Aldine-Westfield Road

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 Aldine-Westfield 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 Aldine-Westfield Road Project ("Project"). The project limits are detailed in Table 1.

Table 1. Project Limits

Street	Terminus A	Terminus B
Aldine-Westfield Road	S of Little York Road	700 feet south of Beltway 8 (Intercontinental Park Blvd)

BCA Result Summary

Benefits and costs in real dollars and discounted real dollars are shown in the table below. The benefit-cost ratio is 3.1 in 2022 real dollars and 2.0 when discounted at 3.1%.

Table 2. BCA Summary

Scenario	$2022 Real Dollars	$2022 Real Dollars 3.1% Discount
Benefits	$549,088,000	$299,548,000
Costs	$179,652,000	$149,273,000
BCA	3.1	2.0

BCA Methodology and Foundations

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 $212,663,000 (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 $179,652,000. These costs are discounted at 3.1% from the expenditure year to 2022, resulting in total discounted costs of $149,273,000.

Table 3. Project Costs

Cost	Nominal $ Year of Expenditure No Discount	Real $ $2022 No Discount	3.1% Discount $2022
Planning	$815,000	$771,000	$725,000
Design/Environmental	$25,014,000	$22,715,000	$20,415,000
Construction	$186,835,000	$156,166,000	$128,132,000
Project Costs	$212,663,000	$179,652,000	$149,273,000

Planning Horizon

The planning horizon spans from 2024 to 2050, 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 Build scenario entails the execution of the proposed project. The Aldine-Westfield Road project involves a complete road reconstruction, including new subsurface utilities, a stormwater conveyance system, and a shared-use path to accommodate pedestrians and bicyclists. The project will expand the current 2-lane undivided asphalt road into a 4-lane divided concrete roadway with a raised median. It also includes the relocation of utilities. Major intersection improvements will be implemented to enhance traffic flow and safety, including upgraded traffic signals, additional turning lanes, and improved pavement markings.

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 adding this new link into the 2024 H-GAC Travel Demand Model and subsequent outputs.

Table 4. Average Daily Traffic Volume

Segment	2031	2050	CAGR
Aldine Westfield Rd- Intercontinental Park Blvd -> Little York Rd	14,036	19,323	1.70%

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	2031	2050
Aldine Westfield Rd- Intercontinental Park Blvd -> Little York Rd	4.60	64,567	88,888

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 facility length (0.86 mi) and the bike facility length (2.36) to estimate the VMT reduction derived from modal diversion.

Table 6. Daily VMT Reduced by Modal Diversion

Mode	Daily Induced Demand 2031	Daily Induced Demand 2050	Daily VMT Reduced 2031	Daily VMT Reduced 2050
Pedestrian	90	124	77	107
Bike	187	257	441	221
Total	277	381	518	328

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

Segment	Corridor Length Miles	2031	2050
Aldine Westfield Rd- Intercontinental Park Blvd -> Little York Rd	4.6	64,049	88,560

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

Useful Life Calculation	No Build	Build
Construction Cost	$0	$156,166,000
(x) Remaining Life at End of Planning Horizon		60%
Total in Real $	*$0*	$93,700,000
Total Monetized Benefit Real $ (Build - No Build)	**$93,700,000**	
Total Monetized Benefit Discounted @ 3.1% (Build – No Build)	**$39,856,000**	

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 can 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

State of Good Repair Calculation	No Build	Build
On-Going Maintenance Cost	$1,519,300	$439,800
Rehab Cost	$15,492,300	$0
Residual Life of Rehab	($2,526,200)	$0
User Costs (Value of Travel Time)	$74,458,300	$34,317,700
Vehicle Wear and Tear	$6,643,900	$779,400
Total in Real $	*$95,587,600*	*$35,536,800*
Total Monetized Benefit Real $ (No Build – Build)	**$60,050,800**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$32,021,100**	

Benefit 3: Safety Improvements

The analysis uses the average number of crashes by type over the last 5 years (2018-2022) from TxDOT Crash Record Information System (CRIS) database. The appropriate reduction factor is provided 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.[2] 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	310	240	306	415	391	332.4
Possible Injury	51	33	54	35	44	43.4
Non-Incap. Injury	21	25	13	28	21	21.6
Serious Injury	3	12	8	11	3	7.4
Fatality	1	0	1	0	0	0.4
Unknown Injury	35	25	38	41	52	38.2

2 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 - 108 Improve Traffic Signals

Injury	Roadway Countermeasure #1 - 108 Improve Traffic Signals Reduction Factor: 24% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	16	11	23	35	19	20.8	15.8
Possible Injury	3	8	13	9	15	9.6	7.3
Non-Incap. Injury	3	0	1	4	8	3.2	2.4
Serious Injury	0	1	2	4	1	1.6	1.2
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	7	1	2	3	6	3.8	2.9

Table 12. Roadway Countermeasure #2 - 108, 110, 407 Improve Traffic Signals, Install Pedestrian Signal, Install Sidewalks

Injury	Roadway Countermeasure #2 - 108, 110, 407 Improve Traffic Signals, Install Pedestrian Signal, Install Sidewalks Reduction Factor: 42% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	1	8	16	12	6	8.6	5.0
Possible Injury	1	1	4	3	0	1.8	1.0
Non-Incap. Injury	0	0	2	0	0	0.4	0.2
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	0	1	1	0	1	0.6	0.3

Table 13. Roadway Countermeasure #3 - 108, 131, 407 Improve Traffic Signals, Improve Pedestrian Signal, Install Sidewalks

Injury	Roadway Countermeasure #3 - 108, 131, 407 Improve Traffic Signals, Improve Pedestrian Signal, Install Sidewalks Reduction Factor: 38% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	4	11	11	7	5	7.6	4.7
Possible Injury	3	0	2	0	3	1.6	1.0
Non-Incap. Injury	0	2	0	1	0	0.6	0.4
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	0	2	0	3	1	1.2	0.7

Table 14. Roadway Countermeasure #4 - 203, 407 Install Raised Median, Install Sidewalks

Injury	Roadway Countermeasure #4 - 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	8	11	5	3	6	6.6	4.2
Possible Injury	2	1	2	4	0	1.8	1.1
Non-Incap. Injury	0	0	0	0	0	0.0	0.0
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	1	1	0	0	5	1.4	0.9

Table 15. Roadway Countermeasure #5 - 209, 304 Safety Treat Fixed Objects, Safety Lighting

Injury	Roadway Countermeasure #5 - 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	60	33	54	95	96	67.6	18.9
Possible Injury	14	7	0	9	7	7.4	2.1
Non-Incap. Injury	6	2	5	9	9	6.2	1.7
Serious Injury	2	1	1	6	1	2.2	0.6
Fatality	0	0	1	0	0	0.2	0.1
Unknown Injury	12	5	12	12	14	11.0	3.1

Table 16. Roadway Countermeasure #6 - 209, 517 Safety Treat Fixed Objects, Add Through Lane

Injury	Roadway Countermeasure #6 - 209, 517 Safety Treat Fixed Objects, Add Through Lane Reduction Factor: 64% Service Life: 20 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	37	43	37	54	59	46.0	16.6
Possible Injury	5	3	5	2	0	3.0	1.1
Non-Incap. Injury	1	1	0	3	1	1.2	0.4
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	2	4	7	6	2	4.2	1.5

Table 17. Roadway Countermeasure #7 - 521 Add Right Turn Lane

Injury	Roadway Countermeasure #7 - 521 Add Right Turn Lane Reduction Factor: 25% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	37	18	35	10	26	25.2	18.9
Possible Injury	3	3	5	0	1	2.4	1.8
Non-Incap. Injury	2	3	1	0	0	1.2	0.9
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	1	2	4	3	2	2.4	1.8

Table 18. Roadway Countermeasure #8 - 522 Lengthen Right Turn Lane

Injury	Roadway Countermeasure #8 - 522 Lengthen Right Turn Lane Reduction Factor: 40% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	0	0	0	0	7	1.4	1.1
Possible Injury	0	0	0	0	1	0.2	0.2
Non-Incap. Injury	0	0	0	0	0	0.0	0.0
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	3	0.6	0.5

Table 19. Roadway Countermeasure #9 - 538 Convert 2 Lane Facility to 4 Lane Divided

Injury	Roadway Countermeasure #9 - 538 Convert 2 Lane Facility to 4 Lane Divided Reduction Factor: 45% Service Life: 20 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	18	7	4	19	7	11.0	8.3
Possible Injury	1	1	0	0	4	1.2	0.9
Non-Incap. Injury	1	0	0	0	0	0.2	0.2
Serious Injury	0	0	0	0	0	0.0	0.0
Fatality	0	0	0	0	0	0.0	0.0
Unknown Injury	2	1	1	0	5	1.8	1.4

Table 20. Roadway Countermeasure #10 - 401 Install Pavement Markings

Injury	Roadway Countermeasure #10 - 401 Install Pavement Markings Reduction Factor: 20% Service Life: 4 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	129	98	121	180	160	137.6	103.2
Possible Injury	19	9	23	8	13	14.4	10.8
Non-Incap. Injury	8	17	4	11	3	8.6	6.5
Serious Injury	1	10	5	1	1	3.6	2.7
Fatality	1	0	0	0	0	0.2	0.2
Unknown Injury	10	8	11	14	13	11.2	8.4

Table 21. Pedestrian Related Crashes - Injury Data (5-Year Average)

Injury	First Harmful Event – Pedestrian					
	2019	2020	2021	2022	2023	Average (No-Build)
Non-Injury	4	2	0	0	0	*1.2*
Possible Injury	2	2	1	1	0	*1.2*
Non-Incap. Injury	1	1	0	0	0	*0.4*
Serious Injury	0	0	1	0	0	*0.2*
Fatality	0	0	0	0	0	*0.0*
Unknown Injury	1	1	2	1	0	*1.0*

Table 22. Pedestrian Countermeasure #1 - 407 Install Sidewalks

Injury	Pedestrian Countermeasure #1 - 407 Install Sidewalks Reduction Factor: 65% Service Life: 10 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	0	0	0	0	0	*0.0*	*0.0*
Possible Injury	0	0	1	0	0	*0.2*	*0.1*
Non-Incap. Injury	0	0	0	0	0	*0.0*	*0.0*
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	1	0	0	*0.2*	*0.1*

Table 23. Bicycle Related Crashes - Injury Data (5-Year Average)

Injury	First Harmful Event – Bicycle					
	2019	2020	2021	2022	2023	Average (No-Build)
Non-Injury	1	0	0	1	0	*0.4*
Possible Injury	1	0	0	0	0	*0.2*
Non-Incap. Injury	0	0	0	1	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 24. Bicycle Countermeasure #1 - Buffered bicycle lane on 2-lane roads

Injury	Bicycle Countermeasure #1 - Buffered bicycle lane on 2-lane roads Reduction Factor: 63% Service Life: 20 Years						
	2019	2020	2021	2022	2023	Average (No-Build)	Average (Build)
Non-Injury	1	0	0	0	0	*0.2*	*0.1*
Possible Injury	1	0	0	0	0	*0.2*	*0.1*
Non-Incap. Injury	0	0	0	0	0	*0.0*	*0.0*
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 25. Safety - Auto

Safety - Auto	No Build	Build
Countermeasure #1: 108 Improve Traffic Signals	$46,524,800	$35,358,848
Countermeasure #2: 108, 110, 407 Improve Traffic Signals, Install Pedestrian Signal, Install Sidewalks	$4,681,400	$2,715,212
Countermeasure #3: 108, 131, 407 Improve Traffic Signals, Improve Pedestrian Signal, Install Sidewalks	$6,181,200	$3,832,344
Countermeasure #4: 203, 407 Install Raised Median, Install Sidewalks	$10,774,000	$6,787,620
Countermeasure #5: 209, 304 Safety Treat Fixed Objects, Safety Lighting	$202,435,600	$56,681,968
Countermeasure #6: 209, 517 Safety Treat Fixed Objects, Add Through Lane	$35,191,600	$12,668,976
Countermeasure #7: 521 Add Right Turn Lane	$11,968,800	$8,976,600
Countermeasure #8: 522 Lengthen Right Turn Lane	$1,599,000	$1,199,250
Countermeasure #9: 538 Convert 2 Lane Facility to 4 Lane Divided	$12,549,600	$9,412,200
Countermeasure #10: 401 Install Pavement Markings	$54,087,200	$40,565,400
Total in Real $	*$385,993,200*	*$178,198,418*
Total Monetized Benefit Real $ (No Build – Build)	**$207,795,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$123,629,000**	

Table 26. Safety – Pedestrian

Safety – Pedestrian	No Build	Build
Countermeasure #1 - 407 Install Sidewalks	$658,600	$230,510
Total in Real $	$658,600	$230,510
Total Monetized Benefit Real $ (No Build – Build)	**$428,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$285,000**	

Table 27. Safety – Bicycle

Safety – Bicycle	No Build	Build
Countermeasure #1 - Buffered bicycle lane on 2-lane roads	$466,800	$172,716
Total in Real $	$466,800	$172,716
Total Monetized Benefit Real $ (No Build – Build)	**$294,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$170,000**	

Table 28. Safety – All Modes

Safety – All Modes	No Build	Build
Auto	$385,993,200	$178,198,418
Pedestrian	$658,600	$230,510
Bicycle	$466,800	$172,716
Total in Real $	*$387,118,600*	*$178,601,644*
Total Monetized Benefit Real $ (No Build – Build)	**$208,517,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$124,084,000**	

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 29. Delay Seconds Per Vehicle 2027

Delay (Sec/Vehicle) (2027)	No-Build		Build	
Intersection	**AM**	**PM**	**AM**	**PM**
Aldine Westfield Rd and Little York Rd	35.10	31.90	26.90	29.00
Aldine Westfield Rd and Hopper Rd	13.30	14.20	16.60	15.10
Aldine Westfield Rd and Aldine Mail Rd	17.40	16.10	17.60	15.20
Aldine Westfield Rd and Lauder Rd	79.40	64.20	17.60	16.40
Aldine Westfield Rd and Aldine Bender Rd	186.30	185.40	31.60	29.00

Table 30. Delay Seconds Per Vehicle 2047

Delay (Sec/Vehicle) (2047)	No-Build		Build	
Intersection	**AM**	**PM**	**AM**	**PM**
Aldine Westfield Rd and Little York Rd	48.20	51.00	35.10	39.10
Aldine Westfield Rd and Hopper Rd	16.40	19.90	18.40	17.90
Aldine Westfield Rd and Aldine Mail Rd	68.10	50.90	27.90	19.80
Aldine Westfield Rd and Lauder Rd	192.70	142.00	20.60	18.20
Aldine Westfield Rd and Aldine Bender Rd	365.10	380.80	53.00	63.10

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 31. Value of Travel Time

Value of Time Calculation	No Build	Build
Auto Vehicles	$195,675,028	$50,778,511
Commercial Vehicles	$6,620,370	$1,718,015
Total in Real $	$202,295,399	$52,496,526
Total Monetized Benefit Real $ (No Build – Build)	**$149,799,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$81,618,000**	

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 (NO_X): 0.19 grams (g) per VMT

United Environmental Protection Agency (EPA) uses the following emissions factor for CO_2:[3]

- Carbon Dioxide (CO_2): 0.0089 metric tons per gallon of gasoline used.

NOx and CO_2 have measurable societal economic impacts on the economy. The 2023 USDOT BCA Guide provides recommended monetized values of damage costs for NOx and CO_2 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 32. Emission

Emission Calculation	No Build	Build
Nitrogen Oxides (NO_X)	$7,350	$2,630
Carbon Dioxide (CO_2)	$21,115,260	$8,778,450
Total in Real $	*$21,122,610*	*$8,781,080*
Total Monetized Benefit Real $ (No Build – Build)	**$12,341,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$8,226,000**	

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 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.

3 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 33. Facility Improvements Benefits

Facility Improvements Calculation	No Build	Build
Pedestrian Facility	N/A	$549,505
Bike Facility	N/A	$3,002,504
Total in Real $	*N/A*	*$3,553,000*
Total Monetized Benefit Real $ (Build – No Build)	**$3,553,000**	
Total Monetized Benefit Discounted @ 3.1% (Build – No Build)	**$2,016,000**	

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 45 within the relevant age range (20-74 years), 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 42 within the relevant age range (20-64 years), 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 34. Mortality Reduction

Mortality Reduction Calculation	No Build	Build
Pedestrian Facility	$2,862,000	$716,000
Bike Facility	$4,593,000	$0
Total in Real $	*$7,455,000*	*$716,000*
Total Monetized Benefit Real $ (No Build – Build)	**$6,740,000***	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$3,825,000**	

Benefit 8: Other Externalities

The 2023 USDOT BCA Guide provides recommended monetized values for externalities associated with highway use. 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 35. Other Externalities

Other Externalities Calculation	No Build	Build
Congestion Externality	$510,900	$18,300
Noise Externality	$16,900	$600
Total in Real $	*$527,800*	*$18,900*
Total Monetized Benefit Real $ (No Build – Build)	**$509,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$289,000**	

Benefit 9: Auto Fuel Consumption

Fuel consumption is modeled through Synchro for the AM and PM peak hours in the No-Build and Build scenarios. The 2021 U.S. Energy Information Administration shows that the fuel cost per gallon in Texas is $2.73. The Texas Comptroller shows the fuel taxes as $0.38.

Total Cost of Fuel = (Fuel Cost per Gallon in Texas – Fuel Taxes) *Daily Gallons of Fuel Consumed * 365

Table 36. Auto Idle Fuel Consumption

Auto Idle Fuel Consumption	No Build	Build
Auto Idle Fuel Consumption	$24,059,040	$10,179,370
Total in Real $	*$24,059,040*	*$10,179,370*
Total Monetized Benefit Real $ (No Build – Build)	**$13,880,000**	
Total Monetized Benefit Discounted @ 3.1% (No Build – Build)	**$7,613,000**	

Summary of Benefits and Costs

The table below summarizes the Project benefits detailed above.

Table 37. 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	$93,700,000	$39,856,000
2	State of Good Repair	Ongoing expensive maintenance of roadway pavement	Low maintenance required of new facility through the planning horizon	Maintenance cost savings	$60,051,000	$32,021,000
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	$208,517,000	$124,084,000
4	Value of Travel Time	The current facilities lead to delay of users.	Improvements to the current facilities will reduce delay	Travel time savings	$149,799,000	$81,618,000
5	Emissions Reduction	The current facilities are not conductive 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	$12,341,000	$8,226,000
6	Facility Improvements	The current facilities are not conductive 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	$3,553,000	$2,016,000

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	$6,740,000	$3,825,000
8	Externalities Reduction	Roadway is not conducive for active transportation.	New and improved facilities will encourage more walking and cycling	Reduced various externalities	$509,000	$289,000
9	Automobile Idling Fuel Consumption	Vehicle idling results in consumption of fuel	Improvements slightly decreases fuel consumption	Increased fuel consumption	$13,880,000	$7,613,000
Totals					**$549,090,000**	**$299,548,000**