

Telephone Road Reconstruction

HGAC ID - #1222

Benefit-Cost Analysis

August 2024



The 2024 USDOT Benefit-Cost Analysis (BCA) Guidance for Discretionary Grant Programs forms the basis for the methodologies employed to estimate quantified and, subsequently, monetized benefits for the Telephone Road project.¹ The BCA evaluation process examines the fundamental question of whether the anticipated societal benefits of the project justify the associated costs, acknowledging the inherent difficulty in quantifying some benefits and costs. This analysis examines how the No-Build and Build Scenarios enhance societal benefits over the planning horizon.

This BCA analysis quantifies the net difference between the No-Build and Build Scenarios for the Telephone Road Project (“Project”). The project limits are detailed in Table 1.

Table 1. Project Limits

Street	Terminus A	Terminus B
Telephone Road	South Loop E (Eastbound Frontage Road)	Reveille Street

BCA Result Summary

Benefits and costs in real dollars and discounted real dollars are shown in the table below. The benefit-cost ratio is 4.0 in 2022 real dollars and 2.8 when discounted at 3.1%.

Table 2. BCA Summary

Scenario	\$2022 Real Dollars	\$2022 Real Dollars 3.1% Discount
Benefits	\$153,635,000	\$94,878,000
Costs	\$38,682,000	\$33,908,000
BCA	4.0	2.8

BCA Methodology and Foundations to BCA

The baseline (No-Build) and Build methodology and calculations for each benefit are contained within this technical memorandum, supported by the BCA Excel Workbook. The calculation is based on the following methodologies and general assumptions.

Real Dollars & Discount Rate

All monetized values in the analysis are standardized to 2022 (real dollars). Costs from previous years were adjusted using a 2.79% annual inflation factor, derived from Table A-7 of the 2024 USDOT BCA Guide, to **reflect real dollars in 2022**.¹ The final present-value estimates in this **Benefit-Cost Analysis (BCA) utilized a 3.1% discount rate** recommended by OMB Circular A-94 for both benefits and costs. Real dollars, also known as inflation-free or constant dollars, allow for consistent comparisons over time by negating the effects of inflation.

¹ United States Department of Transportation (2024). Benefit-Cost Analysis Guidance for Discretionary Grant Programs. Retrieved January 2024 from <https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0>

Summarized Costs

The costs for the Project in the year of expenditure amount to \$43,576,000 (nominal dollars). Applying an annual inflation factor of 2.79%, the costs were discounted from the expenditure year to reflect real dollars in 2022. Consequently, the total project cost in 2022 real dollars is \$38,682,000. These costs are discounted at 3.1% from the expenditure year to 2022, resulting in total discounted costs of \$33,908,000.

Table 3. Project Costs

Cost	Nominal \$ Year of Expenditure No Discount	Real \$ \$2022 No Discount	3.1% Discount \$2022
Planning	\$486,000	\$473,000	\$459,000
Design/Environmental	\$3,772,000	\$3,474,000	\$3,170,000
Construction	\$39,317,000	\$34,735,000	\$30,280,000
Project Costs	\$43,576,000	\$38,682,000	\$33,908,000

Planning Horizon

The planning horizon spans from 2022 to 2047, initiating from the project's planning phase. The Project is expected to begin operations in 2028, with a projected 20-year operating period. Consequently, benefits are quantified over the 20-year period from 2028 to 2047.

No-Build Scenario

The No-Build scenario assumes minimal planned improvements to the project corridor's roadway. It considers factors such as future changes in traffic volumes and routine maintenance that would occur irrespective of the proposed project.

Build Scenario

The proposed project is a total reconstruction of Telephone Road from I-610 to Reveille Road. The Project will replace and upgrade roadway, multimodal, and public utility infrastructure (stormwater, water, wastewater) within existing public right-of-way.

The reconstruction of the corridor includes reconfiguring lanes to improve access management and traffic flow, as well as improving lighting, traffic markings, and related signalization. The proposed cross section includes dedicated bike lanes (5-FT) and dedicated sidewalks (6-FT) on both sides of the roadway, which aligns with the Houston Bike Plan. The proposed improvements will provide a safe, contiguous, accessible, dedicated multimodal infrastructure.

Improvements along the project corridor will provide a direct, safe connection to the Sims Bayou Greenway connecting residents to nearby parks and community resources. Several intersecting and adjacent corridors are also identified on the Houston Bike Plan and have "high comfort" bike lanes.

As part of the project scope, existing broken and narrow sidewalks will be replaced with a dedicated, barrier-separated sidewalks on both sides of the roadway for the length of the project corridor. ADA ramps and crosswalks will also be replaced.

Major Key Data Points

To measure the economic value of outcomes to be achieved by a project, several key data points are used throughout the analysis.

Annual Average Daily Traffic

Current and future vehicle daily volumes are obtained from the Texas Department of Transportation (TxDOT) Statewide Planning Map.²

Table 4. Average Daily Traffic Volume

Segment	2028	2047	CAGR
Telephone Road: Telephone Road - Between IH-610 EB Frontage Road and Reveille Street	19,056	20,073	0.27%

Daily Vehicle Miles Traveled

Vehicle miles traveled are calculated by multiplying the daily AADT by the length of the project corridor.

Table 5. Average Daily Vehicle Miles Traveled (Without Modal Diversion)

Segment	Corridor Length Miles	2028	2047
Telephone Road: Telephone Road - Between IH-610 EB Frontage Road and Reveille Street	1.60	30,490	32,116

Daily Vehicle Miles Traveled with Modal Diversion

The benefits of active transportation improvements of the Project are mostly derived from the new projected walking and cycling trips diverted from automobile usage. New daily induced trips are gathered from the Activity-Connectivity Explorer (ACE) Advance viewer interactive web app on H-GAC website. The induced daily trips are multiplied by the pedestrian (0.86 national average walking distance) and bike facility length (2.06 mi) to estimate the VMT reduction derived from modal diversion.

Table 6. Daily VMT Reduced by Modal Diversion

Mode	Daily Induced Demand	Daily Induced Demand	Daily VMT Reduced	Daily VMT Reduced
	2028	2047	2028	2047
Pedestrian	23	30	20	26
Bike	156	201	249	321
Total	179	231	269	347
<i>Transit Total</i>	<i>12,890</i>	<i>13,881</i>	<i>73,089</i>	<i>78,705</i>

² TxDOT – Statewide Planning Map. Accessed on March 2024, from https://www.txdot.gov/apps/statewide_mapping/StatewidePlanningMap.html

Table 7. Average Daily Vehicle Miles Traveled (With Modal Diversion)

Segment	Corridor Length Miles	2028	2047
Telephone Road: Telephone Road - Between IH-610 EB Frontage Road and Reveille Street	1.60	30,221	31,769

Project Specific Monetized Benefits

The 2024 USDOT BCA guidance provides guidance on an array of benefits that can be monetized using parameters provided by the USDOT. Proceeding with the **Build** scenario will yield the following monetizable societal benefits; however, there are also associated disbenefits with the project, as explained below:

Benefit 1: Remaining Useful Life of Asset

The asset is expected to have a 50-year useful life. After 20 years of operation, 60% of its useful life will remain at the end of the planning horizon.

Table 8. Useful Life Monetized Benefits

Useful Life Calculation	No Build	Build
Construction Cost	\$0	\$34,735,000
(x) Remaining Life at End of Planning Horizon		40%
<i>Total in Real \$</i>		<i>\$20,841,000</i>
Total Monetized Benefit Real \$	\$20,841,000	
Total Monetized Benefit Discounted @ 3.1%	\$9,715,000	

Benefit 2: State of Good Repair

Maintenance and user costs associated with the condition of a roadway's surface are significant factors in the decision to continue with the current pavement or to replace it. The capital expenditure required for a reconstruction project may make economic sense if it saves money over the planning horizon. Demonstrating a roadway's current surface condition, or state of good repair (SOGR), and projecting the costs and benefits for alternative maintenance strategies will provide the information needed to make this decision.

Table 9. State of Good Repair Monetized Benefits

State of Good Repair Calculation	No Build	Build
On-Going Maintenance Cost	\$1,534,100	\$280,700
Rehab Cost	\$15,578,200	\$0
Residual Life of Rehab	(\$5,080,500)	\$0
User Costs (Value of Travel Time)	\$11,561,200	\$8,309,700
Vehicle Wear and Tear	\$3,829,200	\$357,100
<i>Total in Real \$</i>	<i>\$27,422,300</i>	<i>\$8,947,600</i>
Total Monetized Benefit Real \$	\$18,475,000	
Total Monetized Benefit Discounted @ 3.1%	\$10,637,000	

Benefit 3: Safety Improvements

The analysis uses the average number of crashes by type over the last 5 years (2019-2023) from TxDOT Crash Record Information System (CRIS) database. The appropriate reduction factor was given by TxDOT based on the 2022 TxDOT Highway Safety Improvement Program (HSIP) work codes, and the damages avoided are quantified using USDOT parameters by injury type.³ A crash can only be assigned to one work code. If multiple work codes are applicable to one crash, the work code with the highest crash reduction rate will be assigned to that crash. For the Project, crashes and corresponding injuries were assigned to codes listed in tables below.

Table 10. Roadway Related Crashes - Injury Data (5-Year Average)

Injury	First Harmful Event - Auto					
	2019	2020	2021	2022	2023	Average (No-Build)
Non-Injury	87	68	88	98	89	86
Possible Injury	16	16	13	11	21	15.4
Non-Incap. Injury	9	5	7	6	5	6.4
Serious Injury	3	1	0	4	8	3.2
Fatality	0	0	0	1	0	0.2
Unknown Injury	15	12	12	21	15	15

³ Texas Department of Transportation (2022). Highway Safety Improvement Manual. Retrieved August 2022 from <https://www.txdot.gov/inside-txdot/forms-publications/publications/highway-safety.html>

Table 11. Roadway Countermeasure #1 - 209, 304 Safety Treat Fixed Objects, Safety Lighting

Injury	Roadway Countermeasure #1 - 209, 304 Safety Treat Fixed Objects, Safety Lighting Reduction Factor: 72% Service Life: 20 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	17	8	20	14	23	16.4	4.6
Possible Injury	3	3	6	1	4	3.4	1.0
Non-Incap. Injury	1	2	1	4	0	1.6	0.4
Serious Injury	0	1	0	1	8	2.0	0.6
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	5	1	2	6	2	3.2	0.9

Table 12. Roadway Countermeasure #2 - 203, 407 Install Raised Median, Install Sidewalks

Injury	Roadway Countermeasure #2 - 203, 407 Install Raised Median, Install Sidewalks Reduction Factor: 37% Service Life: 20 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	25	17	29	39	25	27.0	17.0
Possible Injury	6	9	5	7	3	6.0	3.8
Non-Incap. Injury	6	3	3	1	1	2.8	1.8
Serious Injury	2	0	0	0	0	0.4	0.3
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	5	6	4	7	10	6.4	4.0

Table 13. Roadway Countermeasure #3 - 303, 401 Resurfacing, Install Pavement Markings

Injury	Roadway Countermeasure #3 - 303, 401 Resurfacing, Install Pavement Markings Reduction Factor: 50% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	35	27	20	31	22	27.0	13.5
Possible Injury	6	2	0	3	5	3.2	1.6
Non-Incap. Injury	2	0	2	1	4	1.8	0.9
Serious Injury	1	0	0	0	0	0.2	0.1
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	3	3	3	4	1	2.8	1.4

Table 14. Roadway Countermeasure #4 - 108, 305 Improve Traffic Signals, Safety Lighting at Intersection

Injury	Roadway Countermeasure #4 - 108, 305 Improve Traffic Signals, Safety Lighting at Intersection Reduction Factor: 33% Service Life: 15 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	10	16	19	14	19	15.6	10.5
Possible Injury	1	2	2	0	9	2.8	1.9
Non-Incap. Injury	0	0	1	0	0	0.2	0.1
Serious Injury	0	0	0	3	0	0.6	0.4
Fatality	0	0	0	1	0	0.2	0.1
Unknown Injury	2	2	3	4	2	2.6	1.7

Table 15. Pedestrian Related Crashes - Injury Data (5-Year Average)

Injury	First Harmful Event – Pedestrian					
	2019	2020	2021	2022	2023	Average (No-Build)
Non-Injury	1	1	2	1	0	1.0
Possible Injury	1	1	2	1	0	1.0
Non-Incap. Injury	0	0	0	1	0	0.2
Serious Injury	0	0	1	0	0	0.2
Fatality	0	0	0	0	0	0.0
Unknown Injury	0	0	1	2	0	0.6

Table 16. Pedestrian Countermeasure #1 - 403, 407 Install Pedestrian Crosswalk, Install Sidewalks

Injury	Pedestrian Countermeasure #1 - 403, 407 Install Pedestrian Crosswalk, Install Sidewalks Reduction Factor: 74% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	1	1	2	1	0	1.0	0.3
Possible Injury	1	1	2	1	0	1.0	0.3
Non-Incap. Injury	0	0	0	1	0	0.2	0.1
Serious Injury	0	0	1	0	0	0.2	0.1
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	0	0	1	2	0	0.6	0.2

Table 17. Bicycle Related Crashes - Injury Data (5-Year Average)

Injury	First Harmful Event – Bicycle					
	2019	2020	2021	2022	2023	Average (No-Build)
Non-Injury	0	0	2	0	0	0.4
Possible Injury	0	0	1	0	0	0.2
Non-Incap. Injury	0	0	1	0	0	0.2
Serious Injury	0	0	0	0	0	0.0
Fatality	0	0	0	0	0	0.0
Unknown Injury	0	0	0	0	0	0.0

Table 18. Bicycle Countermeasure #1 - Bicycle Lane on Urban 4-lane Undivided Collectors and Local Roads

Injury	Bicycle Countermeasure #1 - Bicycle Lane on Urban 4-lane Undivided Collectors and Local Roads						
	Reduction Factor: 74%						
	Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	0	0	2	0	0	0.4	0.1
Possible Injury	0	0	1	0	0	0.2	0.1
Non-Incap. Injury	0	0	1	0	0	0.2	0.1
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	0	0	0	0	0	0.0	0.0

Table 19. Safety - Auto Monetized Benefits

Safety - Auto Monetized Benefits	No Build	Build
Countermeasure #1 - 209, 304 Safety Treat Fixed Objects, Safety Lighting	\$78,171,600	\$21,888,000
Countermeasure #2 - 203, 407 Install Raised Median, Install Sidewalks	\$66,555,200	\$41,929,800
Countermeasure #3 - 303, 401 Resurfacing, Install Pavement Markings	\$17,602,000	\$8,801,000
Countermeasure #4 - 108, 305 Improve Traffic Signals, Safety Lighting at Intersection	\$63,243,000	\$42,372,800
<i>Total in Real \$</i>	<i>\$225,571,800</i>	<i>\$114,991,600</i>
Total Monetized Benefit Real \$	\$110,580,000	
Total Monetized Benefit Discounted @ 3.1%	\$71,759,000	

Table 20. Safety – Pedestrian Monetized Benefits

Safety – Pedestrian Monetized Benefits	No Build	Build
Countermeasure #1 - 403, 407 Install Pedestrian Crosswalk, Install Sidewalks	\$5,317,000	\$1,382,000
<i>Total in Real \$</i>	<i>\$5,317,000</i>	<i>\$1,382,000</i>
Total Monetized Benefit Real \$	\$3,934,000	
Total Monetized Benefit Discounted @ 3.1%	\$2,866,000	

Table 21. Safety – Bicycle Monetized Benefits

Safety – Bicycle Monetized Benefits	No Build	Build
Countermeasure #1 - Bicycle Lane on Urban 4-lane Undivided Collectors and Local Roads	\$711,000	\$185,000
<i>Total in Real \$</i>	<i>\$711,000</i>	<i>\$185,000</i>
Total Monetized Benefit Real \$	\$526,000	
Total Monetized Benefit Discounted @ 3.1%	\$383,000	

Table 22. Safety – Total Benefits

Safety – Total Benefits	No Build	Build
Auto	\$225,571,800	\$114,991,600
Pedestrian	\$5,317,000	\$1,382,000
Bicycle	\$711,000	\$185,000
<i>Total in Real \$</i>	<i>\$231,599,800</i>	<i>\$116,558,600</i>
Total Monetized Benefit Real \$	\$115,040,000	
Total Monetized Benefit Discounted @ 3.1%	\$75,008,000	

Benefit 4: Value of Time

The impact of a project on congestion can be measured through the value of travel time (VoTT) on the network. Travel time has a direct relationship with overall network congestion. The more congested a roadway or network is, the longer the travel time is, thereby increasing person hours traveled. The methodology for determining congestion benefits uses Synchro software to analyze delay reduction at intersections with a micro-level model during the AM and PM peak hour. This method requires collecting the current traffic counts, including pedestrian counts, along the affected roadways and project the future volume under the Build and No-build scenarios. The Synchro analysis shows the operational impacts of the proposed Project, which includes intersection delay (see table below).

Table 23. Delay Seconds Per Vehicle 2028

Intersection	Delay (Sec/Vehicle) (2028)	
	AM	PM
Telephone Rd. @ IH 610 WB Frontage Rd.	19.1	19.7
Telephone Rd. @ IH 610 EB Frontage Rd.	20.9	22.1
Telephone Rd. @ Golfway St./Woodridge Dr.	21.9	58.4
Telephone Rd. @ Briefway St.	15.3	16.1
Telephone Rd. @ Southway Dr.	19.0	18.9
Telephone Rd. @ Fairway Dr.	20.0	14.4
Telephone Rd. @ Gammage St.	16.5	20.5
Telephone Rd. @ Winfree Dr.	14.0	18.6
Telephone Rd. @ Eppes St.	20.2	25.8
Telephone Rd. @ McHenry St N. (Eastbound)	14.2	19.3
Telephone Rd. @ McHenry St S. (Westbound)	20.2	15.7
Telephone Rd. @ Kinney St.	13.7	16.7
Telephone Rd. @ Gillen St.	13.3	14.7
Telephone Rd. @ Joplin St.	92.7	21.3
Telephone Rd. @ Long Dr./Park Pl Blvd.	43.2	48.5
Telephone Rd. @ Edna St.	15.4	23
Telephone Rd. @ Moline St. - Westbound	35.2	95.8
Telephone Rd. @ Moline St. - Eastbound	46.9	58.4
Telephone Rd. @ Buena Vista St.	17.9	17.8
Telephone Rd. @ Dixie Dr.	18.4	14.6
Telephone Rd. @ El Rancho St.	22.3	20.8
Telephone Rd. @ La Paseo St.	107.3	36.3
Telephone Rd. @ Hereford St.	14.9	21.6
Telephone Rd. @ Oak Vista St.	19.0	21.7
Telephone Rd. @ Vista Verde St.	15.6	16.5
Telephone Rd. @ Westover St.	32.2	9.1
Telephone Rd. @ Stanwick Dr.	26.7	139.5

Table 24. Delay Seconds Per Vehicle 2048

Delay (Sec/Vehicle) (2048)	No-build		Build	
Intersection	15.2	18.0	15.2	18.0
Telephone Rd. @ IH 610 WB Frontage Rd.	16.5	20.7	16.5	20.7
Telephone Rd. @ IH 610 EB Frontage Rd.	22.9	76.1	23.2	76.1
Telephone Rd. @ Golfway St./Woodridge Dr.	14.6	15.0	15.3	20.1
Telephone Rd. @ Briefway St.	18.1	18.3	25.6	32.1
Telephone Rd. @ Southway Dr.	7.9	6.9	7.9	6.9
Telephone Rd. @ Fairway Dr.	14.4	19.4	20.2	32.7
Telephone Rd. @ Gammage St.	14.5	18.4	20.3	29.4
Telephone Rd. @ Winfree Dr.	20.7	24.9	42.5	56.3
Telephone Rd. @ Eppes St.	14.9	17.6	21.1	26.8
Telephone Rd. @ McHenry St N. (Eastbound)	18.9	15.8	31.6	23.6
Telephone Rd. @ McHenry St S. (Westbound)	14.3	17.6	19.5	27.8
Telephone Rd. @ Kinney St.	13.9	13.6	18.4	15.8
Telephone Rd. @ Gillen St.	50.5	18.2	49.0	17.6
Telephone Rd. @ Joplin St.	31.6	45.7	31.6	46.8
Telephone Rd. @ Long Dr./Park Pl Blvd.	15.3	23.3	15.2	22.9
Telephone Rd. @ Edna St.	39.9	46.5	37.7	40.8
Telephone Rd. @ Moline St. - Westbound	36.6	69.0	34.5	58.5
Telephone Rd. @ Moline St. - Eastbound	18.2	16.1	18.1	16.0
Telephone Rd. @ Buena Vista St.	10.7	16.2	8.7	15.3
Telephone Rd. @ Dixie Dr.	22.1	22.8	22.1	22.6
Telephone Rd. @ El Rancho St.	38.8	39.9	32.5	34.1
Telephone Rd. @ La Paseo St.	14.2	30.3	14.2	17.0
Telephone Rd. @ Hereford St.	18.2	20.2	18.1	19.2
Telephone Rd. @ Oak Vista St.	15.6	16.4	15.6	16.3
Telephone Rd. @ Vista Verde St.	29.5	9.7	34.3	7.4
Telephone Rd. @ Westover St.	34.7	116.5	26.5	61.5
Telephone Rd. @ Stanwick Dr.	15.2	18.0	15.2	18.0

The 2023 USDOT BCA Guidance provides recommended hourly values (\$2022) of travel time savings for occupants of passenger vehicles (\$19.60/person-hour and 1.67 persons per vehicle) and for commercial vehicle operators (\$33.50/person-hour). A separate value is provided for reductions in other components or aspects of travel time, including walking, cycling, waiting time, transfer time, and time spent standing in a crowded transit vehicle (\$35.80/person-hour). The factors are multiplied by the total hours of delay experienced by each person derived from the delay seconds per vehicle above (note each vehicle is assumed to have 1.67 persons per vehicle).

Table 25. Value of Time Benefits

Value of Time Calculation	No Build	Build
Auto Vehicles	\$190,082,400	\$198,193,400
Commercial Vehicles	\$6,639,000	\$6,922,300
<i>Total in Real \$</i>	<i>\$196,721,400</i>	<i>\$205,115,700</i>
Total Monetized Benefit Real \$	(\$8,394,000)	
Total Monetized Benefit Discounted @ 3.1%	(\$5,278,000)	

Benefit 5: Emissions

The Project will install new sidewalks that can accommodate both pedestrians and bicyclists, these amenities will result in modal shift with a reduction in overall VMT.

H-GAC models NOx using the following emissions factor:

- Nitrogen Oxides (NOx): 0.19 grams (g) per VMT

United Environmental Protection Agency (EPA) uses the following emissions factor for CO₂:⁴

- Carbon Dioxide (CO₂): 0.0089 metric tons per gallon of gasoline used.

NOx and CO₂ have measurable societal economic impacts on the economy. The 2023 USDOT BCA Guide provides recommended monetized values of damage costs for NOx and CO₂ emissions per metric ton by year between 2022 and 2050. These values are used to calculate the Project’s benefit derived from the reduction of harmful air pollutants.

Table 26. Emission Benefits

Emission Calculation	No Build	Build
Nitrogen Oxides (NOx)	\$713,750	\$631,800
Carbon Dioxide (CO ₂)	\$1,320,250	\$1,051,750
<i>Total in Real \$</i>	<i>\$2,034,000</i>	<i>\$1,683,550</i>
Total Monetized Benefit Real \$	\$350,000	
Total Monetized Benefit Discounted @ 3.1%	\$223,000	

Benefit 6: Facility Improvements

Improvements to pedestrian, cycling, transit facilities, and transit vehicles often provide amenities that can improve the quality and comfort of journeys made by active transportation (e.g., cyclists and pedestrians) and public transportation users. The improvements will not only benefit the existing users, but also encourage more people walking, biking, and using public transit. The methodology used to estimate new active or public transportation demand is explained in the Major Key Data Points section on page 3. The 2023 USDOT BCA Guidance provides recommended monetized values for facility improvement benefits based on research on system users’ preferences.

4 Environmental Protection Agency. (n.d.). EPA. Retrieved April 2024, from <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

Sidewalk Expansion Benefit = \$0.11 * Added Width (foot) * (½ New Walking Trips) * Trip Length

Trip Length = Proposed Length of Expanded Sidewalk or 0.86 Miles (whichever is smaller)

Cycling Facility Improvement Benefit = Value per Cycling Mile * (½ New Cycling Trips) * Trip Length

Trip Length = Proposed Cycling Facility Length or 2.38 Miles (whichever is smaller)

Table 27. Facility Improvements Benefits

Facility Improvements Calculation	No Build	Build
Pedestrian Facility	\$0	\$788,000
Bike Facility	\$0	\$1,627,000
<i>Total in Real \$</i>	<i>\$0</i>	<i>\$2,415,000</i>
Total Monetized Benefit Real \$	\$2,415,000	
Total Monetized Benefit Discounted @ 3.1%	\$1,507,000	

Benefit 7: Mortality Reduction

To monetize the reduction in mortality risks associated with increased walking, the 2023 USDOT BCA Guide recommends \$7.20 (\$2021) per induced walking trip. This is based on the following factors: an assumed average walking speed of 3.2 miles per hour, an assumed average age of the relevant age range (20-74 years) of 45, a corresponding baseline mortality risk of 267.1 per 100,000, an annual risk reduction of 8.6 percent per daily mile walked, and an average walking trip distance of 0.86 miles. This monetized value can only be applied to trips induced from non-active transportation modes within the relevant age range. A general assumption of 68% of overall induced trips falling into the walking age range (20-74 years), assuming a distribution matching the national average, is applied in the absence of more localized data on the proportion of the expected users falling into the age range.

Mortality Reduction Benefits = Number of New Walking Trips Induced from Non-Active Transportation Modes * 68% * \$7.20

The 2023 USDOT BCA Guide recommends \$6.42 (\$2021) per induced cycling trip to monetize reduced mortality risks associated with increased cycling. It is based on an assumed average cycling speed of 9.8 miles per hour, an assumed average age of the relevant age range (20-64 years) of 42, a corresponding baseline mortality risk of 217.9 per 100,000, an annual risk reduction of 4.3 percent per daily mile cycled, and an average cycling trip distance of 2.38 miles. This monetization value can only be applied to trips induced from non-active transportation modes within the relevant age ranges. A general assumption of 59% of overall induced trips falling into the cycling age range (20-64 years), assuming a distribution matching the national average, is applied in the absence of more localized data on the proportion of the expected users falling into the age range.

Mortality Reduction Benefits = Number of New Cycling Trips Induced from Non-Active Transportation Modes * 59% * \$6.42

Table 28. Mortality Reduction Monetized Benefits

Mortality Reduction Calculation	No Build	Build
Pedestrian Facility	\$3,432,917	\$2,720,425
Bike Facility	\$3,701,000	\$0
<i>Total in Real \$</i>	<i>\$7,133,917</i>	<i>\$2,720,425</i>
Total Monetized Benefit Real \$	\$4,413,000	
Total Monetized Benefit Discounted @ 3.1%	\$2,755,000	

Benefit 8: Other Externalities

The 2023 USDOT BCA Guide provides recommended monetized values for external highway use costs. The recommended costs per vehicle mile traveled including all kinds of vehicles in urban locations are \$0.144 for congestion and \$0.0048 for noise.

Other Externalities Reduction = VMT * (\$0.144+\$0.0048)
VMT = Vehicle Miles Traveled Reduced because of Modal Diversion

Table 29. Other Externalities Monetized Benefits

Other Externalities Calculation	No Build	Build
Congestion Externality	\$2,359,000	\$1,879,000
Noise Externality	\$78,000	\$62,000
<i>Total in Real \$</i>	<i>\$2,437,000</i>	<i>\$1,942,000</i>
Total Monetized Benefit Real \$	\$495,000	
Total Monetized Benefit Discounted @ 3.1%	\$311,000	

Summary of Benefits and Costs

The table below summarizes the Project benefits detailed above.

Table 30. Project Benefits Summary

Benefit #	Benefit Name	Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	\$2022 Monetized Value	\$2022 Real Dollars 3.1% Discount Rate
1	Remaining Useful Life of Asset	The current asset has 0% remaining useful life	Replace infrastructure within public right-of-way	Extend useful life	\$20,841,000	\$9,715,000
2	State of Good Repair	Ongoing expensive maintenance of roadway pavement	Low maintenance required of new facility through the planning horizon	Maintenance cost savings	\$18,475,000	\$10,637,000
3	Safety Benefits	Outdated design, disproportionally higher crash rates	Safety improvement resulting in reduction in traffic crashes	Reduced crashes resulting in reduced fatalities and injuries	\$115,040,000	\$75,008,000
4	Value of Travel Time	The current facilities lead to delay of users.	Improvements to the current facilities will reduce delay	Travel time savings	(\$8,394,000)	(\$5,278,000)
5	Emissions Reduction	The current facilities are not conducive for active transportation	Improvements to the existing facilities will induce demand for walking and biking	Reduced emission derived from modal shift from driving personal vehicles to walking and biking	\$350,000	\$223,000
6	Facility Improvements	The current facilities are not conducive for active transportation or using transit	Improvements to the current facilities will improve the quality or comfort of journeys	Improved comfort for active transportation and public transportation users	\$2,415,000	\$1,507,000

Benefit #	Benefit Name	Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	\$2022 Monetized Value	\$2022 Real Dollars 3.1% Discount Rate
7	Mortality Reduction Benefits	Roadway is not conducive for active transportation.	New and improved active transportation facilities will encourage more walking and cycling	Reduced mortality risks associated with increased walking and cycling	\$4,413,000	\$2,755,000
8	Externalities Reduction	Roadway is not conducive for active transportation.	New and improved facilities will encourage more walking and cycling	Reduced various externalities	\$495,000	\$311,000
Totals					\$153,635,000	\$94,878,000