MEMORANDUM

To: City of High Point

From: Alta Planning + Design

Date: 7/12/2021

Re: RAISE Benefit-Cost Analysis Memo

Benefit-Cost Analysis for High Point RAISE Grant Application

Executive Summary

This Benefit-Cost Analysis (BCA) includes the benefits and costs for the three components of the proposed project that would be fully constructed if the RAISE grant is awarded. The analysis period was 25 years (five years of construction and 20 years of operation) and assumes a useful service life of 30 years for the project. All costs and benefits are presented in 2019 base year dollars.

The following categories of benefits were considered in the BCA:

- **Safety:** The expected reduction in collisions and associated costs.
- **Environmental Sustainability:** Includes reductions in the following pollutants that impact air quality, CO_2, NO_X SO_2, and $PM_{2.5}$.
- **Quality of Life:** Includes the health benefits of increased physical activity and decreased healthcare costs from new users of the project.
- **Economic Competitiveness:** Includes savings in household transportation costs and traffic congestion costs.
- **State of Good Repair:** Includes reductions in roadway maintenance costs.
- **Maintenance costs (dis-benefit):** Covers the ongoing costs of upkeep to the proposed project

Result Summary

Table 1 displays the total benefits by category included in the BCA. The capital costs included in the BCA are $27.9 million. This BCA estimates that the proposed project compared to the no-build scenario over a 26-year evaluation (2022-2047) and at a 7 percent real discount rate has a net present value of **$23 million** and a benefit-cost ratio of **2.05 : 1.0.**

Table 1. Total Undiscounted Benefits over 20 years of Operation

CATEGORY	MONETARY VALUE (In 2019 dollars)
Safety Benefits	**$76,356,558**
Environmental Sustainability	**$4,882,686**
Quality of Life	**$23,419,209**
Economic Competitiveness	**$48,775,221**
State of Good Repair	**$6,238,210**
Maintenance Costs	**$200,000**
Residual Value	**$9,296,363**
TOTAL BENEFITS (UNDISCOUNTED)	**$131,438,261**

The Benefit Cost Analysis captures Census Tracts and Transportation Analysis Zones within a three-mile radius around the project to determine the project's expected impact on the surrounding population. This three-mile radius for each component of the project (Southwest Heritage Greenway, North Elm Complete Streets, and Montlieu Avenue Complete Street) primarily affects the benefits of the project (e.g. health benefits to the population). These benefits are compared to each project's costs to produce a benefit-cost ratio.

These three components' three-mile radii overlap to a large degree, so when taken together to calculate the composite benefit-cost ratio, the Benefit portion of the ratio changes minimally (the population captured is almost the same), while the Cost portion increases dramatically (the three project costs combined). This increase in cost, while benefits remain largely unchanged, results in a lower benefit-cost ratio for the composite project as compared to each individual project component. Tables 2a-2d list the full project and component piece summaries of benefits, costs, and benefit-cost ratios.

Table 2a. Benefit-Cost Analysis Summary for Full Project (All Three Components)

CATEGORY	DISCOUNTED [1] VALUE (in 2019 dollars)
Net Discounted Benefits	**$44,235,536**
Net Discounted Capital Costs	**$21,560,091**
Net Present Value	**$22,675,445**
Benefit - Cost Ratio	**2.05**

[1] A 7% discount rate was used for all benefits and costs with the exception of carbon benefits which were discounted at 3% per year.

Table 2b. Benefit-Cost Analysis Summary for the Southwest Heritage Greenway Component

CATEGORY	DISCOUNTED[2] VALUE (in 2019 dollars)
Net Discounted Benefits	**$16,215,929**
Net Discounted Capital Costs	**$6,387,493**
Net Present Value	**$9,828,436**
Benefit - Cost Ratio	**2.54**

Table 2c. Benefit-Cost Analysis Summary for the North Elm Street Component

CATEGORY	DISCOUNTED[2] VALUE (in 2019 dollars)
Net Discounted Benefits*	**$30,778,950**
Net Discounted Capital Costs	**$10,953,343**
Net Present Value	**$19,825,607**
Benefit - Cost Ratio	**2.81**

*The utility maintenance benefit was calculated at the full project level and was not accounted for in the component-level analysis

Table 2d. Benefit-Cost Analysis Summary for the Montlieu Avenue/Sunset Drive Component

CATEGORY	DISCOUNTED[2] VALUE (in 2019 dollars)
Net Discounted Benefits*	**$16,711,329**
Net Discounted Capital Costs	**$4,219,255**
Net Present Value	**$12,492,074**
Benefit - Cost Ratio	**3.96**

*The utility maintenance benefit was calculated at the full project level and was not accounted for in the component-level analysis

[2] A 7% discount rate was used for all benefits and costs with the exception of carbon benefits which were discounted at 3% per year.

Background

The benefit-cost analysis (BCA) for this project follows the principles documented in the USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs (February 2021), and uses the recommended parameter values where applicable. The BCA includes the benefits and costs for the seven components of the proposed project that would be fully constructed if the RAISE grant is awarded. The analysis period was 25 years (five years of construction and 20 years of operation) and assumes a useful service life of 30 years for the project. All costs and benefits are presented in 2019 base year dollars. Benefits and cost streams were discounted using a 7% per year discount rate, with the exception of carbon benefits which were discounted at 3% per year. This memo contains a detailed explanation of the BCA methodology and the parameter values that were used.

Approach to Benefits and Study Area

This BCA approach expands on the methods suggested by the National Cooperative Highway Research Program (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities by incorporating detailed local demographic information and using new data and research that has become available since Guidelines for Analysis was published in 2006.

While construction of the project will benefit all residents of and visitors to the region, those living within three miles (about a 15-minute bike ride) and one-half mile (about a 10-minute walk) of the project will have the most convenient access and will gain the most from its completion. Accordingly, this BCA focuses on the bicycling benefits attributed to residents living within three miles of the project and on the walking benefits attributed to residents living within one-half mile project. There are several benefit categories that benefit the region more widely (reduced roadway maintenance, healthcare costs), but these ranges are used to constrain this analysis to the main beneficiaries.

Benefits were primarily calculated by comparing walking and biking activity (including collisions) under the baseline to a Build scenario in which the Connecting Communities project has been implemented. The baseline and build scenarios encompass an identical geography (Census Tracts within 3 miles of the project). **The benefits included in the Net Present Value and Benefit-Cost Ratio calculations are the net difference between the two scenarios.**

Table 3: Summary Matrix

Baseline	Build Scenario	Type of Impacts
Walking and biking activity within 3 miles of the study area.	Construction of the Southwest Heritage Greenway and critical on-street connections to close a gap in regional multi-modal connectivity and the estimated impacts on walking and biking activity within 3 miles of the study area.	Reduced pollution, reduced healthcare costs, reduced bicycle, pedestrian, and vehicle collisions, reduced roadway maintenance, reduced utility maintenance, reduced traffic congestion, and reduced household transportation costs.

Costs

Refer to the main application for a detailed breakdown of projects costs. The capital cost schedule is shown in **Table 4.** This schedule includes design, engineering, permitting, contracting and installation.

Table 4. Project Construction Schedule and Cost

Construction Year	Composite Anticipated Cost	*Southwest Heritage Greenway Anticipated Cost*	*North Elm Street Complete Street Anticipated Cost*	*Montlieu Avenue/Sunset Drive Complete Street Anticipated Cost*
2022	**$733,246**	*$206,667*	*$371,939*	*$154,640*
2023	**$1,609,161**	*$757,055*	*$495,920*	*$356,186*
2024	**$4,861,422**	*$619,278*	*$2,322,555*	*$1,919,589*
2025	**$15,080,185**	*$3,406,500*	*$8,794,301*	*$2,879,384*
2026	**$5,605,075**	*$3,406,500*	*$2,198,575*	-
Total Capital Costs	**$27,889,089**	*$8,396,000*	*$14,183,290*	*$5,309,799*

The estimated maintenance costs range from $6,147 to $10,000 per mile per year. These values were determined based on maintenance costs of the existing greenway in High Point and estimated maintenance costs along similar roadway segments to those in this project. The City of High Point estimates the utility improvements included in the build scenario will reduce per year maintenance costs by $40,000 to $60,000. This analysis includes the mid-point value of $50,000 per year in reduced maintenance costs. The total annual maintenance costs included in the BCA were -$10,331 per year (undiscounted) and they were included as a benefit in the benefit-cost ratio.

Useful Life

The expected useful life of the proposed trail facilities is 30 years. The window of analysis used was 20 years. A residual value of $9,296,363 (undiscounted) was claimed as a benefit in the final year of the analysis period, assuming linear depreciation.

Benefits

Walking and Biking Activity

The BCA estimated current levels of walking and biking within the project area using American Community Survey (ACS) data. **Table 5** displays the existing commute to work mode share for people within walking and biking distance of the proposed project. Population and demographic forecasts from the Metropolitan Transportation Commission (MTC) at the Transportation Analysis Zone (TAZ) level were used to estimate population growth in the study area over the analysis period. Population forecasts were collected for 2013, 2021, 2030, and 2040, and were interpolated for each intermediate year in the analysis.

Table 5. Means of Transportation to Work of Employed People Living in the Study Area (2019 American Community Survey)

High Point on the Rise Corridor	Population	Drove Alone	Carpool	Public Transit	Bicycled	Walked	Other
Walkshed (within half-mile)	15,003	23.9%	7.5%	0.54%	0.11%	2.2%	1.57%
Bikeshed (within 3 miles)	81,074	32.9%	5.3%	0.37%	0.03%	1.04%	1.65%

The means of transportation to work data was converted to daily estimates and extrapolated to annual trip volumes and broken into different trip types (i.e. commute, school, college, and utilitarian) using the existing travel patterns (**Table 5**) and data from the National Household Transportation Survey (**Table 6**). The annual extrapolations account for the expected number of trips per week by trip type (i.e., commute, school, and college trips are expected five out of seven days a week, and other trip types are expected to occur seven days a week).

Table 6: Trip Purpose Multiplier[3]

	Bike	Walk
Utilitarian Trip Multiplier	5.33	8.77

Increase in Walking and Biking Activity

The Baseline assumes that the walking and biking mode share will remain constant and that trips will increase annually with expected population growth. In the Build scenario, the demand estimates for the proposed project were added to the existing walking and biking activity starting in 2026 (the expected opening year). The demand estimates were escalated by the expected population growth factor each year.

Decrease in Motor Vehicle Trips

Some of the estimated annual bicycle and pedestrian trips within the proposed project area are expected to replace motor vehicle trips. **Table 7** shows motor vehicle trip replacement values estimated through a comparison of local commute mode share data for the project area from the American Community Survey (2014-2018) and national mode share data for all trip purposes from the 2017 National Household Travel Survey.

Table 7: Motor Vehicle Trip Replacement Factors[4]

	Bike	Walk
Commute Trips	0.60	0.61
College Trips	0.77	0.85
K-12 School Trips	0.53	0.55
Utilitarian Trips	0.85	0.87

[3] Travel Day Person Trips (in millions), NHTSA 2017 https://nhts.ornl.gov/
[4] American Community Survey 2015-19 and National Household Transportation Survey 2017

To estimate the number of vehicle-miles that might be replaced by bicycling and walking trips, Table 8 shows the average trip distance of bicycling and walking trips by trip purpose. The number of vehicle miles reduced due to bicycle and pedestrian trips was calculated by multiplying the number of biking or walking trips by the trip replacement and trip distance factors.

Table 8: Trip Distance (miles)

	Bike	Walk
Commute Trips[5]	2.47	0.72
College Trips[6]	1.31	0.43
K-12 School Trips[7]	1.36	0.69
Utilitarian Trips[8]	2.28	0.83
Social/Recreational Trips[9]	2.73	1.12

Environmental Sustainability Benefits

For every vehicle-mile reduced, there is an assumed decrease in greenhouse gases and criteria pollutants. **Table 9** lists the reduction in greenhouse gases and criteria pollutants by vehicle-mile traveled. The cost to mitigate or clean-up those pollutants was calculated using the monetary values provided by the 2021 USDOT BCA Guidance Table A-6 for the corresponding year. Emissions types not listed in that table were not included in the analysis.

Table 9: Environmental Sustainability Multipliers (notes supplied at the end of this memo)

	Value (metric tons/VMT)
Particulate Matter 2.5 ($PM_{2.5}$) [i]	0.0000000044
Nitrous Oxides (NOx) [ii]	0.0000008
Sulfur Oxides (SO_2) [iii]	0.00000001
Carbon Dioxide[iv]	0.00044

[5] NHTS (2017). http://nhts.ornl.gov/tables09/fatcat/2009/aptl_TRPTRANS_WHYTRP1S.html
[6] Ibid.
[7] Safe Routes National Center for Safe Routes to School, Trends in Walking and Bicycling to School from 2007 to 2013 (2015). http://www.saferoutesinfo.org/sites/default/files/SurveyTrends_2007-13_final1.pdf
[8] NHTS (2017). http://nhts.ornl.gov/tables09/fatcat/2009/aptl_TRPTRANS_WHYTRP1S.html
[9] Ibid

Quality of Life Benefits

More people bicycling and walking can help encourage an increase in physical activity levels, which may help reduce healthcare costs for residents in the region. As shown in **Table 10**, 27 percent of adults and 18 percent of children in North Carolina report little or no leisure-time physical activity. The health benefits from a physically inactive person becoming physically active and having a reduced probability of suffering from chronic diseases or missing work for health-related reasons can save an individual approximately $1,616 per year in healthcare costs.

Table 10: Health Multipliers

	Value
Physically Inactive Adults in North Carolina	0.27
Physically Inactive Children in North Carolina	0.18
Healthcare Cost Savings[10]	$1,672 per newly active person

Economic Competitiveness Benefits

For every vehicle-mile reduced, there is a reduction in household transportation costs and congestion costs. ***Table 11*** displays the multipliers use to calculate economic competitiveness benefit.

Table 11: Economic Competitiveness Multipliers

Value	
Household Transportation Cost Savings	**$0.43 per VMT**[11]
Congestion Cost Savings	$0.06 per VMT[12,13]

Safety Benefits

The proposed project would decrease conflicts between people walking and biking with motor vehicles. Collision data from police-reported crashes were collected for a thirteen-year period between 2007 and 2019 sourced from the North Carolina Pedestrian and Bicycle Crash Data Tool hosted by PedBikeInfo and NCDOT. Collisions under consideration all involved a bicycle and/or pedestrian and were located within a quarter mile of proposed project **(Table 12**). The Crash Reduction Factor (CRF) Install Shared Use Path (CM ID: R37) was applied to the selected crashes proximate to the Southwest Greenway portion of the project, and the CRF Road Diet (CM ID: R15) was applied to the

[10] Inadequate Physical Activity and Health Care Expenditures in the United States. http://www.cdc.gov/nccdphp/dnpao/docs/carlson-physical-activity-and-healthcare-expenditures-final-508tagged.pdf
[11] Our Driving Costs, AAA (2016). http://exchange.aaa.com/automobiles-travel/automobiles/driving-costs/#.Vw_xCPkrKUk
[12] Crashes vs. Congestion: What's the Cost to Society? AAA (2011). http://www.camsys.com/pubs/2011_AAA_CrashvCongUpd.pdf
[13] Crashes vs. Congestion: What's the Cost to Society? AAA (2011). http://www.camsys.com/pubs/2011_AAA_CrashvCongUpd.pdf

Elm and Montlieu sections of the project, and the benefits were monetized using the values provided in the 2021 USDOT BCA Guidance Table A-1 on MAIS Level data.

The proposed project would also decrease conflicts between motor vehicles due to the proposed road diets along Elm Street and Montlieu Avenue. A crash period of three years (2016-2019) was examined, with data from NCDOT. **Table 13** displays the vehicle-vehicle crashes on the roadway segments that will be receiving a road diet under the proposed project.

Table 12. Summary of Pedestrian and Bicyclist Collisions

Trail (Location)	Number of Collisions (2007-19)	Fatal	Critical	Severe	Serious	Moderate	Minor	Property Damage	Maximum Collision Buffer Distance	Rationale
Southwest Heritage Greenway	30	0	-	-	4	12	11	3	0.25 Mile	Provides an off-street facility for walking and biking
North Elm Street	25	0	-	-	3	5	13	4	0.25 Mile	Standard connectivity exists but road diet will increase safety.
Sunset/Montlieu/Blain	11	1	-	-	1	2	6	1	0.25 Mile	Standard connectivity exists but road diet will increase safety.
Annual Average	5.1	0.08	-	-	0.62	1.46	2.31	0.62		

Table 13: Summary of Motor Vehicle-Motor Vehicle collisions

Corridor (Location)	Number of Collisions (2016-19)	Fatal	Critical	Severe	Serious	Moderate	Minor	Minor	Maximum Collision Buffer Distance	Rationale
North Elm Street	440	1	-	-	0	12	57	370	On corridor	4 to 3 or 4 to 2 Road Diet
Montlieu	132	0	-	-	0	1	13	118	On corridor	5 to 4 or 5 to 3 Road Diet
Annual Average	190.67	0.33	-	-	0	4.33	23.3	163		

Economic Competitiveness Benefits

Table 14 shows the estimated roadway maintenance cost savings associated with a reduction in vehicle-miles traveled.

Table 14: State of Good Repair Multiplier

	Value (metric tons/VMT)
Roadway Maintenance Cost Savings	$0.06 per VMT[v]

Results

Table 15 through Table 24 display the results of the benefit-cost analysis for each year of the analysis period. This BCA estimates that the proposed project compared to the no-build scenario over a 25-year evaluation (2022-2046) and at a 7 percent real discount rate has a net present value of **$22.7 million** and a benefit-cost ratio of **2.05 : 1.0.**

Table 15: Estimated Annual Bicycle and Walk Trips

Year	Baseline	Build Scenario	Additional Trips
2022	2,550,000	2,550,000	-
2023	2,570,000	2,570,000	-
2024	2,590,000	2,590,000	-
2025	2,610,000	2,610,000	-
2026	2,630,000	2,630,000	-
2027	2,650,000	2,860,000	210,000
2028	2,670,000	3,090,000	420,000
2029	2,680,000	3,320,000	640,000
2030	2,700,000	3,550,000	850,000
2031	2,720,000	3,790,000	1,070,000
2032	2,740,000	4,030,000	1,290,000
2033	2,760,000	4,280,000	1,520,000
2034	2,780,000	4,530,000	1,750,000
2035	2,800,000	4,780,000	1,980,000
2036	2,820,000	5,030,000	2,210,000
2037	2,830,000	5,280,000	2,450,000
2038	2,850,000	5,540,000	2,690,000
2039	2,870,000	5,800,000	2,930,000
2040	2,890,000	6,070,000	3,180,000
2041	2,910,000	6,330,000	3,420,000
2042	2,930,000	6,600,000	3,670,000
2043	2,950,000	6,880,000	3,930,000
2044	2,960,000	7,150,000	4,190,000
2045	2,980,000	7,430,000	4,450,000
2046	3,000,000	7,710,000	4,710,000
		Total Additional Trips:	$ 47,560,000

Table 16: Estimated Annual Vehicle Miles Reduced

Year	Baseline	Build Scenario	Additional Vehicle Miles Reduced
2022	1,750,000	1,750,000	-
2023	1,760,000	1,760,000	-
2024	1,780,000	1,780,000	-
2025	1,790,000	1,790,000	-
2026	1,800,000	1,800,000	-
2027	1,810,000	2,030,000	220,000
2028	1,830,000	2,270,000	440,000
2029	1,840,000	2,500,000	660,000
2030	1,850,000	2,740,000	890,000
2031	1,870,000	2,990,000	1,120,000
2032	1,880,000	3,230,000	1,350,000
2033	1,890,000	3,480,000	1,590,000
2034	1,900,000	3,740,000	1,840,000
2035	1,920,000	3,990,000	2,070,000
2036	1,930,000	4,250,000	2,320,000
2037	1,940,000	4,510,000	2,570,000
2038	1,950,000	4,780,000	2,830,000
2039	1,970,000	5,040,000	3,070,000
2040	1,980,000	5,310,000	3,330,000
2041	1,990,000	5,590,000	3,600,000
2042	2,010,000	5,860,000	3,850,000
2043	2,020,000	6,140,000	4,120,000
2044	2,030,000	6,420,000	4,390,000
2045	2,040,000	6,710,000	4,670,000
2046	2,060,000	7,000,000	4,940,000
Total Additional Vehicle Miles Reduced:			$ 49,870,000

Table 17: Estimated Annual Environmental Sustainability Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ 80,000	$ 90,000	$ 10,000
2028	$ 80,000	$ 110,000	$ 30,000
2029	$ 80,000	$ 110,000	$ 30,000
2030	$ 90,000	$ 130,000	$ 40,000
2031	$ 90,000	$ 140,000	$ 50,000
2032	$ 90,000	$ 150,000	$ 60,000
2033	$ 90,000	$ 170,000	$ 80,000
2034	$ 90,000	$ 180,000	$ 90,000
2035	$ 90,000	$ 200,000	$ 110,000
2036	$ 100,000	$ 210,000	$ 110,000
2037	$ 100,000	$ 220,000	$ 120,000
2038	$ 100,000	$ 240,000	$ 140,000
2039	$ 100,000	$ 260,000	$ 160,000
2040	$ 100,000	$ 270,000	$ 170,000
2041	$ 100,000	$ 290,000	$ 190,000
2042	$ 110,000	$ 310,000	$ 200,000
2043	$ 110,000	$ 320,000	$ 210,000
2044	$ 110,000	$ 340,000	$ 230,000
2045	$ 110,000	$ 360,000	$ 250,000
2046	$ 110,000	$ 380,000	$ 270,000
		Total Benefits:	$ 2,550,000

Table 18: Estimated Annual Quality of Life Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ 150,000	$ 230,000	$ 80,000
2028	$ 150,000	$ 310,000	$ 160,000
2029	$ 150,000	$ 390,000	$ 240,000
2030	$ 150,000	$ 480,000	$ 330,000
2031	$ 160,000	$ 560,000	$ 400,000
2032	$ 160,000	$ 650,000	$ 490,000
2033	$ 160,000	$ 740,000	$ 580,000
2034	$ 160,000	$ 820,000	$ 660,000
2035	$ 160,000	$ 910,000	$ 750,000
2036	$ 160,000	$ 1,000,000	$ 840,000
2037	$ 160,000	$ 1,100,000	$ 940,000
2038	$ 160,000	$ 1,190,000	$ 1,030,000
2039	$ 160,000	$ 1,280,000	$ 1,120,000
2040	$ 170,000	$ 1,380,000	$ 1,210,000
2041	$ 170,000	$ 1,470,000	$ 1,300,000
2042	$ 170,000	$ 1,570,000	$ 1,400,000
2043	$ 170,000	$ 1,670,000	$ 1,500,000
2044	$ 170,000	$ 1,770,000	$ 1,600,000
2045	$ 170,000	$ 1,870,000	$ 1,700,000
2046	$ 170,000	$ 1,970,000	$ 1,800,000
		Total Benefits:	$ 18,130,000

Table 19: Estimated Annual Economic Competitiveness Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ 920,000	$ 1,030,000	$ 110,000
2028	$ 930,000	$ 1,150,000	$ 220,000
2029	$ 940,000	$ 1,270,000	$ 330,000
2030	$ 940,000	$ 1,400,000	$ 460,000
2031	$ 950,000	$ 1,520,000	$ 570,000
2032	$ 960,000	$ 1,650,000	$ 690,000
2033	$ 960,000	$ 1,770,000	$ 810,000
2034	$ 970,000	$ 1,900,000	$ 930,000
2035	$ 970,000	$ 2,030,000	$ 1,060,000
2036	$ 980,000	$ 2,160,000	$ 1,180,000
2037	$ 990,000	$ 2,290,000	$ 1,300,000
2038	$ 990,000	$ 2,430,000	$ 1,440,000
2039	$ 1,000,000	$ 2,570,000	$ 1,570,000
2040	$ 1,010,000	$ 2,700,000	$ 1,690,000
2041	$ 1,010,000	$ 2,840,000	$ 1,830,000
2042	$ 1,020,000	$ 2,980,000	$ 1,960,000
2043	$ 1,030,000	$ 3,120,000	$ 2,090,000
2044	$ 1,030,000	$ 3,270,000	$ 2,240,000
2045	$ 1,040,000	$ 3,410,000	$ 2,370,000
2046	$ 1,050,000	$ 3,560,000	$ 2,510,000
		Total Benefits:	**$ 25,360,000**

Table 20: Estimated Annual Safety Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ -	$ 3,640,000	$ 3,640,000
2028	$ -	$ 3,640,000	$ 3,640,000
2029	$ -	$ 3,640,000	$ 3,640,000
2030	$ -	$ 3,640,000	$ 3,640,000
2031	$ -	$ 3,640,000	$ 3,640,000
2032	$ -	$ 3,640,000	$ 3,640,000
2033	$ -	$ 3,640,000	$ 3,640,000
2034	$ -	$ 3,640,000	$ 3,640,000
2035	$ -	$ 3,640,000	$ 3,640,000
2036	$ -	$ 3,640,000	$ 3,640,000
2037	$ -	$ 3,640,000	$ 3,640,000
2038	$ -	$ 3,640,000	$ 3,640,000
2039	$ -	$ 3,640,000	$ 3,640,000
2040	$ -	$ 3,640,000	$ 3,640,000
2041	$ -	$ 3,640,000	$ 3,640,000
2042	$ -	$ 3,640,000	$ 3,640,000
2043	$ -	$ 3,640,000	$ 3,640,000
2044	$ -	$ 3,640,000	$ 3,640,000
2045	$ -	$ 3,640,000	$ 3,640,000
2046	$ -	$ 3,640,000	$ 3,640,000
		Total Benefits:	**$ 72,800,000**

Table 21: Estimated Annual State of Good Repair Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ 120,000	$ 130,000	$ 10,000
2028	$ 120,000	$ 150,000	$ 30,000
2029	$ 120,000	$ 160,000	$ 40,000
2030	$ 120,000	$ 180,000	$ 60,000
2031	$ 120,000	$ 190,000	$ 70,000
2032	$ 120,000	$ 210,000	$ 90,000
2033	$ 120,000	$ 230,000	$ 110,000
2034	$ 120,000	$ 240,000	$ 120,000
2035	$ 120,000	$ 260,000	$ 140,000
2036	$ 130,000	$ 280,000	$ 150,000
2037	$ 130,000	$ 290,000	$ 160,000
2038	$ 130,000	$ 310,000	$ 180,000
2039	$ 130,000	$ 330,000	$ 200,000
2040	$ 130,000	$ 350,000	$ 220,000
2041	$ 130,000	$ 360,000	$ 230,000
2042	$ 130,000	$ 380,000	$ 250,000
2043	$ 130,000	$ 400,000	$ 270,000
2044	$ 130,000	$ 420,000	$ 290,000
2045	$ 130,000	$ 440,000	$ 310,000
2046	$ 130,000	$ 460,000	$ 330,000
		Total Benefits:	$ 3,260,000

Table 22: Estimated Annual Maintenance Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	$ 10,000	$ 10,000
2027	$ -	$ 10,000	$ 10,000
2028	$ -	$ 10,000	$ 10,000
2029	$ -	$ 10,000	$ 10,000
2030	$ -	$ 10,000	$ 10,000
2031	$ -	$ 10,000	$ 10,000
2032	$ -	$ 10,000	$ 10,000
2033	$ -	$ 10,000	$ 10,000
2034	$ -	$ 10,000	$ 10,000
2035	$ -	$ 10,000	$ 10,000
2036	$ -	$ 10,000	$ 10,000
2037	$ -	$ 10,000	$ 10,000
2038	$ -	$ 10,000	$ 10,000
2039	$ -	$ 10,000	$ 10,000
2040	$ -	$ 10,000	$ 10,000
2041	$ -	$ 10,000	$ 10,000
2042	$ -	$ 10,000	$ 10,000
2043	$ -	$ 10,000	$ 10,000
2044	$ -	$ 10,000	$ 10,000
2045	$ -	$ 10,000	$ 10,000
2046	$ -	$ 10,000	$ 10,000
		Total Benefits:	$ 200,000

Table 23: Estimated Annual Benefits (Undiscounted)

Year	Baseline	Build Scenario	Benefits
2022	-	-	-
2023	-	-	-
2024	-	-	-
2025	-	-	-
2026	-	-	-
2027	$ -	$ 3,820,000	$ 3,820,000
2028	$ -	$ 4,040,000	$ 4,040,000
2029	$ -	$ 4,300,000	$ 4,300,000
2030	$ -	$ 4,520,000	$ 4,520,000
2031	$ -	$ 4,750,000	$ 4,750,000
2032	$ -	$ 4,980,000	$ 4,980,000
2033	$ -	$ 5,210,000	$ 5,210,000
2034	$ -	$ 5,450,000	$ 5,450,000
2035	$ -	$ 5,690,000	$ 5,690,000
2036	$ -	$ 5,930,000	$ 5,930,000
2037	$ -	$ 6,180,000	$ 6,180,000
2038	$ -	$ 6,430,000	$ 6,430,000
2039	$ -	$ 6,680,000	$ 6,680,000
2040	$ -	$ 6,940,000	$ 6,940,000
2041	$ -	$ 7,200,000	$ 7,200,000
2042	$ -	$ 7,460,000	$ 7,460,000
2043	$ -	$ 7,730,000	$ 7,730,000
2044	$ -	$ 8,000,000	$ 8,000,000
2045	$ -	$ 8,270,000	$ 8,270,000
2046	$ -	$ 17,840,000	$ 17,840,000
		Total Benefits:	$ 131,420,000

Table 24: Estimated Discounted Net Costs and Benefits (discounted at 7%)[14]

Year	Net Costs	Net Benefits	Net Cumulative Costs and Benefits
2022	$ (690,000)	$ -	$ (690,000)
2023	$ (1,410,000)	$ -	$ (2,090,000)
2024	$ (3,930,000)	$ -	$ (6,060,000)
2025	$ (11,500,000)	$ -	$ (17,560,000)
2026	$ (4,000,000)	$ -	$ (21,560,000)
2027	-	$ 2,550,000	$ (19,010,000)
2028	-	$ 2,520,000	$ (16,490,000)
2029	-	$ 2,510,000	$ (13,990,000)
2030	-	$ 2,470,000	$ (11,520,000)
2031	-	$ 2,420,000	$ (9,100,000)
2032	-	$ 2,380,000	$ (6,720,000)
2033	-	$ 2,330,000	$ (4,400,000)
2034	-	$ 2,280,000	$ (2,120,000)
2035	-	$ 2,220,000	$ 100,000
2036	-	$ 2,170,000	$ 2,270,000
2037	-	$ 2,120,000	$ 4,390,000
2038	-	$ 2,060,000	$ 6,450,000
2039	-	$ 2,010,000	$ 8,460,000
2040	-	$ 1,950,000	$ 10,410,000
2041	-	$ 1,890,000	$ 12,300,000
2042	-	$ 1,840,000	$ 14,140,000
2043	-	$ 1,790,000	$ 15,930,000
2044	-	$ 1,730,000	$ 17,660,000
2045	-	$ 1,680,000	$ 19,340,000
2046	-	$ 3,340,000	$ 22,680,000
Total Net Discounted Costs: $21,570,000		**Total Discounted Net Benefits: $44,260,000**	**Net Present Value: $22,680,000**
			Benefit-Cost Ratio: 2.05

[14] Carbon reduction benefits were discounted at 3%

Multiplier Notes

[i] The Safer Affordable Fuel-Efficient Vehicles Rule for MY2021-MY2026 Passenger Cars, BUILD Guidance 2020, Table A-7 and Light Trucks Preliminary Regulatory Impact Analysis (October 2018) https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ld_cafe_co2_nhtsa_2127-al76_epa_pria_181016.pdf

[ii] The Safer Affordable Fuel-Efficient Vehicles Rule for MY2021-MY2026 Passenger Cars, BUILD Guidance 2020, Table A-7 and Light Trucks Preliminary Regulatory Impact Analysis (October 2018) https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ld_cafe_co2_nhtsa_2127-al76_epa_pria_181016.pdf

[iii] The Safer Affordable Fuel-Efficient Vehicles Rule for MY2021-MY2026 Passenger Cars, BUILD Guidance 2020, Table A-7 and Light Trucks Preliminary Regulatory Impact Analysis (October 2018) https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ld_cafe_co2_nhtsa_2127-al76_epa_pria_181016.pdf

[iv] Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf

[v] Kitamura, R., Zhao, H., and Gubby, A. R. Development of a Pavement Maintenance Cost Allocation Model. Institute of Transportation Studies, University of California, Davis. https://trid.trb.org/view.aspx?id=261768