Hochatown Community Access and Pedestrian Safety Project

Benefit-Cost Analysis Technical Memorandum

Oklahoma Department of Transportation
FY2024 U.S. DOT RAISE Discretionary Grant Program
February 28, 2024

Executive Summary

The benefit-cost analysis evaluated the impacts of expanding the roadway capacity and implementing new pedestrian and bicyclist improvements along State Route 259 ("SR 259") near the town of Hochatown as part of the ***Hochatown Community Access and Pedestrian Safety Project*** (or, "the Project"). The Project will expand the two-lane undivided highway into a four-lane highway divided by a two-way left turn lane ("TWLTL") and add active transportation improvements, improving the links for residents and tourists to the accommodations and amenities in and around the town of Hochatown. The neighboring Beaver Bend State Park attracts about 6,500 daily visitors to Hochatown and the surrounding areas for accommodations and recreational opportunities.

The Project will add to the infrastructure for bicyclists and pedestrians along SR 529, including marked crosswalks, 5' wide sidewalks, and a shared use path. An additional lane in each direction and a TWLTL will be constructed along SR 259 for 4.2 miles, providing additional capacity for roadway vehicles while allowing for safer turning movements throughout the corridor. Streetlights will be installed along SR 259 to improve visibility for vehicle drivers, pedestrians and bicyclists during low-light conditions. In addition to improving roadway conditions, the Project is expected to encourage existing and new pedestrian and bicyclist users throughout the SR 259 corridor to use the new facilities, resulting in safety benefits, facility amenity benefits and the benefits from shifting trips from personal vehicles.

The environmental, design, engineering and construction activities of the Project are assumed to start in 2024 and be completed by 2026 with operations starting in 2027. The analysis period for the Project is 20 years of operations following project completion. The analysis was conducted in compliance with the U.S. DOT *Benefit-Cost Analysis Guidelines for Discretionary Grant Programs* published on December 2023. The methodology of the analysis conforms to U.S. DOT and other federal guidelines regarding benefit-cost analysis and was performed in line with industry standards and best practices.

Executive Summary Matrix

Table ES-1 summarizes the key components of the analysis, describing the baseline status of non-motorized and roadway vehicle travel along the SR 259 corridor and the expected impacts of the proposed project improvements.

Table ES-1. Executive Project Summary Matrix

Project Parameters	Description
Current Status / Baseline and Problem to be Addressed	Currently, pedestrians and bicyclists traveling in the SR 259 corridor must travel along the two-lane highway without protective infrastructure to continue their journey or reach their destinations. Users experience inadequate protective infrastructure along the busy roadway and at intersections, discouraging non-motorized travel in favor of personal vehicle use. Roadway vehicles experience significant congestion during the peak hours of the day, especially during the summer tourism season, resulting in travel delays and collisions between vehicles.
Change to Baseline Conditions / Alternatives	**Baseline:** Pedestrians and bicyclists continue to be exposed to the safety risks along the busy two-lane highway. Users will continue to be encouraged to use personal vehicles to complete their trips, instead of walking or biking. Roadway vehicles experience worsening congestion during peak hours and risk of crashes during turning movements.
	Alternative: The Project expands the sidewalk infrastructure for pedestrians along the west side of SR 259, improving ADA accessibility and encouraging local walk trips. A shared use path for pedestrians and bicyclists will be built on the east side of SR 259, improving accessibility for residents and visitors throughout the corridor. The installation of streetlights improve the feeling of safety and comfort for pedestrians and roadway traffic during low-light conditions. The installation of left turn lanes throughout the corridor will result in a more efficient traffic flow during peak periods and avoided vehicle collisions.
Type of Impacts	**Pedestrian Safety Improvements Benefits:** The Project includes the installation of marked crosswalks throughout the SR 259 corridor. The improvements are expected to reduce the risk of conflicts between pedestrians and vehicles and encourage non-motorized user-trips by creating a safe and comfortable street environment.
	Pedestrian and Bicyclist Facility Amenity Benefits: The Project adds new amenities for pedestrians and bicyclists, including the expansion of the sidewalks, the

Project Parameters	Description
	construction of a shared use path and the installation of marked crosswalks, along SR 259. As a result, users will perceive a higher value per trip.
	Pedestrian and Bicyclist Health Benefits: The Project is expected to encourage existing and new pedestrian and bicyclist users within the SR 259 corridor to use the improved facilities. Based on the reduction in mortality risk associated with physical activity, the increase in adult users is expected to reduce the cost of long-term health risks.
	Reduction in Vehicle Collisions: The Project is expected to reduce the incidence of future vehicle collisions in the SR 259 corridor as the construction of left-turn lanes help roadway traffic users experience reduced risk of crashes from congested roadways and during turning movements.
	Auto and Truck Travel Time Savings: The Project is expected to reduce the travel time for autos and trucks during the peak period through the installation of left-turn lanes and an additional lane in each direction to facilitate traffic flow. The Project is expected to reduce delays throughout the SR 259 corridor.
	Vehicle Operating Cost Savings: The Project is expected to encourage residents and visitors in the Hochatown area to use the improved facilities to complete their trips by walking and bicycling, instead of using a personal vehicle. These avoided vehicle-trips reduce their costs for vehicle fuel and maintenance.
	Vehicle Emissions Reduction: The Project is expected to encourage residents and visitors in the Hochatown area to use the improved facilities to complete their trips by walking and bicycling, instead of using a personal vehicle. These avoided vehicle-trips reduce the generation of vehicle emissions.
	Roadway Safety, Noise and Congestion Benefits: The Project is expected to encourage residents and visitors in the Hochatown area to use the improved facilities to complete their trips by walking and bicycling, instead of using a personal vehicle. These avoided vehicle-miles traveled reduce the social costs related to roadway safety, noise and congestion.
	Residual Value: The proposed project improvements in the SR 259 corridor are expected to have a useful life of at least 30 years, representing a long-term investment in the Hochatown area. The analysis monetizes the useful life of the capital investment remaining at the end of the 20-year analysis period.

Summary of Benefit-Cost Analysis Results

The benefit-cost analysis evaluates and monetizes the social benefits and costs of the Project over a three-year design and construction period and a 20-year operations period. The construction period of the Project is expected to last from 2024 to 2026; it includes design, engineering, and construction. Costs related to the Project expended before 2024 have been included. The analysis period of the Project is, following the completion of construction, from 2027 to 2046. The analysis period evaluates the user and social benefits of the proposed project improvements in the project area. The benefits and costs evaluated in the analysis are calculated in 2022 constant dollars and their present value is calculated using a 3.1 percent discount rate, per U.S. DOT BCA guidance.[1]

Costs

The total capital cost of the Project is expected to be $44.4 million in year-of-expenditure dollars; this includes $4.7 million in previously expended costs. The construction costs for the Project represent the estimated costs for environmental planning, design, engineering and construction of the proposed project improvements based on the known concept parameters and schedule. When deflating from year-of-expenditure dollars, assuming an annual escalation rate of 3.0 percent from 2024 to 2026, the capital costs are estimated to be $40.6 million in undiscounted 2022 dollars. At a 3.1 percent discount rate, the capital costs would be $37.2 million in 2022 dollars. The capital costs by year are summarized below in Table ES-2.

[1] U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, December 2023

Table ES-2. Project Cost by Year (in millions of dollars)

Cost Category	2022*	2023	2024	2025	2026	Total
Year-of-Expenditure Dollars						
Environmental, Design and Engineering	$4.7	-	$0.1	-	-	**$4.8**
Construction	-	-	-	$27.7	$11.9	**$39.6**
Total	**$4.7**	**-**	**$0.1**	**$27.7**	**$11.9**	**$44.4**
Adjusted constant 2022 dollars						
Environmental, Design and Engineering	$4.7	-	$0.1	-	-	**$4.8**
Construction	-	-	-	$25.3	$10.5	**$35.8**
Total	**$4.7**	**-**	**$0.1**	**$25.3**	**$10.5**	**$40.6**

*Note: Values of line items may not up to totals due to rounding. * Includes the value of previously expended costs.*

The annual maintenance costs for all proposed project improvements are estimated to be $358,200 in 2022 dollars. As a lifecycle cost analysis has not been completed for the project elements, the annual maintenance costs are assumed to represent a conservative estimate of additional maintenance represented as one percent of total construction costs; the improvements would be covered by currently planned levels of maintenance. Over the 20-year analysis period, the total maintenance costs for the project improvements are estimated to be $7.2 million in undiscounted 2022 dollars, or $4.7 million when discounted at 3.1 percent. The annual operations and maintenance costs are summarized below in Table ES-3.

Table ES-3. Annual Operations and Maintenance Costs (in undiscounted 2022 dollars)

	No Build Scenario	Build Scenario
Total	**-**	**$358,200**

Benefits

The Project is expected to improve the facilities for pedestrians and bicyclists and alleviate the congested conditions for vehicle traffic in the SR 259 corridor. The improvement of the active transportation infrastructure and the expansion of the roadway capacity will provide a more enjoyable and safe experience for all users, while reducing journey time delay and injuries and fatalities from future crashes. Existing and new pedestrians and bicyclist users in the Hochatown area around the improved facilities are expected to enjoy its benefits; they will include adult commuter and adult and child recreational users. With planned development of additional tourist accommodations and amenities around Hochatown, existing and new residents and visitors are expected to increase their demand on pedestrian and bicyclist infrastructure. Over the 20-year analysis period, the monetized impacts include the following:

Pedestrian and Bicyclist Benefits

The improvement of the sidewalk and bicyclist infrastructure provides numerous benefits for existing and new pedestrian and bicyclist users within a catchment area of 3/8 mile and one mile, respectively, around SR 259.[2] Marked crosswalks installed throughout the corridor are expected to reduce the risk of incidents between pedestrians and roadway traffic, while the sidewalks and shared use path provide a safer alternative pathway for pedestrians and cyclists currently traveling through the Hochatown area.

Mode-Shift Benefits

Existing and new pedestrian and bicyclist users in the areas around the improved facilities are expected to be encouraged to differentiate their travel behavior compared to the No Build conditions. The methodology for calculating existing and new pedestrians and bicyclists associated with an improved facility is based on demographic data of residents within a catchment area of 3/8 mile and one mile, respectively, from the facility.[3] Under No Build conditions, the new users would be expected to complete their trips by an alternative mode of travel based on a mode-shift profile derived from the National Household

[2] Krizek, et al, *NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities*, pg. 38, Transportation Research Board, 2006

[3] Krizek, et al, *NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities*, pg. 38, Transportation Research Board, 2006

Transportation Survey published in 2017.[4] The analysis evaluates the impacts of the percentage of new users who would have otherwise chosen to complete their trip by personal vehicle, if the improved facilities were not available. The reduction in vehicle-miles traveled results in the reduction of the following: vehicle operating costs, roadway safety risk, roadway congestion, noise pollution, pavement damage and vehicle emissions.

Roadway Traffic Benefits

Auto and truck traffic in the SR 259 corridor is expected to experience improved traffic flow and reduced conflicts on the roadway due to the increase in roadway capacity and the construction of the TWLTL. The modeled traffic conditions are calculated from on traffic count data of SR 259 and a Level of Service (LOS) analysis based on evaluating the daily average volume/capacity ratio using the *Highway Capacity Manual.* Due to the magnitude of traffic attributed to visitors relative to local trips, the analysis evaluates traffic impacts during the workweek and the weekend for the summer season and the off-season months. Evaluating the average daily traffic conditions in the corridor with and without the project improvements illustrates the benefits to auto and truck traffic.

Asset Useful Life and Residual Value

The analysis assumes a useful life of at least 30 years for the proposed improvements, signifying a significant capital investment for the Hochatown area. The residual value measures the remaining value of the capital investment after the first 20 years of straight-line depreciation at the end of the analysis period.

Benefit-Cost Analysis Results

The total benefits generated from the project improvements within the analysis period are calculated to be $65.7 million in discounted 2022 dollars. The total capital costs, including design, preliminary engineering, and construction, are calculated to be $37.2 million in discounted 2022 dollars. The difference of the discounted benefits and costs equals a net present value of $28.5 million in discounted 2022 dollars, resulting in a benefit-cost ratio (BCR) of 1.77. Table ES-4 below summarizes the results of the base analysis for the Project by benefit category.

Table ES-4. BCA Summary Results (in 2022 dollars)

BCA Metric	Monetized Value	
	Undiscounted	**Discounted**
Total Benefits	**$106,861,000**	**$65,673,000**
Bicycle and Pedestrian Safety and Facility Benefits	$4,602,000	$3,002,000
Bicycle and Pedestrian Health Benefits	$8,830,000	$5,760,000
Reduction in Roadway Crashes	$56,887,000	$37,108,000
Auto and Truck Travel Time Savings	$30,449,000	$17,879,000
Vehicle Operating Costs Savings	$1,086,000	$708,000
Vehicle Emissions Reduction	$84,000	$54,000
Highway Roadway Externalities	$147,000	$96,000
Residual Value	$11,941,000	$5,739,000
Change in O&M Costs	($7,165,000)	($4,674,000)
Total Capital Costs	**$40,628,000**	**$37,200,000**
Net Present Value	**$66,233,000**	**$28,473,000**
Benefit-Cost Ratio	**2.63**	**1.77**
Internal Rate of Return	**8%**	

[4] U.S. Department of Transportation, Federal Highway Administration, 2017 National Household Travel Survey. https://nhts.ornl.gov.

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Tables

1. Introduction

The benefit-cost analysis (BCA) evaluates the Oklahoma Department of Transportation's proposed ***Hochatown Community Access and Pedestrian Safety Project*** (or, "the Project"), details the methodology and assumptions used to calculate benefits and costs, summarizes project benefits, and details project costs. The BCA is a requirement of the FY2024 Rebuilding American Infrastructure with Sustainability and Equity (RAISE) discretionary grant program administered by the U.S. Department of Transportation (U.S. DOT).

1.1 BCA Framework

A BCA is an evaluation framework to assess the economic advantages (benefits) and disadvantages (costs) of an investment alternative. Benefits and costs are broadly defined and are quantified in monetary terms to the extent possible. The overall goal of a BCA is to assess whether the expected benefits of a project justify the costs from a national perspective. A BCA framework attempts to capture the net welfare change created by a project. It includes cost savings and increases in welfare (benefits), disbenefits where costs can be identified (e.g., project capital costs), and welfare reductions where some groups are expected to be made worse off because of the proposed project.

The BCA framework involves defining a Base Case or "No Build" Case, which is compared to the "Build" Case, where the grant request is awarded, and the project is built as proposed. The BCA assesses the incremental difference between the No Build Case and the Build Case, which represents the net change in welfare. BCAs are forward-looking exercises which seek to assess the incremental change in welfare over a project life cycle. The importance of future welfare changes is determined through discounting, which is meant to reflect both the opportunity cost of capital as well as the societal preference for the present.

The analysis was conducted in accordance with the benefit-cost methodology as recommended by the U.S. DOT in the *BCA Guidance for Discretionary Grant Programs* released in December 2023. This methodology includes the following analytical assumptions:

- Defining existing and future conditions under a No Build scenario and Build scenario;
- Estimating benefits and costs during project construction and operation, including 20 years of operations beyond the Project completion when benefits accrue;
- Using U.S. DOT recommended monetized values for travel time savings, vehicle operating cost savings, pedestrian and bicyclist health benefits and amenities, and emissions, while relying on best practices for monetization of other benefits;
- Presenting dollar values in real 2022 dollars. In instances where cost estimates and benefits valuations are expressed in historical or future dollar years, using an appropriate inflation rate to adjust the values;
- Discounting future benefits and costs with a real discount rate of 3.1 percent; a discount rate of 2 percent is applied to the value of CO_2 emissions.

1.2 Report Contents

The Report illustrates the methodology, assumptions and inputs used in the BCA and an evaluation of its results. Section 2 provides an explanation of the BCA methodology and a description of the project. Section 3 provides an explanation of the project costs. Section 4 provides an outline of the calculation of the benefit categories. Section 5 outlines the summary results of the BCA.

2. Project Overview

2.1 Description

With the planned development of tourist accommodations and amenities in and around the town of Hochatown, there is an urgent need to develop infrastructure to support the reliable and safe access for pedestrian, bicyclists, and roadway users. Hochatown is home to approximately 250 residents; however, on any given weekend, during holidays, or seasonally, the town hosts more than 30,000 people. In 2021, Beavers Bend State Park reported approximately 2.2 million visitors, a daily average of 6,500 people, making it the most visited state park in Oklahoma. Because of the influx of visitors, congestion and associated safety challenges along US-259 are becoming more frequent and are expected to worsen in the foreseeable future.

The existing US-259 within the Project area contains a two-lane undivided roadway with limited shoulder widths and stormwater conveyed through roadside ditches. There are only limited left or right turning lanes, but no existing bicycle or pedestrian facilities. The highway also provides access to over 100 residential and commercial driveways. The Project will improve vehicular movements, enhance overall safety, and provide a reliable infrastructure investment in a rural community that is often overlooked.

2.2 General Assumptions

The BCA requires a number of general assumptions that guide the overall analysis, presented below in Table 1.

Table 1: General Assumptions

Assumption	Value
Base Year Dollars	2023
Capital Cost Adjustment	2023 dollars converted to 2022 dollars using an inflation adjustment factor of 0.9674 (U.S. DOT Guidance)
Real Discount Rate	3.1 percent, excluding 2 percent for CO_2 emissions (consistent with U.S. DOT BCA guidance and OMB Circular A-94)
Environmental/Design/Construction Start Date	2024
Environmental/Design/Construction End Date	2026
Project Opening	2027
End of Analysis Period	2046
Operations Period	20 years (post-construction)

2.3 Build and No-Build Scenario Comparison

The BCA assesses whether a proposed infrastructure investment is economically viable by comparing the quantified benefits to the expected costs of both the Build and No Build/Base Case. Benefits/ disbenefits are estimated through changes in user costs and impacts on the wider community with the project. Net project impacts are measured by comparing benefits to (a) capital costs and (b) ongoing operational expenditures for both the Build and No Build.

The No Build assumes the existing traffic conditions in the SR 259 corridor remain without any improvement. Planned development in the Hochatown area increases the demand for the sparse pedestrian infrastructure and roadway capacity, creating conflict points between pedestrians and roadway users. Bicyclists and pedestrians will continue to complete their trips on constrained sidewalks and a busy highway without protective infrastructure, presenting continued safety risk to users and discouraging trips by walking and biking. The current roadway geometry will continue to perform at constrained levels, resulting in growing roadway congestion and crash risk. Pedestrians trying to access the Hochatown area will complete their trip using inadequate pedestrian sidewalk and intersection infrastructure. The rate of crashes experienced by vehicle users in the SR 259 corridor will continue at historical levels. Residents within the project area will continue to utilize their current choice of mode of travel to complete their trips.

The Build Case assumes the construction of the additional roadway capacity and pedestrian and bicyclist infrastructure in the SR 259 corridor will be completed, encouraging residents in the project area to walk and/or bike to complete their trips. The planned developments in the Hochatown area will increase the attraction to visitors. The installation of marked crosswalks, sidewalks and a shared use path improves the mobility and safety of residents and visitors; installation of streetlights improves safety and comfort during low-light conditions. Enhancements in the roadway geometry improve the flow of traffic in the corridor, managing intersection delay and reducing the risk of vehicle crashes.

3. Project Costs

The expected costs associated with the Project include the capital expenditures for the planning, engineering and construction of the Project and the change in annual operations and maintenance costs for maintaining the operationality of the proposed improvements. Previously expended costs related to the Project have been included in the analysis.

3.1 Project Capital Costs

The Project includes the previously expended and future costs for design, engineering and construction services required to develop all the project elements. The capital expenditures are expressed in year-of-expenditure dollars with 2022 as the base year for the cost estimate of material, labor and services for a total value of $44.4 million. Assuming an annual future escalation rate of 3.0 percent, the costs are converted to constant 2022 dollars for a total value of $40.6 million. Table 2 shows the breakdown of capital expenditures by cost category and year in year-of-expenditure dollars and constant 2022 dollars.

Table 2: Capital Expenditures by Category and Year (in dollars)

Cost Category	2022*	2023	2024	2025	2026	Total
Year-of-Expenditure Dollars						
Environmental, Design and Engineering	$4.7	-	$0.1	-	-	**$4.8**
Construction	-	-	-	$27.7	$11.9	**$39.6**
Total	**$4.7**	**-**	**$0.1**	**$27.7**	**$11.9**	**$44.4**
Adjusted constant 2022 dollars						
Environmental, Design and Engineering	$4.7	-	$0.1	-	-	**$4.8**
Construction	-	-	-	$25.3	$10.5	**$35.8**
Total	**$4.7**	**-**	**$0.1**	**$25.3**	**$10.5**	**$40.6**

*Note: Values of line items may not up to totals due to rounding. *Includes the value of previously expended costs.*

3.2 Project Operations and Maintenance Costs

The annual maintenance costs for all proposed project improvements are estimated to be $358,200 in 2022 dollars. As a lifecycle cost analysis has not been completed for the project elements, the annual maintenance costs are assumed to represent a conservative estimate of additional maintenance represented as one percent of total construction costs; the improvements would be covered by currently planned levels of maintenance. Over the 20-year analysis period, the total maintenance costs for the project improvements are estimated to be $7.2 million in undiscounted 2022 dollars, or $4.7 million when discounted at 3.1 percent. The annual operations and maintenance costs are summarized below in Table 3.

Table 3: Annual Operations and Maintenance Costs (in undiscounted 2022 dollars)

	No Build Scenario	Build Scenario
Total	**-**	**$358,200**

4. Project Impacts

The Project is expected to result in the following impacts to existing and new pedestrian and bicyclist users and roadway traffic users in the SR 259 corridor:

- Pedestrian Safety Improvements Benefits;
- Bicycle and Pedestrian Facility Benefits;
- Bicycle and Pedestrian Health Benefits;
- Reduction in Roadway Crashes;
- Auto and Truck Travel Time Savings;
- Vehicle Operating Costs Savings;
- Vehicle Emissions Reduction;
- Highway Roadway Externalities (Congestion, Safety and Noise); and,
- Residual Value

The quantifying of these benefits is based on a projection of future existing and new users related to their proximity to improved pedestrian and bicyclist facilities and the standardized economic value of those improvements, based on the *U.S. DOT BCA Guidance for Discretionary Grant Programs* published in December 2023.

4.1 Bicyclist and Pedestrian Trip Projections

The analysis projects the number of current and future pedestrian and bicyclist trips in the project area based on the methodology outlined in *NCHRP Report 552 Guidelines for Analysis of Investments in Bicycle Facilities.* [5] The methodology estimates the number of existing and induced adult and child cyclists and pedestrians in the areas around a new facility based on the existing commute share and their relative distance from the facility. Using multipliers measuring the likelihood for a resident to use the facility, the percentage of existing and new pedestrian and bicyclist users from the local population can be derived based on their proximity. Demographic and population data from the Hochatown CDP define the potential population of existing and induced users; the data is extracted from the American Community Survey published by the Census Bureau. The expected population of residents and visitors in Hochatown and their characteristics identified for the analysis are shown below in Table 4.

Table 4: Population and Demographic Data, Town of Hochatown, 2022

	Population			Commute Share[1]	
	Adults	**Children**	**Employed**	**Bike**	**Walk**
Total / Average	**5,686**	**820**	**3,221**	**1.1%**	**2.9%**

(1) The analysis uses the commute share for walking and biking for the state of Oklahoma; the relatively high ratio of visitors to residents is expected to substantially affect the likely share of walking and biking trips. The calculation of the employed population and the commute share by mode is expected to illustrate the likelihood of tourists to travel by walking or biking while in the project area.

Using the demographic and population for Hochatown CDP, the analysis calculates the population density and commute share by mode within a buffer zone around the new facility. The analysis discerns between the adult and child populations in the project area due to differences in their trip purposes (commute and recreational use), participation in activities and the allocation of benefits to each population. Due to the high ratio of visitors to residents, the analysis assumes the population to remain constant into the future to account for the year-to-year fluctuations in the visitor population.

[5] Krizek et al, "NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities", 2006, Transportation Research Board, https://www.trb.org/Main/Blurbs/157244.aspx

The buffer zone identifies the Project's catchment area for existing and induced users; bicycle users within one mile of the facility and pedestrians within 3/8 mile of the facility would be likely to use the facility. Based on the average trip distance of 2.38 miles for bicyclists and 0.86 miles for pedestrians defined in the U.S. DOT BCA guidance documents, the utilization of the facility by users in the project area is estimated based on the location of the access points and the length of the facility. With these assumptions, the number of existing and induced trips and person-miles traveled by pedestrians and bicyclists in the project area can be projected under current and future conditions, shown in Table 5 for the current estimate, project opening year and last analysis year.

Table 5: Projected Pedestrian and Bicycle User-Trips in Project Area

User Population By Mode	2022	2027 (Opening Year)	2046 (Last Analysis Year)
Existing Annual Pedestrian-Trips	17,700	17,700	17,700
Existing Annual Bicycle-Trips	43,500	43,500	43,500
Induced Annual Pedestrian-Trips	-	18,900	18,900
Induced Annual Bicycle-Trips	-	41,500	41,500

4.2 Bicyclist and Pedestrian Benefits

The calculation of benefits to bicyclists and pedestrians is based on the projected user-trips and person-miles by mode and the standardized values for benefits related to facilities and the reduction of mortality risk. The benefits from a new bicycle facility applies to adult and child users, while the reduction in mortality risk applies only to adult users between the ages of 20 to 64. Based on the characteristics of user populations and travel mode within the project area, the analysis evaluates the changes in user-trips and person-miles traveled to most precisely attribute benefits to the users of the Project. The length of the pedestrian infrastructure improvements in the SR 259 corridor is measured at 1.0 miles, while the shared use path is measured at 1.8 miles.

4.2.1 Pedestrian Safety Improvements Benefits

The analysis calculates the benefit of safety improvements for pedestrians in the SR 259 corridor by applying the standardized economic value per person-trip for "Install Marked-Crosswalk on Roadway with Volumes Greater Than 10,000 ADT" to the projected volumes of pedestrian users, based on the definitions for pedestrian infrastructure in the U.S. DOT BCA guidance documents. In the year 2023, the vehicle ADTs traveling north- and southbound on SR 259 were measured at 11,100, meeting the requirements for the identified safety improvement. The analysis assumes the baseline condition of the existing infrastructure includes travel on street-level infrastructure without additional improvements for pedestrians. The improvements in the SR 259 corridor include the following:

- New marked crosswalks will be installed at the intersections of Stevens Gap Road and SH-259A North and South

In addition to the new marked crosswalks, the Project will be replacing the temporary traffic lighting at the intersection of Stevens Gap Road and SH-259A North and South with permanent systems. While the installation of the permanent traffic lights ensures pedestrian users will continue to enjoy the benefits of safer crossings, the analysis assumes existing users already benefits from those improvements. The calculated benefits are based on the projected person-trips (refer to Table 5) using the facility. The economic value per person-trip for the proposed pedestrian infrastructure is $0.19 (Marked Crosswalk) per person-trip generated by the Project above baseline conditions.

Table 6: Economic Value of Pedestrian Safety Improvements on SR 259

	Total Annual Person-Trips		Value of Pedestrian Safety Benefits (2022$)	
	2027	2046	2027	2046
Pedestrian Safety Improvement Benefits by Year	102,700	102,700	$12,500	$12,500

Over the 20-year analysis period, the total value of pedestrian safety improvement benefits is estimated to be $0.3 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of pedestrian facility benefits is calculated to be $0.2 million in discounted 2022 dollars. Table 7 summarizes the monetized value of safety improvements for pedestrians.

Table 7: Pedestrian Safety Improvement Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$251,000**	**$164,000**

4.2.2 Pedestrian Facility Benefits

The analysis calculates the facility benefits related to the proposed project improvements in the SR 259 corridor by applying the standardized economic value per person-mile for an "Expanded Sidewalk" with an additional width of 5 feet on both sides of each roadway, based on the definitions for pedestrian infrastructure in the U.S. DOT BCA guidance documents. The improved infrastructure will consist of 10-foot-wide pedestrian space, split between 5-foot-wide amenity space and a 5-foot-wide sidewalk, on the west side of SR 259 and a 10-foot-wide shared use path on the east side of the corridor; the pedestrian space is assumed to be limited to a 5-foot-wide sidewalk. The calculated benefits are based on the additional person-miles from users in the project area using the improved facilities. The economic value per person-mile for the proposed pedestrian infrastructure is $0.11 per person-mile generated by the Project above baseline conditions. The "rule of half" was applied to the value of the miles from the induced person-trips, per U.S. DOT BCA guidance.

Table 8: Economic Value of Induced Person-Miles by Pedestrians in SR 259 Corridor

	Increase in Annual Person-Miles		Value of Pedestrian Facility Benefits (2022$)	
	2027	2046	2027	2046
Pedestrian Facility Benefits by Year	45,600	45,600	$36,000	$36,000

Over the 20-year analysis period, the total value of pedestrian facility benefits is estimated to be $0.7 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of pedestrian facility benefits is calculated to be $0.5 million in discounted 2022 dollars. Table 9 summarizes the monetized value of facility amenities for pedestrians.

Table 9: Pedestrian Facility Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$721,000**	**$470,000**

4.2.3 Bicycle Facility Benefits

The analysis calculates the facility benefits related to the proposed improvements for the SR 259 corridor by applying the standardized economic value per person-mile for a "Cycling Path with At-Grade Crossing", respectively, based on the definitions for bicyclist infrastructure in the U.S. DOT BCA guidance documents. The analysis assumes the baseline condition of the existing infrastructure includes on-street travel on SR 259 without improvements for bicyclists. The calculated benefits are based on the additional person-miles from new users in the project area using the improved facilities. The economic value per person-mile for the proposed bicycle infrastructure is $1.57 ("Cycling Path with At-Grade Crossings") per person-mile generated by the Project above baseline conditions. The "rule of half" was applied to the value of the miles from the induced bike-trips, per U.S. DOT BCA guidance.

Table 10: Economic Value of Increase in Person-Miles by Bicyclists in Project Area

	Total Person-Miles		Value of Bicycle Facility Benefits (2022$)	
	2027	2046	2027	2046
Bicycle Facility Benefits by Year	**153,000**	**153,000**	**$181,500**	**$181,500**

Over the 20-year analysis period, the total value of bicycle facility benefits is estimated to be $3.6 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of bicycle facility benefits is calculated to be $2.4 million in discounted 2022 dollars. Table 11 summarizes the monetized value of facility amenities for bicyclists.

Table 11: Bicyclist Facility Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$3,631,000**	**$2,367,000**

4.2.4 Bicycle and Pedestrian Health Benefits

The analysis calculates the health benefits related to the proposed improvements in the SR 259 corridor by applying the standardized economic value per induced person-trip for pedestrians and bicyclists between the ages of 20 to 64, based on the definitions in the U.S. DOT BCA guidance documents. The projections of pedestrians and bicyclists break out future induced trips by adults and children, allowing for the calculation of the reduced mortality risk for users within the project area. The standardized value of the health benefits is defined at $6.80 per person-trip for adult bicyclists and $7.63 per person-trip for adult pedestrians.

Table 12: Economic Value of Health Benefits for Pedestrians and Bicyclists in Project Area

	Induced Person-Trips		Value of Health Benefits (2022$)	
	2027	2046	2027	2046
Adult Bicyclists	30,500	30,500	$24,500	$24,500
Adult Pedestrians	45,800	45,800	$36,100	$36,100
Total	**76,300**	**76,300**	**$60,600**	**$60,600**

Over the 20-year analysis period, the total value of pedestrian and bicyclist health benefits is estimated to be $8.8 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of pedestrian and bicyclist health benefits is calculated to be $5.8 million in discounted 2022 dollars. Table 13 summarizes the monetized value of pedestrian and bicyclist health benefits.

Table 13: Pedestrian and Bicyclist Health Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Bicyclist Health Benefits	$3,332,000	$2,173,000
Pedestrian Health Benefits	$5,498,000	$3,587,000
Total Benefits	**$8,830,000**	**$5,760,000**

4.3 Reduction in Crashes Involving Roadway Vehicles

The analysis calculates the reduction in crashes involving roadway vehicles related to the proposed project improvements in the project area by applying the appropriate crash modification factor to the historical average

crashes in the project area, based on crash history from 2014 to 2023 organized by location, crash severity and mode of travel. Based on the characteristics of the project improvements, a percentage of crashes involving roadway vehicles in the project area are expected to be avoided in the future. The detailed crash data for the project area is provided in the tab labeled "Collision Data" in the BCA model spreadsheet file. Given the characteristics of improvements in each segment, the following crash modification factors were assigned to crashes within each project segment:

- Install lighting (CMF ID: 7776) – 32% reduction in crashes; and,
- Install TWLTL (two-way left turn lane) on rural two-lane roads (CMF ID: 583) – 36% reduction in crashes

The crash modification factors reflect the proposed changes in roadway geometry within each project segment. The installation of traffic signals and left-turn lanes would reduce the risk of crashes during turning movements and intersection movements. The summary of crash data by collision severity is shown in the "Crash Data Summary" tab of the BCA model spreadsheet file; crashes are attributed to whether they would benefit from the street lighting or the TWLTL to avoid double-counting. The number of crashes by collision severity are shown below in Table 14.

Table 14: Crash History for Vehicles in Project Area (2012 to 2021)

Crash Severity	Number of Crashes	Annual Average	Annual Avoided Crashes
No Injury	111	11.1	3.8
Possible Injury	48	4.8	1.6
Non-Incapacitating Injury	15	1.5	0.5
Incapacitating Injury	9	0.9	0.3
Fatality	5	0.5	0.2
Injury Severity Unknown	0	-	-
Total	**108**	**10.8**	**6.4**

Over the 20-year analysis period, the total value of avoided crashes involving roadway vehicles is estimated to be $56.9 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of avoided crashes involving roadway vehicles is calculated to be $37.1 million in discounted 2022 dollars. Table 15 summarizes the monetized value of avoided injuries from crashes involving roadway vehicles.

Table 15: Value of Avoided Crashes Involving Roadway Vehicles (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$56,887,000**	**$37,108,000**

4.4 Auto and Truck Traffic Benefits

With the proposed improvements in the roadway geometry, auto and truck traffic in the project area are expected to experience improved traffic conditions during the peak periods, as compared to the No Build conditions. Traffic count data was collected at two sites on SR 259 near Hochatown; the traffic count data included daily totals from July 2022 to January 2024 and hourly totals from July 11 to July 25. The daily traffic count data illustrated the traffic volumes during the week (Monday to Thursday) relative to higher volumes on the weekend (Friday to Sunday); similarly, average daily traffic volumes are higher during the summer season compared to the off-season months. The hourly traffic count illustrates the differences in the distribution of traffic by hour during the week and on the weekend.

Due to the impact of visitor traffic on roadway conditions in Hochatown, the analysis evaluated the impacts of the proposed project improvements on traffic conditions during these distinct periods. These considerations specifically affect the volume/capacity ratio of the roadway under No Build and Build conditions, resulting in differences in the average travel speed for roadway vehicles. Based on these assumptions, the analysis calculates the vehicle-hours traveled for auto and truck traffic under the No Build and Build conditions. In the BCA model spreadsheet file, a

detailed summary of the traffic data is provided in the "Traffic Data Summary" tab and the calculations of the traffic impacts are provided in the "Traffic Data Inputs" tab.

Table 16: Projected Annual Vehicle-Hours Traveled in Project Area

	No Build		Build	
	2027	**2046**	**2027**	**2046**
Vehicle-Hours Traveled (Auto)	328,300	655,700	323,300	571,400
Vehicle-Hours Traveled (Trucks)	30,500	60,900	26,500	46,700
Vehicle-Hours Traveled (Total)	**358,800**	**716,600**	**349,800**	**618,100**

Over the 20-year analysis period, the total value of auto and truck travel time savings is estimated to be $30.4 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of vehicle operating cost savings is calculated to be $17.9 million in discounted 2022 dollars. Table 17 summarizes the monetized value of auto and truck travel time savings.

Table 17: Value of Auto and Truck Travel Time Savings (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Travel Time Savings for Autos	$24,838,000	$14,450,000
Travel Time Savings for Trucks	$5,611,000	$3,429,000
Total Benefits	**$30,449,000**	**$17,879,000**

4.5 Mode-Shift Benefits

With the proposed project improvements, existing and new pedestrian and bicyclist users in the catchment area are expected to be encouraged to differentiate their travel behavior compared to the No Build conditions. The methodology for calculating existing and new pedestrians and bicyclists associated with a new facility is based on demographic data of residents within a catchment area of 3/8 mile and one mile, respectively, from the facility.[6] Under No Build conditions, the new users would be expected to complete their trips by an alternative mode of travel based on a mode-shift profile derived from the National Household Transportation Survey published in 2017.[7] The analysis evaluates the impacts of the percentage of new users who would have otherwise chosen to complete their trip by personal vehicle, if the new facility were not available. The average length of avoided vehicle-trips by pedestrians and bicyclists is based on their average trip length of 2.38 and 0.86 miles, respectively, as defined in the U.S. DOT BCA guidance documents. The calculation of these impacts is based on the avoided vehicle-miles traveled, factors published by the EPA for evaluating vehicle emissions and by the EIA for forecasted fuel efficiency of vehicles. The analysis monetizes the value of these impacts using the standardized factors published by the U.S. DOT.

The calculation of the impacts of the avoided auto vehicle-miles does not include the impacts of roadway conditions experienced by other users in the project area; to evaluate the impacts specific to the Project, all other current impacts on the roadway are assumed to remain constant. The reduction in vehicle-miles traveled results in the reduction of the following: vehicle emissions, vehicle operating costs, roadway safety risk, roadway congestion and noise.

[6] Krizek, et al, *NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities*, pg. 38, Transportation Research Board, 2006

[7] U.S. Department of Transportation, Federal Highway Administration, 2017 National Household Travel Survey. https://nhts.ornl.gov.

Table 18: Avoided Vehicle-Miles Traveled by Mode-Shifted Pedestrians and Bicyclists in Project Area

	Induced Person-Trips		Avoided Vehicle-Miles Traveled	
	2027	2046	2027	2046
Adult Bicyclists	30,500	30,500	30,400	30,400
Adult Pedestrians	45,800	45,800	21,800	21,800
Total	**76,300**	**76,300**	**52,200**	**52,200**

4.5.1 Vehicle Operating Cost Savings

The analysis calculates the reduction in vehicle operating costs, including fuel and non-fuel maintenance, related to the proposed active transportation improvements by applying the standardized economic value per light-duty vehicle-mile traveled, as defined in the U.S. DOT BCA guidance documents. The standardized value of vehicle operating costs for light-duty vehicles is defined at $0.52 per vehicle-mile.

Over the 20-year analysis period, the total value of vehicle operating cost savings is estimated to be $1.1 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of vehicle operating cost savings is calculated to be $0.7 million in discounted 2022 dollars. Table 19 summarizes the monetized value of vehicle operating cost savings.

Table 19: Value of Vehicle Operating Cost Savings (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$1,086,000**	**$708,000**

4.5.2 Highway Roadway Externalities (Congestion, Safety and Noise)

The analysis calculates the reduction in roadway externalities, including roadway congestion, safety and noise, related to the proposed project improvements by applying the standardized economic values per auto vehicle-mile traveled in an urban area, as defined in the U.S. DOT BCA guidance documents. The standardized value of the reduction in roadway externalities are defined as follows:

- Congestion (Auto, Urban): $0.14 per vehicle-mile traveled;
- Safety (Auto, Urban): $0.02 per vehicle-mile traveled; and,
- Noise (Auto, Urban): $0.02 per vehicle-mile traveled

Over the 20-year analysis period, the total value of avoided roadway externalities is estimated to be $0.1 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of avoided roadway externalities is calculated to be $0.1 million in discounted 2022 dollars. Table 20 summarizes the monetized value of avoided highway roadway externalities.

Table 20: Avoided Roadway Externalities Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Highway Roadway Congestion Savings	$30,000	$18,000
Highway Roadway Safety Improvement	$100,000	$65,000
Highway Noise Reduction	$17,000	$11,000
Total Benefits	**$147,000**	**$96,000**

4.5.3 Vehicle Emissions Reduction

The analysis calculates the reduction in vehicle emissions related to the proposed project improvements by applying emissions factors per vehicle-mile traveled and the standardized economic values per metric ton of emissions gas, as defined in the U.S. DOT BCA guidance documents. The emissions factors per vehicle-mile vary by emissions type and the standardized social costs of vehicle emissions vary by year.

Table 21: Avoided Vehicle Emissions in Project Area (in metric tons)

	Avoided Emissions over 20-Year Analysis Period
Emissions – NOx	0.069
Emissions - PM2.5	0.001
Emissions – SOx	0.005
Emissions - CO^2	284

Over the 20-year analysis period, the total value of avoided vehicle emissions is estimated to be $0.1 million in undiscounted 2022 dollars. Assuming a base year of 2022 and real discount rate of 3.1 percent, the net present value of avoided vehicle emissions is calculated to be $0.1 million in discounted 2022 dollars. Table 22 summarizes the monetized value of avoided vehicle emissions.

Table 22: Avoided Vehicle Emissions Benefits (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted @ 3.1%)
Total Benefits	**$84,000**	**$54,000**

4.6 Residual Value

The residual value is calculated by determining the percentage of useful life remaining beyond the analysis period and multiplying that percentage by the construction cost for that component. With a 20-year analysis period and an estimated 30-year design life for the improvements in the project area, the residual value is 33% of the initial cost using the straight-line depreciation method. The remaining capital value is viewed as a cost offset or "negative cost" and is applied to the last year of analysis period as a benefit. The residual value of $11.9 million is discounted back to $5.7 million in discounted 2022 dollars.

Table 23: Residual Value (in 2022 dollars)

	Monetized Value (undiscounted)	Monetized Value (discounted at 3.1%)
Residual Value	**$11,941,000**	**$5,739,000**

5. Benefit-Cost Analysis Results

5.1 Evaluation Measures

The BCA converts potential gains (benefits) and losses (costs) with the Project into monetary units and compares them. The following common benefit-cost evaluation measures are included in this BCA:

- **Net Present Value (NPV):** NPV compares the net benefits (benefits minus costs) after being discounted to present values using the real discount rate assumption. The NPV provides a perspective on the overall dollar magnitude of cash flows over time in today's dollar terms.
- **Benefit Cost Ratio (BCR):** The evaluation also estimates the benefit-cost ratio; the present value of incremental benefits is divided by the present value of incremental costs to yield the benefit-cost ratio. The BCR expresses the relation of discounted benefits to discounted costs as a measure of the extent to which a project's benefits either exceed or fall short of the costs.

- **Internal Rate of Return (IRR):** The IRR is the discount rate which makes the NPV from the Project equal to zero. In other words, it is the discount rate at which the Project breaks even. Generally, the greater the IRR, the more desirable the Project.

5.2 BCA Results

The summary of the benefit-cost analysis is outlined in the table below. The results are in constant 2022 dollars discounted at 3.1 percent, as prescribed by the U.S. DOT BCA Guidance documents. All benefits and costs are calculated in constant 2022 dollars over an evaluation period extending 20 years after the end of construction. The total benefits from the project improvements within the analysis period are calculated to be $65.7 million in discounted 2022 dollars. The total capital costs, including design, engineering, and construction, are calculated to be $37.2 million in discounted 2022 dollars. The difference of the discounted benefits and costs equal a net present value of $28.5 million in discounted 2022 dollars, resulting in a benefit-cost ratio (BCR) of 1.77. The internal rate of return for the project is 8 percent.

Table 24: Summary of Benefit-Cost Analysis (in 2022 dollars)

BCA Metric	Monetized Value	
	Undiscounted	**Discounted**
Total Benefits	**$106,861,000**	**$65,673,000**
Bicycle and Pedestrian Safety and Facility Benefits	$4,602,000	$3,002,000
Bicycle and Pedestrian Health Benefits	$8,830,000	$5,760,000
Reduction in Roadway Crashes	$56,887,000	$37,108,000
Auto and Truck Travel Time Savings	$30,449,000	$17,879,000
Vehicle Operating Costs Savings	$1,086,000	$708,000
Vehicle Emissions Reduction	$84,000	$54,000
Highway Roadway Externalities	$147,000	$96,000
Residual Value	$11,941,000	$5,739,000
Change in O&M Costs	($7,165,000)	($4,674,000)
Total Capital Costs	**$40,628,000**	**$37,200,000**
Net Present Value	**$66,233,000**	**$28,473,000**
Benefit-Cost Ratio	**2.63**	**1.77**
Internal Rate of Return	**8%**	