SAFE Lumberton RAISE Grant – BCA Narrative

Benefit Cost Analysis (BCA) Executive Summary

Lumberton's Benefit-Cost Analysis (BCA) describes the benefits of the SAFE Lumberton project if it was awarded and constructed. NCDOT used USDOT's Benefit-Cost Analysis Guidance (2023) to complete the BCA analysis and used the recommended parameter values where applicable. The BCA used an analysis period of 20 years (2028-2047), with assumed construction in 2027. All costs and benefits are presented in 2021 base year dollars.

The BCA considered seven different benefit categories:

- **Safety:** The reduction in crashes and crash costs.
- **Sustainability:** The reduction in vehicle miles traveled that improves air quality by reducing carbon dioxide emissions.
- **Health:**
    - **Reduce Nitrous Oxide Omissions:** The reduction in nitrous oxide emissions that improves air quality for personal health.
    - **Reduce Mortality Rate by Increasing Walking:** The increase in longevity from providing new opportunities to improve personal health.
- **Economic Activity:** The reduction in operating costs for Lumberton residents resulting from mode shift from driving to walking.
- **Quality of Life:** The improved pedestrian journey quality and experience through increased sidewalk widths.
- **State of Good Repair:** The reduction in recurring annual and long-term maintenance costs from infrastructure improvements.
- **Useful Life:** The residual value remaining for infrastructure improvements after the 20-year evaluation period.

Summary of the BCA Results

Table 1 displays the BCA and total benefits. The capital costs included in the BCA are $10.9 million. The BCA estimated a 20-year evaluation (2028-2047) and a real discount rate of 7 percent and has a **net present value** of **$27,622,270** and a **benefit-cost ratio** of **4.28**. Table 2 describes the benefits for each category over the years of operation.

Table 1. BCA Summary

Category	Discounted Value[1] (in 2021 Dollars)
Net Discounted Benefits	$36,046,061
Net Discounted Capital + O&M Costs	$8,423,790
Net Present Value	$27,622,270
Benefit-Cost Ratio	4.28

[1] NCDOT used a 7 percent discount rate for the benefits and costs and a 3 percent discount rate for CO_2.

Table 2. Undiscounted Benefits over Evaluation Period

Category	Monetary Value (in 2021 Dollars)
Safety Benefits	$101,707,375
Sustainability	$861
Health - Emissions	$522
Health – Reduce Mortality Rate	$307,857
Quality of Life	$15,752
Economic Activity	$14,225
State of Good Repair	$36,624
Useful Life	$1,239,383

Note: Innovation, Partnerships, Resiliency, and Mobility +Connectivity are not featured in the BCA due to lack of data. However, these can be qualitatively described in the vast improvements in walkability and connection to the downtown, especially for those 15% of households in the project area without access to a vehicle.

NCDOT did not calculate the following items given RAISE NOFO guidance and low quantitative values relative to the inputs for:

- Resiliency: While the project does include drainage improvements that will reduce pooling on the roadway during precipitation events and contribute to overall improved drainage in the flood-prone area, its specific contribution cannot be determined.
- Travel time savings: Not used for cost or benefit due to lack of current corridor congestion. This project will not meaningfully improve capacity, congestion, or travel time since the corridor currently performs at a high level of service for each of these traffic operations measures.

Detailed calculations and supporting data for this analysis can be found in the referenced Lumberton RAISE BCA workbook.

Calculating Benefits for SAFE Lumberton

The SAFE Lumberton project will benefit all residents and visitors, however, those that will benefit the most are those living within a ½ mile of the project corridor, which is considered the walk-shed for community and utilitarian trips. The benefits were calculated by using population estimates from the 2020 Census and mode share estimates from the 2017-2021 American Community Survey (ACS) due to Block Group reporting. The Lumberton population and study area population have an assumed 0.1-percent annual population growth rate based on the North Carolina Office of State Budget and Management 2020-2050 population projection for Robeson County (where Lumberton is located) and an assumption that growth is more likely occur in the urbanized vs rural areas.

NCDOT calculated the benefits by comparing walking in the No Build Scenario with how it would be changed if the project was implemented. The Net Present Value and Benefit-Cost Ratio calculations identify the difference between the two scenarios.

Baseline conditions assume no change in mode share from that identified in the 2017-2021 ACS of approximately 1 percent. To determine Commuting Walk Trips Annually, NCDOT assumed that the daily commuting population takes 2 walking trips (one to work and one back) 5 days per week for 52 weeks; this is the annualized walking trip commuting baseline. Utilitarian walking trips were calculated based on the local walk share but for all eligible adults (assumed 68 percent of the population based on USDOT's 2023 BCA Guidance), multiplied by the utilitarian walk share, and 365 days per year.

Build conditions assume induced trips from improved walking conditions towards the walk goal of 3 percent walking mode share for both commuting and utilitarian trips by the year 2047. The trip multipliers for the new trips are found in the "Trip Multipliers" tab of the Lumberton RAISE BCA workbook.

Total Reduced VMT is calculated from the product of the new commuting trips and new utilitarian trips multiplied by the respective trip replacement rates and typical replacement distance for each trip type.

Table 3. Summary of the Benefit Assumptions

Baseline	Build Scenario	Impacts
Walking within ½ mile of the project corridor.	SAFE Lumberton's project corridor will provide more opportunities for commuting and utilitarian trips for those living within the ½ mile walkshed.	Reduced pedestrian, bicyclist, and vehicular crashes, reduced pollution, reduced healthcare costs, improved pedestrian experience, improved economic activity from decreased transportation expenses, and reduced maintenance costs.

Costs

The capital costs for SAFE Lumberton are shown in Table 4. The main application provides more detailed information on the project costs.

Table 4. Project Construction Costs by Segment of Corridor

Segment	Anticipated Cost
Segment A - NC 41 and NC 72	$1,136,000
Segment B - Water St and W 5th St	$592,000
Segment C - NC 41 to 5th St	$3,120,000
Segment D - 2nd and 5th St Roundabout	$1,900,000
Segment E - NC 72 Road Diet	$1,295,000
Segment F - NC 211 and NC 72 Roundabout	$2,880,000
Total Capital Costs	$10,923,000

Note: e used a 40% contingency,
which is added to the segment costs, due to landscaping, lighting, final design, right-of-way, and environmental documentation.

Estimated maintenance costs were based on NCDOT and other State DOT values for anticipated pavement maintenance cycles, average annual signal and roundabout maintenance, and annual sidewalk maintenance. NCDOT estimated that the SAFE Lumberton multimodal improvements in the Build scenario will cost $36,624 less to maintain over the 20 year operational period than maintaining the baseline conditions ($2,840,142 for the Build scenario vs. $2,876,765 for the baseline scenario).

Useful Life

The expected useful life of the SAFE Lumberton improvements is 25 years. NCDOT used an analysis period of 20 years post-construction. NCDOT claimed a residual value benefit of **$1,239,383** which is inclusive of the remaining value for the roundabouts and new and replaced sidewalk. More information on the calculations may be found in the "Residual Value" tab in the Lumberton RAISE BCA workbook.

Benefits

Walking Activity in Lumberton

As mentioned previously, NCDOT used data from ACS to determine walking along the project area. Walking was selected since the project improvements are focused primarily on pedestrians, and NCDOT does not have reported bicycling mode share for commuting, nor facilities aside from the riverfront shared-use path. Table 5 summarizes the baseline mode share.

Table 5. Baseline Mode Share

Trip Type	Population	Drove Alone	Carpool (Any)	Transit total	Motorcycle	Bicycle	Walked	Other means	WFH
Commute (Walk Area)	4,015	80.52%	14.32%	0.15%	0.87%	0.00%	0.87%	0.72%	2.54%
Adult Utilitarian (Walk Area, minus WFH)	3,913	82.62%	14.69%	0.15%	0.89%	0.00%	0.89%	0.74%	N/A

Table 6. Demand/Activity Multipliers (NHTS, 2017)

Demand/Activity Multipliers	Factor
Utilitarian Walk Trip Multiplier	3.27
Vehicle Miles Traveled Reduced	
Commute - Walk	0.72
Utilitarian - Walk	0.83

Increase in Walking in Lumberton

Mode share and multipliers were also only calculated for adults due the lack of schools in the area for both college and K-12 students. Given the absence of other information, the same percentage of utilitarian walk trips (1 percent) was used as for commuting.

The 2047 mode share goal of 3 percent was identified based on NCDOT's existing walking rates and the perceived growth from the significant levels of network completion and crossing enhancements in the downtown area.

Safety Benefits

NCDOT calculated the historical crash costs for the project's six segments and estimated the reduction from the implementation of safety improvements such as pedestrian refuge islands and roundabouts. Table 7 is separated into vehicular crashes (December 2017- November 2022) and non-motorized crashes (2012-2021, due to a lag in pedestrian and bicyclist injury severity reporting) with reported crash severities on the KABCO scale. Vehicular crashes on the corridor were provided by NCDOT, while the bicyclist/pedestrian crashes were selected as within 300 feet of the corridor (300 feet was selected as a buffer to capture the potential for pedestrians and bicyclists to divert to side routes and parking lots to avoid travel on the corridor due to unsafe conditions and incomplete pedestrian network). Bicyclists were included in the crash reporting due to the lack of formal bicycle facilities and local knowledge that bicyclists commonly operate on pedestrian facilities.

Table 7. No Build Crashes (Historical Conditions)

Vehicle Crashes by Segment	**Total Crashes (5-Year)**	**K**	**A**	**B**	**C**	**O**	**U**	**PDO**	**Search Distance**	**Annual Crash Cost**
Segment F - NC 211 and NC 72	79	0	0	3	11	65			On Corridor	$316,920
Segment E - NC 72 Road Diet	66	0	2	6	9	49			On Corridor	$590,660
Segment D - 2nd and 5th St	4	1	0	0	1	2			On Corridor	$2,377,300
Segment C - NC 41 to 5th St	209	2	2	15	53	137			On Corridor	$6,348,520
Segment A - NC 41 and NC 72	50	0	3	2	9	36			On Corridor	$570,160
Segment B - Water St and W 5th St	46	0	1	2	7	36			On Corridor	$313,040
Non-Motorized Crashes by Segment	**Total Crashes (10-Year)**	**K**	**A**	**B**	**C**	**O**	**U**	**PDO**	**Search Distance**	**Annual Crash Cost**
Segment F - NC 211 and NC 72	3				2		1		300' from corridor	$37,090
Segment E - NC 72 Road Diet	3		1		2				300' from corridor	$72,130
Segment D - 2nd and 5th St	0								300' from corridor	$0
Segment C - NC 41 to 5th St	9		1	1	2		4	1	300' from corridor	$173,540
Segment A - NC 41 and NC 72	4				3		1		300' from corridor	$44,940
Segment B - Water St and W 5th St	2			2					300' from corridor	$30,740

NCDOT also calculated the Build anticipated crashes, shown in Table 8. See Table 10 for source information for Crash Modification Factors (CMFs).

Table 8. Build Anticipated Crashes

Primary Countermeasure	Applicable crashes	CMF	K	A	B	C	O	U	PDO
Road Diet (4-lane to 3-lane, urban)	All crashes	0.53	0	1.06	3.18	4.77	25.97	0	0
Roundabout (Two-Way Stop Controlled Orig.)	Injury and fatal crashes	0.18	0.18	0	0	0.18		0	
Install raised median with or without marked crossing	All crashes and severities	0.742	1.484	1.484	11.13	39.326	101.654	0	0
Roundabout (Signalized Orig.)	Injury and fatal crashes	0.22	0	0.66	0.44	1.98		0	
Leading Pedestrian Interval	Vehicle-Ped crashes	0.87	0	0	0	1.74	0	0.87	0
Road Diet (4-lane to 3-lane, urban)	All crashes	0.53	0	0.53	0	1.06	0	0	0
Roundabout (Two-Way Stop Controlled Orig.)	Injury and fatal crashes	0.18	0	0	0	0		0	
Pedestrian refuge island	Ped crashes	0.68	0	0.68	0.68	1.36	0	2.72	0.68
Roundabout (Signalized Orig.)	Injury and fatal crashes	0.22	0	0	0	0.66	0	0.22	0
Pedestrian refuge island	Ped crashes	0.68	0	0	1.36	0	0	0	0

NCDOT multiplied the historical crashes by the USDOT's 2023 BCA Guidance KABCO levels in 2021 dollars and annualized (5 or 10 years). Table 9 describes crash costs and safety benefits, based on crash reductions of proposed countermeasreus. NCDOT computed the annualized crash cost and the Safety Benefit, which is the difference between the historical crash costs and the anticipated crash costs after project construction. The results are calculated in the "Safety and Crash Costs" tab of the Lumberton RAISE BCA workbook.

Table 9. Build Anticipated Crashes

Mode	Segment	Anticipated Annual Crash Cost	Safety Benefit
Vehicle	Segment F - NC 211 and NC 72	$-	$316,920
	Segment E - NC 72 Road Diet	$313,050	$277,610
	Segment D - 2nd and 5th St	$427,626	$1,949,674
	Segment C - NC 41 to 5th St	$4,710,602	$1,637,918
	Segment A - NC 41 and NC 72	$119,099	$451,061
	Segment B - Water St and W 5th St	$-	$313,040
Pedestrian	Segment F - NC 211 and NC 72	$32,268	$4,822
	Segment E - NC 72 Road Diet	$38,229	$33,901
	Segment D - 2nd and 5th St	$-	$-
	Segment C - NC 41 to 5th St	$118,007	$55,533
	Segment A - NC 41 and NC 72	$9,887	$35,053
	Segment B - Water St and W 5th St	$20,903	$9,837
		Total	**$5,085,369**

Safety CMFs

NCDOT documented the applicable crash modification factors (CMFs) for the segment improvements (see Table 10). NCDOT used CMFs according to FHWA's Proven Safety Countermeasures or from the CMF Clearinghouse. The CMFs are available in the "Safety CMFs" tab in the Lumberton RAISE BCA workbook.

Table 10. Summary of CMFs Used for SAFE Lumberton Improvements

Improvement	CRF	CMF	Type	Source
Sidewalk	0.74	0.26	Ped crashes	Gan et al. Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects. Florida DOT, (2005).
High visibility marked crossing	0.4	0.6	Ped injury crashes	Chen, L., C. Chen, and R. Ewing. The Relative Effectiveness of Pedestrian Safety Countermeasures at Urban Intersections - Lessons from a New York City Experience. (2012).
Pedestrian refuge island	0.32	0.68	Ped crashes	Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.
Intersection lighting	0.42	0.58	Ped crashes	Elvik, R. and Vaa, T. Handbook of Road Safety Measures. Oxford, United Kingdom, Elsevier, (2004).
Pedestrian Signal Head - Peds	0.25	0.75	Ped crashes	Estimated CMF based on performance of other traffic controls, such as Pedestrian Hybrid Beacon.
Leading Pedestrian Interval	0.13	0.87	Veh-Ped crashes	Goughnour, E., D. Carter, C. Lyon, B. Persaud, B. Lan, P. Chun, I. Hamilton, and K. Signor. "Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety." Report No. FHWA-HRT-18-044. Federal Highway Administration.
Roundabout (Signalized Orig.)	0.78	0.22	Injury and fatal crashes	AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).
Roundabout (Two-Way Stop Controlled Orig.)	0.82	0.18	Injury and fatal crashes	AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).
Road Diet (4-lane to 3-lane, urban)	0.47	0.53	All crashes	*Persaud, B., Lana, B., Lyon, C., and Bhim, R. "Comparison of empirical Bayes and full Bayes approaches for before-after road safety evaluations." Accident Analysis & Prevention, Vol. 42, Issue 1, pp. 38-43 (2010)*
Install raised median with or without marked crossing	0.258	0.742	All crashes and severities	CMF ID 8800

Health Benefits

Table 11 uses the population assumptions based on the population and mode share and the new induced trips for adults, and calculates the monetized health value (reduced mortality rates) given the USDOT's 2023 BCA Guidance value of $7.20 per walking trip for adults aged 20-74. Additional health benefits from reductions in SO_X, NO_X, and PM 2.5 from reduced VMT are shown in Table 13 alongside CO_2 reductions. See the "Health - Mortality" tab and the "Health-Enviro – Emissions" tab of the Lumberton RAISE BCA workbook for more information.

Table 11. Mortality Reduction Benefits from Induced Walking Trips

Year	Lumberton Population	Study Area Population (0.5 Mile)	New Induced Walking Trips (Annualized)*	Mortality Reduction Estimate (Annualized, 2021 USD)
2023	19,082	12,036	N/A	$-
2024	19,101	12,048	N/A	$-
2025	19,120	12,060	N/A	$-
2026	19,139	12,072	N/A	$-
2027	19,159	12,084	N/A	$-
2028	19,178	12,096	1,040	$7,485
2029	19,197	12,108	1,154	$8,307
2030	19,216	12,121	1,268	$9,131
2031	19,235	12,133	1,383	$9,957
2032	19,255	12,145	1,498	$10,785
2033	19,274	12,157	1,613	$11,614
2034	19,293	12,169	1,728	$12,445
2035	19,312	12,181	1,844	$13,277
2036	19,332	12,193	1,960	$14,111
2037	19,351	12,206	2,076	$14,947
2038	19,370	12,218	2,192	$15,784
2039	19,390	12,230	2,309	$16,623
2040	19,409	12,242	2,426	$17,464
2041	19,429	12,255	2,543	$18,306
2042	19,448	12,267	2,660	$19,150
2043	19,467	12,279	2,777	$19,996
2044	19,487	12,291	2,895	$20,843
2045	19,506	12,304	3,013	$21,692
2046	19,526	12,316	3,131	$22,543
2047	19,545	12,328	3,249	$23,396

Environmental Sustainability Benefits

Table 12 computes the metric tons of NO_X, SO_X, PM 2.5, and CO_2 for the Build condition. While NO_X, SO_X, PM 2.5 are accounted for as Health Benefits, the CO_2 reductions contribute towards the project's environmental sustainability. NCDOT calculated the metric tons of reduced air pollutants from the reduced VMT based on the population and mode share projections and the EPA-estimated grams per mile emissions for standard passenger vehicles. For this analysis, it is assumed that most vehicle trips replaced with walking trips are short commuting trips and utilitarian trips that are accomplished by a passenger vehicle. Trucks, SUVs, and commercial vehicles were not included in the analysis; those emissions values are higher and would result in increased emissions benefits. See the "Health-Enviro - Emissions" tab of the Lumberton RAISE BCA workbook for more information.

Table 12. Metric Tons Reduced Per Year from VMT Reductions

	Metric Tons Reduced Per Year from Build VMT Reductions			
Year	**NO_X**	**SO_X**	**PM2.5**	**CO_2**
2023				
2024				
2025				
2026				
2027				
2028	0.00052	0.00000	0.00000	0.27697
2029	0.00058	0.00000	0.00000	0.30741
2030	0.00064	0.00000	0.00000	0.33790
2031	0.00069	0.00000	0.00000	0.36846
2032	0.00075	0.00000	0.00000	0.39909
2033	0.00081	0.00000	0.00000	0.42977
2034	0.00087	0.00000	0.00001	0.46051
2035	0.00092	0.00000	0.00001	0.49131
2036	0.00098	0.00000	0.00001	0.52218
2037	0.00104	0.00000	0.00001	0.55310
2038	0.00110	0.00000	0.00001	0.58409
2039	0.00116	0.00000	0.00001	0.61514
2040	0.00122	0.00000	0.00001	0.64625
2041	0.00127	0.00000	0.00001	0.67742
2042	0.00133	0.00000	0.00001	0.70866
2043	0.00139	0.00000	0.00001	0.73995
2044	0.00145	0.00000	0.00001	0.77131
2045	0.00151	0.00000	0.00001	0.80273
2046	0.00157	0.00000	0.00001	0.83421
2047	0.00163	0.00000	0.00001	0.86575
Total	**0.01980**	**0.00005**	**0.00012**	**10.52646**

Table 13. Annual Emissions Savings from Build (2021 USD)

	Annual Emissions Savings from Build (2021 USD)					
Year	**NO_X**	**SO_X**	**PM2.5**	**CO_2**	**Total (Excluding CO2)**	**Total for All Pollutants**
2023						
2024						
2025						
2026						
2027						
2028	$9.48	$0.07	$2.71	$17.17	$12.26	$29.43
2029	$10.76	$0.08	$3.06	$19.37	$13.89	$33.26
2030	$12.01	$0.09	$3.41	$21.96	$15.51	$37.48
2031	$13.10	$0.09	$3.72	$24.32	$16.92	$41.23
2032	$14.19	$0.10	$4.03	$26.74	$18.32	$45.06
2033	$15.28	$0.11	$4.34	$29.22	$19.73	$48.95
2034	$16.37	$0.12	$4.65	$31.78	$21.14	$52.92
2035	$17.47	$0.13	$4.96	$34.39	$22.56	$56.95
2036	$18.56	$0.13	$5.27	$37.60	$23.97	$61.57
2037	$19.66	$0.14	$5.59	$40.38	$25.39	$65.77
2038	$20.77	$0.15	$5.90	$43.22	$26.81	$70.04
2039	$21.87	$0.16	$6.21	$46.14	$28.24	$74.38
2040	$22.98	$0.16	$6.53	$49.12	$29.67	$78.78
2041	$24.08	$0.17	$6.84	$52.84	$31.10	$83.94
2042	$25.19	$0.18	$7.16	$55.98	$32.53	$88.52
2043	$26.31	$0.19	$7.47	$59.20	$33.97	$93.17
2044	$27.42	$0.20	$7.79	$62.48	$35.41	$97.89
2045	$28.54	$0.20	$8.11	$65.82	$36.85	$102.68
2046	$29.66	$0.21	$8.43	$70.07	$38.30	$108.37
2047	$30.78	$0.22	$8.74	$73.59	$39.75	$113.33
Total	**$404.49**	**$2.89**	**$114.94**	**$861.38**	**$522.32**	**$1,383.70**

Economic Activity

Table 14 summarizes the base value per mile for light duty vehicles. These values are multiplied by the VMT reduced on the population and mode share (see Tables 15 and 16) to estimate the amount of money Lumberton is saving residents from increased walking and decreased driving. See the "Economic Activity" tab of the Lumberton RAISE BCA workbook for more information.

Table 14. Base Value per Mile (Based on USDOT 2023 BCA Guidance Table A-5)

Vehicle Type	Value per mile (2021 USD)
Light Duty Vehicle	$ 0.46
Commercial Trucks	$ 1.01

Table 15. Baseline and Estimated Walk Trips

	Baseline					
Year	Lumberton Population	Project Area Population (0.5 Mile)	Employed Population in Project Area	Commute Walk Population	Commute Walk Trips (Annualized)	Utilitarian Adult Walk Trips (Annualized)
2023	19,082	12,036	4,027	35	18,255	87,491
2024	19,101	12,048	4,031	35	18,273	87,579
2025	19,120	12,060	4,035	35	18,291	87,666
2026	19,139	12,072	4,039	35	18,309	87,754
2027	19,159	12,084	4,043	35	18,328	87,842
2028	19,178	12,096	4,047	35	18,346	87,929
2029	19,197	12,108	4,051	35	18,364	88,017
2030	19,216	12,121	4,055	35	18,383	88,105
2031	19,235	12,133	4,059	35	18,401	88,194
2032	19,255	12,145	4,063	35	18,420	88,282
2033	19,274	12,157	4,068	35	18,438	88,370
2034	19,293	12,169	4,072	35	18,456	88,458
2035	19,312	12,181	4,076	36	18,475	88,547
2036	19,332	12,193	4,080	36	18,493	88,635
2037	19,351	12,206	4,084	36	18,512	88,724
2038	19,370	12,218	4,088	36	18,530	88,813
2039	19,390	12,230	4,092	36	18,549	88,902
2040	19,409	12,242	4,096	36	18,567	88,990
2041	19,429	12,255	4,100	36	18,586	89,079
2042	19,448	12,267	4,104	36	18,605	89,169
2043	19,467	12,279	4,108	36	18,623	89,258
2044	19,487	12,291	4,112	36	18,642	89,347
2045	19,506	12,304	4,117	36	18,661	89,436
2046	19,526	12,316	4,121	36	18,679	89,526
2047	19,545	12,328	4,125	36	18,698	89,615

Table 16. Future Estimated Walk Trips and Reduced VMT

	Build (Compare with Table 15)					
Year	**Commute Walk Trips (Annualized)**	**Utilitarian Adult Walk Trips (Annualized)**	**Combined New Total Walking Trips (Annualized)****	**Reduced Vehicle Commute Trips (Annualized)**	**Reduced Vehicle Utilitarian Trips (Annualized)**	**Reduced VMT**
2023	-	-	-	-	-	-
2024	-	-	-	-	-	-
2025	-	-	-	-	-	-
2026	-	-	-	-	-	-
2027	-	-	-	-	-	-
2028	18,526	88,790	1,039.53	157	770	751.81
2029	18,564	88,972	1,153.77	174	855	834.43
2030	18,602	89,155	1,268.24	191	939	917.22
2031	18,640	89,338	1,382.94	208	1,024	1,000.18
2032	18,678	89,521	1,497.87	226	1,110	1,083.29
2033	18,716	89,705	1,613.03	243	1,195	1,166.58
2034	18,755	89,888	1,728.41	260	1,280	1,250.03
2035	18,793	90,073	1,844.03	278	1,366	1,333.64
2036	18,832	90,257	1,959.87	295	1,452	1,417.42
2037	18,870	90,442	2,075.94	313	1,538	1,501.37
2038	18,909	90,627	2,192.25	330	1,624	1,585.48
2039	18,947	90,812	2,308.78	348	1,710	1,669.76
2040	18,986	90,997	2,425.55	365	1,797	1,754.21
2041	19,025	91,183	2,542.54	383	1,883	1,838.82
2042	19,064	91,369	2,659.77	401	1,970	1,923.60
2043	19,103	91,556	2,777.23	418	2,057	2,008.55
2044	19,142	91,742	2,894.92	436	2,144	2,093.67
2045	19,181	91,929	3,012.85	454	2,232	2,178.96
2046	19,220	92,116	3,131.00	471	2,319	2,264.41
2047	19,259	92,304	3,249.39	489	2,407	2,350.03

Quality of Life

Table 17 summarizes the revealed values from improved pedestrian facilities and the estimated daily users based on NCDOT's Statewide Exposure Model. These values are derived from the 2023 BCA guidance and the added width of sidewalk from the sidewalk improvements in the Build scenario. Based on the added sidewalk width of 1.5 feet for 0.36 miles of rebuilt sidewalk, the 20-year added value is $**15,752** (Table 18). See the "Pedestrian Journey Quality" tab of the Lumberton RAISE BCA workbook for more information.

Table 17. Pedestrian Facility Improvements Revealed Preference Values and Lumberton Project Area Values

Benefit Per Mile Walked	**Values**	**Unit**
Value per added foot of width	0.11	USD (2021) from RAISE BCA Table A-8
Added width	1.5	Foot
Sidewalk distance to be widened	0.369318	Mile

Daily users (E-W travel)	30	Estimated pedestrians per day in 2021 based on NCDOT Statewide Exposure Model and adjusted to the Build year based on annual walk growth rate to walk share goal.
Annual increase in pedestrians per day	1.01	Percent

Table 18. Pedestrian Journey Quality for Build Scenario

Year	Estimated Pedestrians Traveling Along Corridor (Annualized)	Annualized Benefit from Widened Sidewalk
2023	11,170	N/A
2024	11,282	N/A
2025	11,395	N/A
2026	11,509	N/A
2027	11,624	N/A
2028	11,740	$715.40
2029	11,857	$722.55
2030	11,976	$729.78
2031	12,096	$737.08
2032	12,217	$744.45
2033	12,339	$751.89
2034	12,462	$759.41
2035	12,587	$767.00
2036	12,713	$774.67
2037	12,840	$782.42
2038	12,968	$790.25
2039	13,098	$798.15
2040	13,229	$806.13
2041	13,361	$814.19
2042	13,495	$822.33
2043	13,630	$830.56
2044	13,766	$838.86
2045	13,904	$847.25
2046	14,043	$855.72
2047	14,183	$864.28
Total		**$ 15,752.37**

State of Good Repair

The SAFE Lumberton project is anticipated to result in reduced maintenance costs over the 20-year period following construction. The reduction in overall maintenance costs is realized through the removal of approximately 0.83 lane miles of pavement in Segment E through a road diet, as this segment will incur lower costs for annual pavement treatment, preservation (every 4-7 years), and eventual resurfacing (every 12-15 years) compared to the baseline condition. While the Build scenario increases the length of sidewalk subject to annual maintenance, these additional costs are far less than the cyclical maintenance costs of maintaining the baseline lane miles (Table 19). See the "State of Good Repair O&M" tab of the Lumberton RAISE BCA workbook for more information.

Table 19. State of Good Repair Comparison between Build and Baseline

Year	Baseline	Build	Maintenance Benefit (No Build minus Build, Reduction in Annual Maintenance Costs)	Treatment Note
2023	$27,021.00	N/A	N/A	N/A
2024	$27,021.00	N/A	N/A	N/A
2025	$27,021.00	N/A	N/A	N/A
2026	$27,021.00	N/A	N/A	N/A
2027	$27,021.00	N/A	N/A	N/A
2028	$534,859.95	$475,411.24	$59,448.71	Preservation treatment plus sidewalk and signal maintenance
2029	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2030	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2031	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2032	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2033	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2034	$1,347,688.52	$1,192,943.86	$154,744.65	Resurfacing treatment plus sidewalk and signal maintenance
2035	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2036	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2037	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2038	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2039	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2040	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2041	$534,859.95	$533,586.31	$1,273.64	Preservation treatment plus sidewalk and signal maintenance
2042	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2043	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2044	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2045	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2046	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
2047	$27,021.00	$37,541.20	-$10,520.20	Sidewalk and signal maintenance
Total	**$2,876,765.42**	**$2,840,141.81**	**$36,623.60**	

Results

Table 20 through Table 22 summarize the benefit-cost analysis for each year of the analysis period. NCDOT assumed a no-build scenario over 20 years (2028-2047) with a 3 percent discount rate for CO_2 and a 7 percent real discount rate for the other entries. See the "BCA" tab of the Lumberton RAISE BCA workbook for more information. SAFE Lumberton has a **net present value** of **$27,622,270** and a **benefit-cost ratio** of **4.28**.

Table 20. Estimated Annual Benefits (Undiscounted and Discounted)

	Safety	**Environmental Sustainability**	**Health**		**Quality of Life**	**Economic Activity**	**State of Good Repair**	**Useful Life**		
Year	Safety (Crash Reduction)	Sustainability - Emissions (CO_2)	Health - (SO_x, NO_x, PM2.5)	Health - Mortality Reduction Benefits from Walking	Pedestrian Journey Quality	Reduced operating costs from mode shift	State of Good Repair	Useful Life (residual value)	Benefits Total (Undiscounted)	Benefits (Discounted)
2023										
2024										
2025										
2026										
2027										
2028	$ 5,085,369	$17	$12	$7,485	$715	$346	$ 59,449		$5,153,393	$3,209,277
2029	$ 5,085,369	$19	$14	$8,307	$723	$384	$ (10,520)		$5,084,295	$2,959,110
2030	$ 5,085,369	$22	$16	$9,131	$730	$422	$ (10,520)		$5,085,169	$2,766,000
2031	$ 5,085,369	$24	$17	$9,957	$737	$460	$ (10,520)		$5,086,044	$2,585,493
2032	$ 5,085,369	$27	$18	$10,785	$744	$498	$ (10,520)		$5,086,921	$2,416,766
2033	$ 5,085,369	$29	$20	$11,614	$752	$537	$ (10,520)		$5,087,800	$2,259,051
2034	$ 5,085,369	$32	$21	$12,445	$759	$575	$ 154,745		$5,253,945	$2,180,209
2035	$ 5,085,369	$34	$23	$13,277	$767	$613	$ (10,520)		$5,089,563	$1,973,830
2036	$ 5,085,369	$38	$24	$14,111	$775	$652	$ (10,520)		$5,090,448	$1,845,023
2037	$ 5,085,369	$40	$25	$14,947	$782	$691	$ (10,520)		$5,091,334	$1,724,623
2038	$ 5,085,369	$43	$27	$15,784	$790	$729	$ (10,520)		$5,092,222	$1,612,080
2039	$ 5,085,369	$46	$28	$16,623	$798	$768	$ (10,520)		$5,093,112	$1,506,882
2040	$ 5,085,369	$49	$30	$17,464	$806	$807	$ (10,520)		$5,094,004	$1,408,549
2041	$ 5,085,369	$53	$31	$18,306	$814	$846	$ 1,274		$5,106,693	$1,319,682
2042	$ 5,085,369	$56	$33	$19,150	$822	$885	$ (10,520)		$5,095,795	$1,230,718
2043	$ 5,085,369	$59	$34	$19,996	$831	$924	$ (10,520)		$5,096,692	$1,150,408
2044	$ 5,085,369	$62	$35	$20,843	$839	$963	$ (10,520)		$5,097,592	$1,075,340
2045	$ 5,085,369	$66	$37	$21,692	$847	$1,002	$ (10,520)		$5,098,493	$1,005,170
2046	$ 5,085,369	$70	$38	$22,543	$856	$1,042	$ (10,520)		$5,099,398	$939,580
2047	$ 5,085,369	$74	$40	$23,396	$864	$1,081	$ (10,520)	$1,239,383	$6,339,686	$878,271
Total	$101,707,375	$861	$522	$307,857	$15,752	$14,225	$ 36,624	$1,239,383	$103,322,600	$36,046,061

Table 21. Estimated Annual Costs

	Costs

Year	Capital Expenditures	Operations and Maintenance	Costs Total (Undiscounted)	Costs Total (Discounted)
2023				
2024				
2025				
2026				
2027	$10,923,000.00		$10,923,000.00	$7,278,456.11
2028	$0.00	$475,411.24	$475,411.24	$296,062.23
2029	$0.00	$37,541.20	$37,541.20	$21,849.32
2030	$0.00	$37,541.20	$37,541.20	$20,419.93
2031	$0.00	$37,541.20	$37,541.20	$19,084.04
2032	$0.00	$37,541.20	$37,541.20	$17,835.55
2033	$0.00	$37,541.20	$37,541.20	$16,668.74
2034	$0.00	$1,192,943.86	$1,192,943.86	$495,029.29
2035	$0.00	$37,541.20	$37,541.20	$14,559.12
2036	$0.00	$37,541.20	$37,541.20	$13,606.66
2037	$0.00	$37,541.20	$37,541.20	$12,716.50
2038	$0.00	$37,541.20	$37,541.20	$11,884.58
2039	$0.00	$37,541.20	$37,541.20	$11,107.09
2040	$0.00	$37,541.20	$37,541.20	$10,380.45
2041	$0.00	$533,586.31	$533,586.31	$137,888.84
2042	$0.00	$37,541.20	$37,541.20	$9,066.69
2043	$0.00	$37,541.20	$37,541.20	$8,473.54
2044	$0.00	$37,541.20	$37,541.20	$7,919.20
2045	$0.00	$37,541.20	$37,541.20	$7,401.12
2046	$0.00	$37,541.20	$37,541.20	$6,916.94
2047	$0.00	$37,541.20	$37,541.20	$6,464.43
Total	**$10,923,000.00**	**$2,840,141.81**	**$13,763,141.81**	**$8,423,790.38**

Table 22. Estimated Discounted Total Costs and Benefits (Discounted at 3 percent for CO_2 and 7 percent for other entries per USDOT's 2023 BCA Guidance)

Year	Total Cost	Total Benefit
2023		
2024		
2025		
2026		
2027	$7,278,456.11	
2028	$296,062.23	$3,209,277
2029	$21,849.32	$2,959,110
2030	$20,419.93	$2,766,000
2031	$19,084.04	$2,585,493
2032	$17,835.55	$2,416,766
2033	$16,668.74	$2,259,051
2034	$495,029.29	$2,180,209
2035	$14,559.12	$1,973,830
2036	$13,606.66	$1,845,023
2037	$12,716.50	$1,724,623
2038	$11,884.58	$1,612,080
2039	$11,107.09	$1,506,882
2040	$10,380.45	$1,408,549
2041	$137,888.84	$1,319,682
2042	$9,066.69	$1,230,718
2043	$8,473.54	$1,150,408
2044	$7,919.20	$1,075,340
2045	$7,401.12	$1,005,170
2046	$6,916.94	$939,580
2047	$6,464.43	$878,271
	Total Discounted Costs: $8,423,790	**Total Discounted Benefits: $36,046,061**
Net Present Value: $ $27,622,270		**Benefit-Cost Ratio: 4.28**