-	-	-	-	3,578	**3,578**
	CENSUS TRACT 1039	CENSUS TRACT 1053	CENSUS TRACT 1073.05	CENSUS TRACT 1095	CENSUS TRACT 1097	TOTAL
TOTAL WALKING POPULATION	2,465	2,044	806	2,519	1,666	
TOTAL CYCLING POPULATION	2,299	1,970	742	2,237	1,376	
BUILD WALKING RATE (OKLAHOMA COUNTY RATES)	1.60%	1.60%	1.60%	1.60%	1.60%	
BUILD CYCLING RATE (OKLAHOMA COUNTY RATES)	0.30%	0.30%	0.30%	0.30%	0.30%	
BUILD INDUCED COMMUTER PEDESTRIANS	39	33	13	40	27	**152**
BUILD INDUCED COMMUTER CYCLISTS	7	6	2	7	4	**26**
ANNUAL TRIPS (52 WEEKS * 5 ROUND TRIPS)	520	520	520	520	520	
BUILD WALKING TRIPS	20,509	17,006	6,706	20,958	13,861	**79,040**
BUILD CYCLING TRIPS	3,586	3,073	1,158	3,490	2,147	**13,453**
	CENSUS TRACT 1039	CENSUS TRACT 1053	CENSUS TRACT 1073.05	CENSUS TRACT 1095	CENSUS TRACT 1097	TOTAL
TOTAL WALKING POPULATION	2,465	2,044	806	2,519	1,666	
TOTAL CYCLING POPULATION	2,299	1,970	742	2,237	1,376	
BUILD RECREATIONAL WALKING RATE (NATIONAL RATES)	35.00%	35.00%	35.00%	35.00%	35.00%	
BUILD RECREATIONAL CYCLING RATE (NATIONAL RATES)	11.00%	11.00%	11.00%	11.00%	11.00%	
BUILD INDUCED RECREATIONAL PEDESTRIANS	17	14	5	17	11	**64**
BUILD INDUCED RECREATIONAL CYCLISTS	5	4	2	5	3	**18**

Utilizing this information and unit values provided in the USDOT BCA guidance (**Table 8**), estimates of benefits for existing and potentially induced ped and cyclist users per trip and per year were developed. Those benefits are summarized for the first year of operation (2030) in **Table 9**.

Table 8: US DOT Guidance Values for Pedestrian and Cycling Facilities

PEDESTRIAN FACILITY IMPROVEMENTS REVEALED PREFERENCE VALUES	
IMPROVEMENT TYPE	**RECOMMENDED VALUE PER PERSON-MILE WALKED (2021 $)**
EXPAND SIDEWALK (PER FOOT OF ADDED WIDTH)	$0.11
REDUCING UPSLOPE BY 1%	$1.05
REDUCING TRAFFIC SPEED BY 1 MPH (FOR SPEEDS ≤ 45 MPH)	$0.09
REDUCING TRAFFIC VOLUME BY 1 VEHICLE PER HOUR (FOR ADT ≤ 55,000)	$0.0009
IMPROVEMENT TYPE	**RECOMMENDED VALUE PER PERSON-MILE WALKED (2021 $)**
INSTALL MARKED-CROSSWALK ON ROADWAY WITH VOLUMES ≥ 10,000 VEHICLES PER DAY	$0.18
INSTALL SIGNAL FOR PEDESTRIAN CROSSING ON ROADWAY WITH VOLUMES ≥ 13,000 VEHICLES PER DAY	$0.48
CYCLING FACILITY IMPROVEMENT REVEALED PREFERENCE VALUES	
FACILITY TYPE	**RECOMMENDED VALUE PER PERSON-MILE CYCLED (2021 $)**
CYCLING PATH WITH AT GRADE CROSSINGS	$1.49
CYCLING PATH WITH NO AT GRADE CROSSINGS	$1.87
DEDICATED CYCLING LANE	$1.77
CYCLING BOULEVARD OR SHARROW	$0.28
SEPARATED CYCLE TRACK	$1.77

Table 9: Annual Bike and Pedestrian Benefits for Existing and Induced Users

Cycling			**Pedestrians**		
YEAR		2030	YEAR		2030
EXISTING CYCLIST TRIPS AND BENEFITS			**EXISTING PEDESTRIAN TRIPS AND BENEFITS**		
ESTIMATED EXISTING COMMUTER CYCLISTS	7	7	ESTIMATED EXISTING COMMUTER PEDESTRIANS	255	255
ANNUALIZATION FACTOR	365	365	ANNUALIZATION FACTOR	365	365
CYCLIST TRIP LENGTH	1.055	1.055	PEDESTRIAN TRIP LENGTH	0.86	0.86
ESTIMATED ANNUAL BIKE MILES	2696	2696	ESTIMATED ANNUAL WALK MILES	80045	80045
CYCLING PATH WITH NO AT GRADE CROSSING BENEFIT	$1.87	$1.87	SIDEWALK EXPANSION BENEFIT (10 FEET)	$1.10	$1.10
ANNUAL EXISTING CYCLIST BENEFITS		**$5,041**	**ANNUAL EXISTING PEDESTRIAN BENEFITS**		**$88,049**
INDUCED CYCLIST TRIPS AND BENEFITS			**INDUCED PEDESTRIAN TRIPS AND BENEFITS**		
ESTIMATED INDUCED COMMUTER CYCLISTS	26	26	ESTIMATED INDUCED COMMUTER PEDESTRIANS	152	152
ESTIMATED INDUCED RECREATIONAL CYCLISTS	18	18	ESTIMATED INDUCED RECREATIONAL PEDESTRIANS	64	64
ANNUALIZATION FACTOR	365	365	ANNUALIZATION FACTOR	365	365
CYCLIST TRIP LENGTH	1.055	1.055	PEDESTRIAN TRIP LENGTH	0.86	0.86
ESTIMATED ANNUAL BIKE MILES	16943.3	16943.3	ESTIMATED ANNUAL WALK MILES	67802	67802
CYCLING PATH WITH NO AT GRADE CROSSING BENEFIT	1.87	1.87	SIDEWALK EXPANSION BENEFIT (10 FEET)	1.10	1.10
ANNUAL INDUCED CYCLIST BENEFITS		$31,684	**ANNUAL INDUCED PEDESTRIAN BENEFITS**		$74,583
TOTAL CYCLIST BENEFITS		**$36,725**	**TOTAL PEDESTRIAN BENEFITS**		**$162,632**

Option Value - New Bike and Ped Facilities

In addition to Project benefits potentially realized by existing and induced bike and ped users for commuting and recreational purposes, there is substantial research indicating that proximity to high quality and well-connected recreational trails carries significant *option* value that may be reflected in higher housing values.[5] Typical of these research studies is one conducted in North Carolina indicating that houses adjacent to a regional greenway sold for a premium of about $5,000 above comparable homes that were not located nearby. Similar

[5] Rails to Trails Conservancy, "The Economic Benefits of Recreational Trails", online research monograph: https://www.srs.fs.usda.gov/factsheet/pdf/rectrails.pdf

studies found premiums in land values per acre and in property tax revenues associated with proximity to recreational trails and bikeways.

To capture the potential benefits of the much-enhanced bike-ped access arising from the Project, we have gone back into the Census data from the one-mile radius tracts around the bridge to determine the number of housing units that may experience a benefit. The Census indicates over 6,000 housing units located within the one-mile radius. As a conservative estimate, this analysis assumes about 1,000 of those 6,000 housing units are close enough to the bike and ped enhancements to see significant property value impacts. The analysis estimates a modest one-time aggregate option value boost (as reflected in house value increases) of $5,000,000 in year 2030, assuming a similar $5,000 per unit value premium.

Benefits Not Included in the BCA

Travel Reliability

Traffic data provided by ODOT indicates that indices of travel time variability would be significant for limited windows of time during peak-of-peak periods. However, the data are not sufficient to estimate potential buffer times that truckers and drivers might build into their trips to avoid excessively late arrivals. In addition, because these periods of high variability are limited, we have not estimated these benefits, which are likely minor relative to other benefit categories.

Freight Logistics Savings/Supply Chain Benefits

Like reliability, supply chain benefits were not estimated due to limitations in data and the likelihood the benefits are relatively minor compared with the other benefit categories included in the BCA. However, these benefits, when considered over longer stretches of I-35, would be significant as it relates to corridor-wide I-35 improvements, which are underway by ODOT.

BCA Results (tab Results)

Based on the assumptions, methodology, and other information presented earlier, the I-35 river bridge replacement project yields an overall Benefit-Cost Ratio of 2.40 and a Net Present Value of $120.4 million (**Table 10**). The preponderance of benefits is from crash reductions, with smaller but still significant shares due to life cycle cost savings, emissions reductions, and active transportation benefits (cyclist and pedestrian benefits) arising from the new multimodal path on the I-35 SB bridge, as well as riverfront connections to the existing Oklahoma City Trail system.

Because this grant application is specifically seeking funding for just the multimodal path Project ($17.6 million total capital cost), we sought to separately measure the BCR for those parts of the Project. The approach to estimating multimodal/active transportation benefits is described in the previous section. Based on the cost and benefits of active transportation improvements derived for this BCA, we obtain a BCR of 0.50 for those elements of the Project.

While the BCR for active transportation elements is well below 1.0, this result is to be expected given the relatively high cost (over $17 million) to construct the Project. Indeed, the multimodal path on the bridge is considerably more costly on a per-mile basis than even the

highest quality surface bike-ped lanes, such as high-quality rails-to-trails facilities in urbanized environments.[6]

In this context, the Project's price tag obscures the significant monetizable benefits – close to $5 million in present value terms – that arise from and were estimated for the multimodal elements. Moreover, the monetized benefits captured in this BCA may understate the economic value *all* residents of Oklahoma City would place on creating a major cross-river downtown bike and pedestrian connection, merging and helping to complete a regionwide system of recreational trails. Option value, while likely diminishing with distance, almost certainly extends to residential and commercial areas beyond the one-mile radius included in our more spatially limited estimate of the added value obtained from this high-quality active transportation link.

Table 10: BCA Results

Discounted Costs	**Present Value**
Build Capital Costs	
Vehicular Bridge and Approach Roads	$76,445,276
Pedestrian/Bike Improvements	$9,460,280
Discounted Benefits	
Vehicular Bridge Benefits	
Salvage Value	$5,586,053
Maintenance and Rehab (Life Cycle) Cost Savings	$2,526,633
Value of Vehicular Travel Time Savings	
auto	$28,426,548
truck	$2,148,048
Value of Vehicle Related Crash Reductions	$161,519,522
Value of Emissions Reductions	
CO2	$1,072,962
Other Emissions	$231,555
Total Discounted Benefits - Vehicular Bridge and Approaches	**$201,511,322**
Bike and Ped Facility Enhancement Benefits	
Salvage Value	$691,287
Active Transportation Benefits	
Pedestrian	$1,103,047
Cyclist	$249,084
Option Value - Home Price Appreciation	$2,719,669
Total Discounted Benefits - Bike and Ped Facilities	**$4,763,087**
Summary	
Benefit Cost Ratio - Vehicular Bridge and Approach Roads	**2.64**
Net Present Value - Vehicular Bridge and Approach Roads	**$125,066,046**
Benefit Cost Ratio - Bike and Ped	**0.50**
Net Present Value - Bike and Ped	**($4,697,192)**
Benefit Cost Ratio - Full Project	**2.40**
Net Present Value - Full Project	**$120,368,853**

Source: EBP

[6] https://www.railstotrails.org/resource-library/resources/capital-trails-network-cost-estimate/