

BENEFIT-COST ANALYSIS

Prepared for City of Burlington, Iowa
Downtown/Riverfront Revitalization Project

Introduction

A benefit-cost analysis (BCA) was performed for the City of Burlington Downtown/Riverfront Revitalization Project for submission to the U.S. Department of Transportation (U.S. DOT). Cost-benefit analysis is required as part of the grant application for the 2016 TIGER program. The analysis was completed to determine the possible benefit cost ratios of proposed street, bicycle, pedestrian, transit, and flood protection improvements providing multi-modal connections to Burlington's Downtown/Riverfront. Recommended U.S. DOT methodologies for cost-benefit analysis were followed in order to provide the department with "apples-to-apples" comparisons and to make analysis strategy transparent. Cost-benefit methodologies were captured in The Guide to Preparing Benefit-Cost Analysis for TIGER grants¹. Additional categories of monetized benefits and costs that are not shown in the guide have been developed using alternative strategies. Sources, detailed calculations and rationale are identified in this report for determining these monetized benefits/costs.

This benefit-cost analysis is based on the difference between the "no-build" scenario and the proposed improvements scenario. The "no-build" scenario is for baseline projections if the project were not to take place and is to go without improvements to the existing road and flood area. The baseline projections were then used to estimate the proposed scenario where improvements for flood protection and roadways were taken into account.

General Assumptions

Constant Dollar Values & Discount Rates

Cost/ benefit investments for the projects are shown in constant 2016 dollar values. Most benefit valuations and some costs were expressed in dollar values in a past year dollar value amount. In order to adjust and translate these monetized historical year values into 2016 dollars, the U.S. Bureau of Labor Statistics' Consumer Price Index (CPI) for Urban Consumers² was applied to historical values. Analyzing everything in a single base year of 2016 dollar values helps to further establish an "apples-to-apples" comparison of monetized benefits and costs for the U.S. DOT.

Real discount rates of 3.0% and 7.0% were used in this BCA as recommended by the U.S. DOT guidance for TIGER grants and the White House Office of Management and Budget (OMB Circular A-4)³.

"As a default position, OMB Circular A-94 states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or

¹ TIGER 2014 NOFA: Benefit-Cost Analysis Guidance, Updated March 14, 2014; <http://www.dot.gov/tiger/guidance>

² U.S. Bureau of Labor Statistics. Consumer Price Index, All Urban Consumers, U.S. City Average, Series CUSR0000SA0. 1982-1984=100.

³ White House Office of Management and Budget, Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (October 29, 1992). (<https://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>).

alter the use of capital in the private sector.... The effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption (e.g., through higher consumer prices for goods and services), a lower discount rate is appropriate. The alternative most often used is sometimes called the “social rate of time preference.” This simply means the rate at which “society” discounts future consumption flows to their present value. If we take the rate that the average saver uses to discount future consumption as our measure of the social rate of time preference, then the real rate of return on long-term government debt may provide a fair approximation. Over the last thirty years, this rate has averaged around 3 percent in real terms on a pre-tax basis.⁴”

Evaluation Period

The evaluation period for the City of Burlington Downtown/Riverfront Revitalization Project includes both the construction period and the post-construction period. The post-construction period considered was 20-years of operations and allows for benefit accrual to take place. The construction period is considered to be when capital investment costs are used. This study has assumed the construction period to take place during years 2017-2022. Operations are assumed to begin in year 2023 and designed for 20-years of operations through 2042.

Results & Methodology

The analysis results in a positive return on investment for both 3% and 7% discount rates over the evaluation period. These discounted net present values are based upon undiscounted costs and undiscounted benefits for the period. Undiscounted costs totaled \$83.9 million dollars over the evaluation period and include both capital costs and operations/maintenance costs. Total undiscounted benefits were \$238.7 million dollars over the 20-year period. Analysis yielded a benefit-cost ratio of 1.95 discounted at 3% and a ratio of 1.24 discounted at 7%. Cost table summary on Appendix D – Page 16. It should be noted that benefits do not include O&M cost savings from doing proposed road and flood improvements. The O&M costs for “no-build” situation would likely create an even larger savings benefit for the proposed improvements situation, further increasing the Benefit-Cost Ratio.

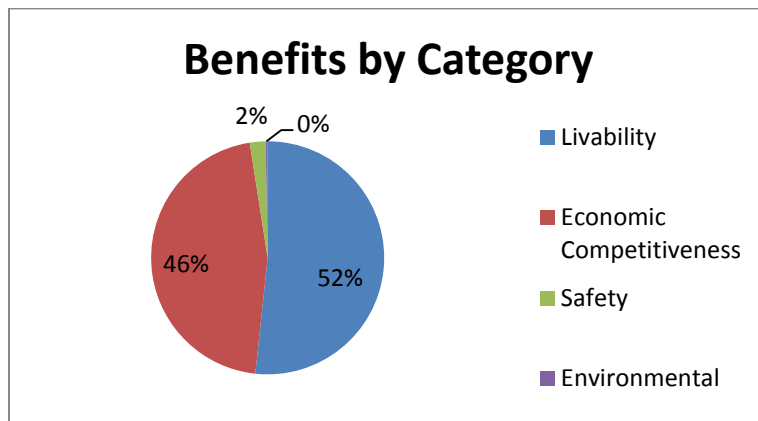
Benefit-Cost Summary		
	3% Discount	7% Discount
Total Benefits	\$ 149,296,889	\$ 84,594,298
Total Costs	\$ 76, 480,801	\$ 68,212,490
Benefit-Cost Ratio	1.95	1.24

Impacts from proposed improvements that created the largest benefit were from flood mitigation/protection and additional annual revenue from increased business attraction.

⁴ White House Office of Management and Budget, Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (October 29, 1992). (<https://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>).

Benefits Summary in 2016 Dollars			
Type of Impact	Benefit	Value @ 3% Discount	Value @ 7% Discount
Economic	Increased Property Value	2,858,653	2,189,453
Economic	Increased Business/Tourism	64,841,270	36,736,986
Flood Mitigation	Property Protection	74,660,148	42,300,048
Safety	Accident Reduction	3,251,831	1,842,383
Environment	Reduced Emissions	983,827	778,221
Total Benefits		\$ 149,296,889	\$ 84,594,298

The categorical pie chart below gives a conceptual look at the percentages that each benefit provided compared to the overall improvement benefits.



Human health benefits were not estimated with monetary values such as the ones shown above. With the “Complete Streets” initiative and apart of the proposed improvements, increased physical activity is linked to improved health and will benefit and have a positive impact on the community of Burlington.

Flood Mitigation Benefits

Flooding in the City of Burlington has been a problematic occurrence for as long as the City has existed. In recent years (2008, 2013, and 2014), a series of record floods have been devastating and cost the City and many private businesses millions of dollars in emergency protection costs, property damage, cleanup, maintenance and lost revenues. Flood levels have exceeded the 100 and 500-year floods in recent years. Protection from these levels of flooding is critical in mitigating large damage costs in the future.

Proposed improvements to flood protection infrastructure include a combination of permanent floodwall and removable flood walls. The permanent proposed flood wall would protect for the 100-year flood, with removable walls to be installed to protect against the 500-year flood if necessary. In order to determine flood mitigation benefits, a review of average property values and number of property facilities was needed. Data from the Iowa Flood Mitigation Program Project Application sent to the State of Iowa by the City of Burlington was used to obtain these values. Average value computations in this application were computed using the 2014 assessed value of properties located within the project

area, as provided by the Des Moines County Assessor's Office, divided by the total properties in each tax class. The population of the project area was determined using EJView based on 2006-2010 American Community Survey of the U.S. Census Bureau. The table below shows assumptions and estimates from the Flood Mitigation Program Project Application.

Flood Mitigation Data Table

	Properties / Facilities	People	Average Value	Total Potential Losses Mitigated
# of People		17,271	\$ -	\$ -
# of Residential Properties	1,331		\$ 57,665.00	\$ 76,752,115.00
# of Commercial Properties	486		\$ 82,983.00	\$ 40,329,738.00
# of Public Properties	104		\$ -	\$ -
# of Critical Facilities	4		\$250,000.00	\$ 1,000,000.00
Total Potential Losses Mitigated	1,925	17,271	\$390,648.00	\$118,081,853.00
Converted from 2014 values to 2016 dollar values:				\$119,843,081.42

Calculated potential losses mitigated totaled \$119,843,081 in undiscounted 2016 dollars. Limited available property elevation data made it very difficult to apply flooding elevation probabilities to create an annual property damage/loss prevention benefit at different river stages. Instead, the total value was evenly distributed over the 20-year post-construction period, creating an annual benefit of \$5,992,154. Flood mitigation benefits of \$74.6 million and \$42.3 million were calculated for the 3% discounts and 7% discounts, respectively.

See Appendix D – Page 10 for Flood Mitigation Benefits table over the project period and further notes and explanation of methodology.

Increased Property Value

Improved roadway/pedestrian-based infrastructure combined with flood protection along Burlington’s Riverfront is likely to increase property value in the downtown. The proposed implementation of “Complete Streets” along Main and Jefferson Street and at the Riverfront will help make these areas more accessible for people on foot or riding bikes. The National Complete Streets Coalition states that increased walkability leads to increased property values and has showed cases where property value increased \$3,000-\$9,000 as a result of Complete Street type projects (added trees, bike paths, sidewalks, green spaces, increased walkability, etc.)⁵. A conservative estimate of 5% increase in property value due to accessibility for pedestrian travel and enhanced multi-modal infrastructure as a result of “Complete Streets” was applied to the existing downtown property value in Burlington. An existing property value of \$35.1 million in the downtown area was obtained from City of Burlington staff officials.

⁵ "Economic Development." *Smart Growth America*. (2016). <http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/economic-revitalization>

Another 5% increase was estimated for downtown property value in the City due to flood protection after new floodwall infrastructure has been built. The additional 5% makes for a total of 10% increase from the downtown's current property value. The 5% increase estimate from flood protection is based on hedonic model studies used to compare flooding and property values. A study performed before and after Hurricane Floyd showed that, on average, property values are reduced by an estimated 5.8% when located in a floodplain⁶. A number of other studies showed decreases in property values within floodplains to be between 4% and 10%⁷. The estimated 5% increase on property value within Burlington's downtown shows to be a conservative estimate based on the protection that will be provided.

For this analysis, the current value of property is considered the "no-build" scenario where improvements would not take place. Overall, the improvements are estimated to result in a 10% increase in downtown properties. The increased property value benefit was considered a one-time "stock" benefit applied in 2023 (first year post-construction) in this analysis and led to a total undiscounted benefit of \$3,515,782. Property value benefits of \$2.9 million and \$2.2 million were calculated for the 3% discounts and 7% discounts, respectively.

Increased Spending (Business/Tourism)

Improved transportation infrastructure is seen as a way to improve economic development in the City of Burlington. Multi-modal "Complete Streets" improvements along with riverfront flood protection and reconditioning are estimated to increase visitor spending by \$5.2 million (undiscounted 2016 dollars) annually. For this analysis, the \$5.2 million was assumed to stay constant over the 20-year post-construction period and applied at discounts of 3% and 7%. Total benefits from increased spending were calculated to be \$64.8 million and \$36.7 million for 3% and 7% discounts, respectively. In this case, the "no-build" scenario assumes that no annual increase is seen during the evaluation period.

Additional visitors to the Burlington Mississippi River Riverfront are estimated at 44,400 and are mainly based on larger event attendance. The following table shows projections on additional visitors.

⁶ Bin, O. and Polasky, S. (2004): Effects of flood hazards on property values: Evidence before and after hurricane Floyd, *Land Economics*, Vol. 80, No. 4, pp490-500

⁷ https://www.fig.net/resources/proceedings/fig_proceedings/fig2012/papers/ts06h/TS06H_kropp_5729.pdf

Annual Proposed Additional Visitors to Burlington Mississippi River Riverfront				
Event	Attendance	Estimated # of Days	Economic Impact	Notes
Riverfront (the landing/bike trail)	10,000	0.5	\$415,000	additional daily use including residents
Burlington Steamboat Days	2,200	2.5	\$456,500	addition to the already 22,000 attendees
Burlington Memorial Auditorium	12,000	2	\$1,992,000	addition to the current attendees (factoring April – July events under flood threats)
American Queen	3,000	1	\$249,000	8 dockings (400 people each dock)
Viking River Cruises	1,200	1	\$99,600	2 dockings (600 people each dock)
New Events Using Riverfront	16,000	1.5	\$1,992,000	proposing 2 new events to the space
Total	44,400	1.5	\$5,204,100	

In the calculated spending increase estimate, it is assumed that the additional attendance spent an average amount of \$83 dollars per visitor and was multiplied by the estimated number of days spent in the community. Projections were obtained from the Greater Burlington Convention & Visitors Bureau. Appendix D – Page 11 shows calculated present value benefits for increased spending.

Reduced Average Daily Traffic (ADT)

A travel-related improvement expected as a result of the improved road infrastructure and pedestrian-based infrastructure is the reduction in ADT along Main Street and Jefferson Street. Impacts to ADT along these roads create a reduction benefit for vehicle operation costs (VOC's) and emissions reductions.

VOC is directly related to the amount of vehicle miles traveled (VMT). In this analysis, it was assumed that there would be a 20% decrease in ADT. US DOT FHWA Road Diet case studies showed cases for "Complete Streets" programs with 18-29% volume reduction⁸, as well as a case with 36% reduction. A value of 20% decrease for the proposed improvements project in Burlington is considered conservative. The 20% reduction is based on the assumption that 20% of the traveling vehicle population will use walking, biking and other modes of transit in this area. ADT traffic information in these corridors was found on 2014 IDOT AADT mapping and averaged 6800 vehicles/day along Main Street and 1890 vehicles/day on Jefferson Street in this corridor. The vehicles/day counts were multiplied by 365 to give an annual estimate for the "no-build" scenario. The "no-build" was based on current AADT rates and is assumed to increase 1% per year over the project period. 20% of the current "no-build" rates were used as the reduction benefit. The reduction benefit of vehicles/year was then multiplied by the distances of Jefferson and Main Street within the project corridor to get VMT reductions. Total distance in this area

⁸ "Case Studies - Safety | Federal Highway Administration." Case Studies - Safety | Federal Highway Administration. (http://safety.fhwa.dot.gov/road_diets/case_studies/).

is 1.24 miles and was considered the total trip length. These reductions were multiplied by the IRS 2016 Standard Mileage Rates⁹ used for cost/mile (\$0.54/mile) to create the VOC savings.

An undiscounted VOC benefit savings of \$5.3 million was calculated, while present benefit values of \$3.2 million and \$1.2 million were calculated for 3% and 7% discounts, respectively. The detailed VOC cost savings table is shown in Appendix D – Page 12.

Reduced ADT also created emission reductions in the project area. Emission rates were analyzed at the current speed limit of 25 MPH. The speed is assumed to stay the same with the improvements project. The following table summarizes monetary values of emissions in accordance with the benefit-cost analysis values as recommended by the U.S. DOT and emissions rates taken from Iowa, ICAAP emissions tables¹⁰.

Monetary Values of Emissions		
	Emission Rate at 25 MPH* (gram/VMT)	\$ / Metric Ton (2016 Dollars)
CO2	563.19	Varies**
VOC	1.818	\$ 2,059.00
NOx	1.806	\$ 8,115.00
PM	0.033	\$371,251.00
SOx	0.01	\$ 47,965.00

*Source: Iowa DOT, ICAAP emissions tables

**Used 3% Social Cost of Carbon as outlined in 2014 Benefit-Cost Analysis Guidance for Tiger Grant Applicants. Dollar values were converted to 2016 dollars.

Present benefit values for emissions totaled \$0.4 million and \$0.315 million were calculated for 3% and 7% discounts, respectively. The detailed emissions reduction benefit savings table is shown in Appendix D – Page 13.

Reduction in Accidents

The benefit-cost analysis assumes a 40% reduction in the number of accidents as a result of safety improvements along the roadway. The “Complete Streets” improvements include bicycle lanes and enhanced pedestrian walkways. The US DOT FHWA Road Diet “Complete Streets” case studies showed strong reinforcement of crash reduction as a result of complete streets programs. Most studies found between 20% and 70% reduction for crash/injury incidents¹¹. A conservative estimate of 40% was used for the analysis due to evidence through “Road Diet” documentation. The case studies show decreased speeding in these improved traffic areas.

⁹ "2016 Standard Mileage Rates for Business, Medical and Moving Announced." 2016 Standard Mileage Rates for Business, Medical and Moving Announced. (<https://www.irs.gov/uac/Newsroom/2016-Standard-Mileage-Rates-for-Business-Medical-and-Moving-Announced>).

¹⁰ Source: Iowa DOT, ICAAP emissions tables (http://www.iowadot.gov/systems_planning/icaap.htm).

¹¹ "Case Studies - Safety | Federal Highway Administration." Case Studies - Safety | Federal Highway Administration. (http://safety.fhwa.dot.gov/road_diets/case_studies/).

The “no-build” scenario considers current crash data obtained from the Iowa DOT’s Crash Mapping Analysis Tool. Through CMAT, historical data of crashes of the past 10 years along Jefferson Street and Main Street were found and data was used to create average incidents per year for baseline projections. The table below shows CMAT data.

2006-2016 IDOT CMAT Crash Injury Summary		
Crash Type	Incidents	Avg. Incidents/Yr
Unknown	3	0.3
Possible	46	4.6
Minor Injury	10	1
Major Injury	3	0.3
Fatal	0	0
Total Injury	62	6.2
PDO	162	16.2

For the improvements scenario, the average incidents/year was calculated by multiplying 40% to the incidents/year values in the CMAT table shown. In order to get monetized values, the obtained data was converted to U.S. DOT recommended AIS scale which allows to give “apples-to-apples” comparisons. The AIS scale conversion table is on Page 14 of this Appendix. Annual cost reduction benefits of approximately \$261,000 were calculated and used for the 20-year post construction period. An undiscounted accident cost savings of \$5.2 million was calculated, while present benefit values \$3.3 million and \$1.8 million were calculated for 3% and 7% discounts, respectively. The detailed crash reduction benefits table is shown in Appendix D – Page 15.

Flood Mitigation Benefits Table (2016 Dollars)

Project Year	Analysis Year	Flood Mitigation	Total Flood Mitigation Benefits	
		Property Protection (2016 Dollars)	Total Benefits @ 3% Discount	Total Benefits @ 7% Discount
1	2017		\$ -	\$ -
2	2018		\$ -	\$ -
3	2019		\$ -	\$ -
4	2020		\$ -	\$ -
5	2021		\$ -	\$ -
6	2022		\$ -	\$ -
7	2023	\$ 5,992,154.07	\$ 4,872,169.61	\$ 3,731,612.40
8	2024	\$ 5,992,154.07	\$ 4,730,261.76	\$ 3,487,488.23
9	2025	\$ 5,992,154.07	\$ 4,592,487.14	\$ 3,259,334.79
10	2026	\$ 5,992,154.07	\$ 4,458,725.38	\$ 3,046,107.28
11	2027	\$ 5,992,154.07	\$ 4,328,859.59	\$ 2,846,829.23
12	2028	\$ 5,992,154.07	\$ 4,202,776.30	\$ 2,660,588.07
13	2029	\$ 5,992,154.07	\$ 4,080,365.34	\$ 2,486,530.91
14	2030	\$ 5,992,154.07	\$ 3,961,519.75	\$ 2,323,860.66
15	2031	\$ 5,992,154.07	\$ 3,846,135.68	\$ 2,171,832.39
16	2032	\$ 5,992,154.07	\$ 3,734,112.31	\$ 2,029,749.90
17	2033	\$ 5,992,154.07	\$ 3,625,351.76	\$ 1,896,962.52
18	2034	\$ 5,992,154.07	\$ 3,519,758.99	\$ 1,772,862.17
19	2035	\$ 5,992,154.07	\$ 3,417,241.74	\$ 1,656,880.53
20	2036	\$ 5,992,154.07	\$ 3,317,710.42	\$ 1,548,486.48
21	2037	\$ 5,992,154.07	\$ 3,221,078.08	\$ 1,447,183.63
22	2038	\$ 5,992,154.07	\$ 3,127,260.27	\$ 1,352,508.06
23	2039	\$ 5,992,154.07	\$ 3,036,175.02	\$ 1,264,026.23
24	2040	\$ 5,992,154.07	\$ 2,947,742.74	\$ 1,181,332.92
25	2041	\$ 5,992,154.07	\$ 2,861,886.16	\$ 1,104,049.46
26	2042	\$ 5,992,154.07	\$ 2,778,530.25	\$ 1,031,821.92
Totals		\$ 119,843,081.42	\$ 74,660,148.31	\$ 42,300,047.78

Assumptions/Notes: Calculated Potential Losses Mitigated undiscounted 2016 value of \$119,843,081.42 to be distributed evenly over the 20-year post-construction period. Three major flood events have plagued the City of Burlington in the last 6 years (2008, 2013, 2014). Flood levels in 2008 reached 25.18 feet on Burlington flood gage (0.0 on the gage is 511.45 NAVD 1988). FEMA flood maps show the 100-year flood elevation for Burlington to be 20.75 feet and 500-year flood 24.55 feet. The permanent proposed flood wall would protect for the 100-year flood, with removable walls to be installed to protect against the 500-year flood if necessary.

Increased Spending Benefits Table (2016 Dollars)

Project Year	Analysis Year	Increased Business & Tourism	Economic Increase Benefit 2016 Dollars	
			Total Benefits @ 3% Discount	Total Benefits @ 7% Discount
1	2017	\$ -	\$ -	\$ -
2	2018	\$ -	\$ -	\$ -
3	2019	\$ -	\$ -	\$ -
4	2020	\$ -	\$ -	\$ -
5	2021	\$ -	\$ -	\$ -
6	2022	\$ -	\$ -	\$ -
7	2023	\$ 5,204,100.00	\$ 4,231,409.53	\$ 3,240,851.93
8	2024	\$ 5,204,100.00	\$ 4,108,164.60	\$ 3,028,833.58
9	2025	\$ 5,204,100.00	\$ 3,988,509.32	\$ 2,830,685.59
10	2026	\$ 5,204,100.00	\$ 3,872,339.14	\$ 2,645,500.55
11	2027	\$ 5,204,100.00	\$ 3,759,552.57	\$ 2,472,430.42
12	2028	\$ 5,204,100.00	\$ 3,650,051.03	\$ 2,310,682.64
13	2029	\$ 5,204,100.00	\$ 3,543,738.87	\$ 2,159,516.48
14	2030	\$ 5,204,100.00	\$ 3,440,523.17	\$ 2,018,239.70
15	2031	\$ 5,204,100.00	\$ 3,340,313.76	\$ 1,886,205.33
16	2032	\$ 5,204,100.00	\$ 3,243,023.07	\$ 1,762,808.72
17	2033	\$ 5,204,100.00	\$ 3,148,566.09	\$ 1,647,484.79
18	2034	\$ 5,204,100.00	\$ 3,056,860.28	\$ 1,539,705.41
19	2035	\$ 5,204,100.00	\$ 2,967,825.51	\$ 1,438,977.02
20	2036	\$ 5,204,100.00	\$ 2,881,383.99	\$ 1,344,838.33
21	2037	\$ 5,204,100.00	\$ 2,797,460.19	\$ 1,256,858.25
22	2038	\$ 5,204,100.00	\$ 2,715,980.76	\$ 1,174,633.88
23	2039	\$ 5,204,100.00	\$ 2,636,874.53	\$ 1,097,788.68
24	2040	\$ 5,204,100.00	\$ 2,560,072.36	\$ 1,025,970.72
25	2041	\$ 5,204,100.00	\$ 2,485,507.14	\$ 958,851.14
26	2042	\$ 5,204,100.00	\$ 2,413,113.73	\$ 896,122.57
Totals		\$ 104,082,000.00	\$ 64,841,269.64	\$ 36,736,985.74

Reduced ADT - Vehicle Operating Costs Savings Benefits Table (2016 Dollars)

Project Year	Analysis Year	ADT ¹ x 365 (No-Build)	365*ADT After (20% Reduction ²)	Reduction Benefit	Main Annual VMT Savings	ADT ¹ x 365 (No-Build)	365*ADT After (20% Reduction ²)	Reduction Benefit	Jefferson Annual VMT Savings	Total Annual VMT Savings	\$/Mile ³	Cost Savings Undiscounted	Total VMT Benefits @ 3% Discount	Total VMT Benefits @ 7% Discount	
1	2017	2,482,000	1,985,600	496,400	347,480	689,850	551,880	137,970	74,504	421,984	0.54				
2	2018	2,506,820	2,005,456	501,364	350,955	696,749	557,399	139,350	75,249	426,204	0.54				
3	2019	2,531,888	2,025,511	506,378	354,464	703,716	562,973	140,743	76,001	430,466	0.54				
4	2020	2,557,207	2,045,766	511,441	358,009	710,753	568,603	142,151	76,761	434,770	0.54				
5	2021	2,582,779	2,066,223	516,556	361,589	717,861	574,289	143,572	77,529	439,118	0.54				
6	2022	2,608,607	2,086,886	521,721	365,205	725,039	580,031	145,008	78,304	443,509	0.54				
7	2023	2,634,693	2,107,754	526,939	368,857	732,290	585,832	146,458	79,087	447,944	0.54	\$ 241,889.93	\$ 196,678.65	\$ 122,481.58	
8	2024	2,661,040	2,128,832	532,208	372,546	739,613	591,690	147,923	79,878	452,424	0.54	\$ 244,308.82	\$ 192,859.64	\$ 112,246.07	
9	2025	2,687,650	2,150,120	537,530	376,271	747,009	597,607	149,402	80,677	456,948	0.54	\$ 246,751.91	\$ 189,114.80	\$ 102,865.92	
10	2026	2,714,527	2,171,621	542,905	380,034	754,479	603,583	150,896	81,484	461,517	0.54	\$ 249,219.43	\$ 185,442.66	\$ 94,269.65	
11	2027	2,741,672	2,193,338	548,334	383,834	762,024	609,619	152,405	82,299	466,133	0.54	\$ 251,711.63	\$ 181,841.83	\$ 86,391.75	
12	2028	2,769,089	2,215,271	553,818	387,672	769,644	615,715	153,929	83,122	470,794	0.54	\$ 254,228.74	\$ 178,310.93	\$ 79,172.18	
13	2029	2,796,780	2,237,424	559,356	391,549	777,340	621,872	155,468	83,953	475,502	0.54	\$ 256,771.03	\$ 174,848.58	\$ 72,555.94	
14	2030	2,824,748	2,259,798	564,950	395,465	785,114	628,091	157,023	84,792	480,257	0.54	\$ 259,338.74	\$ 171,453.46	\$ 66,492.61	
15	2031	2,852,995	2,282,396	570,599	399,419	792,965	634,372	158,593	85,640	485,059	0.54	\$ 261,932.13	\$ 168,124.27	\$ 60,935.97	
16	2032	2,881,525	2,305,220	576,305	403,413	800,894	640,716	160,179	86,497	489,910	0.54	\$ 264,551.45	\$ 164,859.72	\$ 55,843.69	
17	2033	2,910,340	2,328,272	582,068	407,448	808,903	647,123	161,781	87,362	494,809	0.54	\$ 267,196.96	\$ 161,658.56	\$ 51,176.96	
18	2034	2,939,444	2,351,555	587,889	411,522	816,992	653,594	163,398	88,235	499,757	0.54	\$ 269,868.93	\$ 158,519.56	\$ 46,900.22	
19	2035	2,968,838	2,375,070	593,768	415,637	825,162	660,130	165,032	89,118	504,755	0.54	\$ 272,567.62	\$ 155,441.51	\$ 42,980.87	
20	2036	2,998,526	2,398,821	599,705	419,794	833,414	666,731	166,683	90,009	509,802	0.54	\$ 275,293.30	\$ 152,423.22	\$ 39,389.06	
21	2037	3,028,512	2,422,809	605,702	423,992	841,748	673,398	168,350	90,909	514,900	0.54	\$ 278,046.23	\$ 149,463.55	\$ 36,097.40	
22	2038	3,058,797	2,447,037	611,759	428,232	850,166	680,132	170,033	91,818	520,049	0.54	\$ 280,826.69	\$ 146,561.35	\$ 33,080.83	
23	2039	3,089,385	2,471,508	617,877	432,514	858,667	686,934	171,733	92,736	525,250	0.54	\$ 283,634.96	\$ 143,715.49	\$ 30,316.34	
24	2040	3,120,279	2,496,223	624,056	436,839	867,254	693,803	173,451	93,663	530,502	0.54	\$ 286,471.31	\$ 140,924.90	\$ 27,782.87	
25	2041	3,151,481	2,521,185	630,296	441,207	875,926	700,741	175,185	94,600	535,807	0.54	\$ 289,336.02	\$ 138,188.50	\$ 25,461.12	
26	2042	3,182,996	2,546,397	636,599	445,619	884,686	707,749	176,937	95,546	541,166	0.54	\$ 292,229.38	\$ 135,505.22	\$ 23,333.39	
		VMT Savings along Main Street (trip = 0.70 miles)				VMT Savings along Jefferson Street (trip = 0.54 miles)							\$ 5,326,175.24	\$ 3,285,936.39	\$ 1,209,774.39

¹ Average Daily Traffic (ADT) values were averaged along both Main and Jefferson with Iowa DOT AADT Maps. 1% annual increase in traffic was applied. (<http://www.iowadot.gov/maps/msp/traffic/2014/cities/Burlington.pdf>)

² US DOT FHWA Road Diet case studies showed cases for "Complete Streets" programs with 18-29% volume reduction, as well as a case with 36% reduction. A conservative estimate of 20% reduction was estimated due to increased use of other modes of transportation. (http://safety.fhwa.dot.gov/road_diets/case_studies/roaddiet_cs.pdf)

³ The IRS 2016 Standard Mileage Rates were used for cost/mile. (<https://www.irs.gov/uac/Newsroom/2016-Standard-Mileage-Rates-for-Business-Medical-and-Moving-Announced>)

Reduced ADT - Emissions Reduction Benefits Table (2016 Dollars)

Project Year	Analysis Year	Total VMT Savings/Yr	CO2 (Metric Tons/Yr)	CO2 (\$/Metric Ton)	VOC (Metric Tons/Yr)	VOC (\$/Metric Ton)	NOx (Metric Tons/Yr)	NOx (\$/Metric Ton)	PM (Metric Tons/Yr)	PM (\$/Metric Ton)	SOx (Metric Tons/Yr)	SOx (\$/Metric Ton)	Undiscounted Total Non-CO2 Emissions	NPV CO2 at 3% Avg SCC	Total Emissions Benefits @ 3% Discount	Total Emissions Benefits @ 7% Discount
1	2017	421,984	237.66		0.77		0.76		0.014		0.004		-			
2	2018	426,204	240.03		0.77		0.77		0.014		0.004		-			
3	2019	430,466	242.43		0.78		0.78		0.014		0.004		-			
4	2020	434,770	244.86		0.79		0.79		0.014		0.004		-			
5	2021	439,118	247.31		0.80		0.79		0.014		0.004		-			
6	2022	443,509	249.78		0.81		0.80		0.015		0.004		-			
7	2023	447,944	252.28	\$ 13,118.44	0.81	\$ 1,676.77	0.81	\$ 6,564.93	0.015	\$ 5,487.89	0.004	\$ 214.86	\$ 13,944.45	\$ 10,666.49	\$ 22,004.61	\$ 19,350.40
8	2024	452,424	254.80	\$ 13,504.43	0.82	\$ 1,693.54	0.82	\$ 6,630.58	0.015	\$ 5,542.77	0.005	\$ 217.01	\$ 14,083.90	\$ 10,660.52	\$ 21,778.48	\$ 18,857.48
9	2025	456,948	257.35	\$ 14,154.17	0.83	\$ 1,710.48	0.83	\$ 6,696.89	0.015	\$ 5,598.20	0.005	\$ 219.18	\$ 14,224.74	\$ 10,847.99	\$ 21,750.07	\$ 18,585.31
10	2026	461,517	259.92	\$ 14,295.71	0.84	\$ 1,727.58	0.83	\$ 6,763.86	0.015	\$ 5,654.18	0.005	\$ 221.37	\$ 14,366.99	\$ 10,637.35	\$ 21,327.74	\$ 17,940.80
11	2027	466,133	262.52	\$ 14,701.19	0.85	\$ 1,744.86	0.84	\$ 6,831.50	0.015	\$ 5,710.72	0.005	\$ 223.58	\$ 14,510.66	\$ 10,620.45	\$ 21,103.26	\$ 17,514.36
12	2028	470,794	265.15	\$ 15,113.35	0.86	\$ 1,762.31	0.85	\$ 6,899.81	0.016	\$ 5,767.83	0.005	\$ 225.82	\$ 14,655.76	\$ 10,600.20	\$ 20,879.45	\$ 17,107.53
13	2029	475,502	267.80	\$ 15,532.28	0.86	\$ 1,779.93	0.86	\$ 6,968.81	0.016	\$ 5,825.51	0.005	\$ 228.07	\$ 14,802.32	\$ 10,576.73	\$ 20,656.39	\$ 16,719.16
14	2030	480,257	270.48	\$ 15,958.08	0.87	\$ 1,797.73	0.87	\$ 7,038.50	0.016	\$ 5,883.76	0.005	\$ 230.36	\$ 14,950.34	\$ 10,550.17	\$ 20,434.11	\$ 16,348.17
15	2031	485,059	273.18	\$ 16,390.84	0.88	\$ 1,815.70	0.88	\$ 7,108.88	0.016	\$ 5,942.60	0.005	\$ 232.66	\$ 15,099.85	\$ 10,520.66	\$ 20,212.67	\$ 15,993.54
16	2032	489,910	275.91	\$ 16,830.66	0.89	\$ 1,833.86	0.88	\$ 7,179.97	0.016	\$ 6,002.03	0.005	\$ 234.99	\$ 15,250.84	\$ 10,488.31	\$ 19,992.13	\$ 15,654.30
17	2033	494,809	278.67	\$ 17,277.64	0.90	\$ 1,852.20	0.89	\$ 7,251.77	0.016	\$ 6,062.05	0.005	\$ 237.34	\$ 15,403.35	\$ 10,453.26	\$ 19,772.54	\$ 15,329.56
18	2034	499,757	281.46	\$ 17,731.87	0.91	\$ 1,870.72	0.90	\$ 7,324.29	0.016	\$ 6,122.67	0.005	\$ 239.71	\$ 15,557.39	\$ 10,415.61	\$ 19,553.93	\$ 15,018.48
19	2035	504,755	284.27	\$ 18,193.46	0.92	\$ 1,889.43	0.91	\$ 7,397.53	0.017	\$ 6,183.89	0.005	\$ 242.11	\$ 15,712.96	\$ 10,375.48	\$ 19,336.36	\$ 14,720.24
20	2036	509,802	287.12	\$ 18,662.52	0.93	\$ 1,908.32	0.92	\$ 7,471.51	0.017	\$ 6,245.73	0.005	\$ 244.53	\$ 15,870.09	\$ 10,332.98	\$ 19,119.87	\$ 14,434.12
21	2037	514,900	289.99	\$ 19,429.11	0.94	\$ 1,927.41	0.93	\$ 7,546.22	0.017	\$ 6,308.19	0.005	\$ 246.97	\$ 16,028.79	\$ 10,444.11	\$ 19,060.37	\$ 14,315.27
22	2038	520,049	292.89	\$ 19,916.29	0.95	\$ 1,946.68	0.94	\$ 7,621.68	0.017	\$ 6,371.27	0.005	\$ 249.44	\$ 16,189.08	\$ 10,394.16	\$ 18,843.12	\$ 14,048.25
23	2039	525,250	295.82	\$ 20,411.27	0.95	\$ 1,966.15	0.95	\$ 7,697.90	0.017	\$ 6,434.99	0.005	\$ 251.94	\$ 16,350.97	\$ 10,342.22	\$ 18,627.12	\$ 13,791.41
24	2040	530,502	298.77	\$ 20,914.16	0.96	\$ 1,985.81	0.96	\$ 7,774.88	0.018	\$ 6,499.34	0.005	\$ 254.46	\$ 16,514.48	\$ 10,288.38	\$ 18,412.41	\$ 13,544.15
25	2041	535,807	301.76	\$ 21,425.06	0.97	\$ 2,005.67	0.97	\$ 7,852.63	0.018	\$ 6,564.33	0.005	\$ 257.00	\$ 16,679.62	\$ 10,232.73	\$ 18,199.01	\$ 13,305.93
26	2042	541,166	304.78	\$ 21,944.09	0.98	\$ 2,025.72	0.98	\$ 7,931.15	0.018	\$ 6,629.97	0.005	\$ 259.57	\$ 16,846.42	\$ 10,175.36	\$ 17,986.95	\$ 13,076.24
Totals				\$ 345,504.62		\$ 36,920.87		\$ 144,553.28		\$ 120,837.93		\$ 4,730.93	\$ 307,043.01	\$ 209,623.15	\$ 399,050.60	\$ 315,654.69

AIS Crash Data Conversion Calculations

NO-BUILD		No Injury		Possible Injury		Non-incapacitating		Incapacitating		Killed		Injured Severity Unknown		Property Damage Only	
AIS Accident Counts	0	2016 \$ Value	4.6	2016 \$ Value	1	2016 \$ Value	0.3	2016 \$ Value	0	2016 \$ Value	0.3	2016 \$ Value	16.2	2016 \$ Value	
0	0.00	\$ -	1.078102	\$ -	0.08347	\$ -	0.010311	\$ -	0.00	\$ -	0.064614	\$ -	N/A	N/A	
1	0.00	\$ -	3.171516	\$ 90,173.56	0.76843	\$ 21,848.25	0.166347	\$ 4,729.63	0.00	\$ -	0.188184	\$ 5,350.51	N/A	N/A	
2	0.00	\$ -	0.293986	\$ 127,119.55	0.10898	\$ 48,544.02	0.062724	\$ 27,939.76	0.00	\$ -	0.031200	\$ 13,897.72	N/A	N/A	
3	0.00	\$ -	0.049266	\$ 47,590.96	0.03191	\$ 31,754.64	0.043311	\$ 43,100.13	0.00	\$ -	0.011574	\$ 11,517.65	N/A	N/A	
4	0.00	\$ -	0.006532	\$ 15,985.11	0.00620	\$ 15,630.20	0.011958	\$ 30,146.11	0.00	\$ -	0.001326	\$ 3,342.85	N/A	N/A	
5	0.00	\$ -	0.000598	\$ 3,262.45	0.00101	\$ 5,676.32	0.005349	\$ 30,062.04	0.00	\$ -	0.003102	\$ 17,433.62	N/A	N/A	
Fatality	0.00	\$ -	0.000000	\$ -	0.000000	\$ -	0.000000	\$ -	0.00	\$ -	0.000000	\$ -	N/A	N/A	
	0.0	\$ -	4.6	\$ 284,131.62	1.0	\$ 123,453.43	0.3	\$ 135,977.67	0.0	\$ -	0.3	\$ 51,542.34	16.2	\$ 65,535.97	\$ 660,641.03

Notes: This case assumes that improvements are NOT built and crash/injury stays consistent with historical data given by Iowa Department of Transportation crash data from 2006-2016.

This table has converted available IDOT crash data (shown on a KABCO scale) into AIS Data in accordance to the U.S. DOT'S TIGER BENEFIT-COST ANALYSIS RESOURCE GUIDE. This table, provided by the National Highway Traffic Safety Administration (NHTSA), makes a conversion from available reported data into re-interpreted AIS data for "apples-to-apples" comparisons for the U.S. DOT.

Property Damage Only (PDO) - This is not originally part of the AIS conversion table, but has been added to this table to account for PDO damage costs. Monetary values for injury/PDO are given by U.S. DOT's TIGER BENEFIT-COST ANALYSIS GUIDE and amounts have been converted to 2016 dollars.

REDUCTION OF 40%		No Injury		Possible Injury		Non-incapacitating		Incapacitating		Killed		Injured Severity Unknown		Property Damage Only	
AIS Accident Scale	0	2016 \$ Value	1.84	2016 \$ Value	0.4	2016 \$ Value	0.12	2016 \$ Value	0	2016 \$ Value	0.12	2016 \$ Value	6.48	2016 \$ Value	
0	0.000000	\$ -	0.4312408	\$ -	0.033388	\$ -	0.0041244	\$ -	0.000000	\$ -	0.0258456	\$ -	N/A	N/A	
1	0.000000	\$ -	1.2686064	\$ 36,069.42	0.307372	\$ 8,739.30	0.0665388	\$ 1,891.85	0.000000	\$ -	0.0752736	\$ 2,140.20	N/A	N/A	
2	0.000000	\$ -	0.1175944	\$ 50,847.82	0.043592	\$ 18,849.18	0.0250896	\$ 10,848.74	0.000000	\$ -	0.012480	\$ 5,396.35	N/A	N/A	
3	0.000000	\$ -	0.0197064	\$ 19,036.38	0.012764	\$ 12,330.02	0.0173244	\$ 16,735.37	0.000000	\$ -	0.0046296	\$ 4,472.19	N/A	N/A	
4	0.000000	\$ -	0.0026128	\$ 6,394.04	0.002480	\$ 6,069.06	0.0047832	\$ 11,705.45	0.000000	\$ -	0.0005304	\$ 1,297.99	N/A	N/A	
5	0.000000	\$ -	0.0002392	\$ 1,304.98	0.000404	\$ 2,204.06	0.0021396	\$ 11,672.80	0.000000	\$ -	0.0012408	\$ 6,769.31	N/A	N/A	
Fatality	0.000000	\$ -	0.000000	\$ -	0.000000	\$ -	0	\$ -	0.000000	\$ -	0	\$ -	N/A	N/A	
	0.0	\$ -	1.84	\$ 113,652.65	0.40	\$ 48,191.62	0.12	\$ 52,854.21	0.0	\$ -	0.12	\$ 20,076.05	6.48	\$ 26,214.39	\$ 260,988.92

Assumption: US DOT FHWA Road Diet "Complete Street" case studies showed strong support for crash reduction as a result of the complete streets program. Most case studies found reductions between 20% and 70% for crash/injury incidents. A conservative estimate of 40% reduction was used for analysis of crash reduction due to improvements project and is strongly reinforced by "Road Diet" documentation. (http://safety.fhwa.dot.gov/road_diets/case_studies/roaddiet_cs.pdf)

Crash Reduction Benefits (2016 Dollars)

Crash Reduction Savings Benefits in 2016 Dollars				
Project Year	Analysis Year	Crash Reduction (40%)	Total Benefits @ 3% Discount	Total Benefits @ 7% Discount
1	2017	\$ -	\$ -	\$ -
2	2018	\$ -	\$ -	\$ -
3	2019	\$ -	\$ -	\$ -
4	2020	\$ -	\$ -	\$ -
5	2021	\$ -	\$ -	\$ -
6	2022	\$ -	\$ -	\$ -
7	2023	\$ 260,988.92	\$ 212,207.88	\$ 162,530.78
8	2024	\$ 260,988.92	\$ 206,027.07	\$ 151,897.93
9	2025	\$ 260,988.92	\$ 200,026.28	\$ 141,960.68
10	2026	\$ 260,988.92	\$ 194,200.27	\$ 132,673.53
11	2027	\$ 260,988.92	\$ 188,543.95	\$ 123,993.96
12	2028	\$ 260,988.92	\$ 183,052.38	\$ 115,882.20
13	2029	\$ 260,988.92	\$ 177,720.76	\$ 108,301.12
14	2030	\$ 260,988.92	\$ 172,544.42	\$ 101,216.00
15	2031	\$ 260,988.92	\$ 167,518.86	\$ 94,594.40
16	2032	\$ 260,988.92	\$ 162,639.67	\$ 88,405.98
17	2033	\$ 260,988.92	\$ 157,902.59	\$ 82,622.41
18	2034	\$ 260,988.92	\$ 153,303.49	\$ 77,217.20
19	2035	\$ 260,988.92	\$ 148,838.34	\$ 72,165.61
20	2036	\$ 260,988.92	\$ 144,503.24	\$ 67,444.50
21	2037	\$ 260,988.92	\$ 140,294.41	\$ 63,032.24
22	2038	\$ 260,988.92	\$ 136,208.16	\$ 58,908.64
23	2039	\$ 260,988.92	\$ 132,240.93	\$ 55,054.80
24	2040	\$ 260,988.92	\$ 128,389.26	\$ 51,453.08
25	2041	\$ 260,988.92	\$ 124,649.76	\$ 48,086.99
26	2042	\$ 260,988.92	\$ 121,019.19	\$ 44,941.12
Totals		\$ 5,219,778.46	\$ 3,251,830.89	\$ 1,842,383.19

Costs Summary Table (2016 Dollars)

Cost Summary in Constant 2016 Dollars						
Project Year	Analysis Year	Cost of Improvements	Maintenance	Total Costs Undiscounted	Present Value of Costs	
		Capital Costs Undiscounted	O&M Costs Undiscounted		Total Costs @ 3% Discount	Total Costs @ 7% Discount
1	2017	\$ 25,281,287.78	-	\$ 25,281,287.78	\$ 24,544,939.59	\$ 23,627,371.76
2	2018	\$ 11,311,368.44	-	\$ 11,311,368.44	\$ 10,662,049.62	\$ 9,879,787.27
3	2019	\$ 16,981,091.44	-	\$ 16,981,091.44	\$ 15,540,104.20	\$ 13,861,628.89
4	2020	\$ 2,811,368.44	-	\$ 2,811,368.44	\$ 2,497,864.45	\$ 2,144,779.52
5	2021	\$ 7,930,716.44	-	\$ 7,930,716.44	\$ 6,841,105.67	\$ 5,654,491.22
6	2022	\$ 19,576,174.44	-	\$ 19,576,174.44	\$ 16,394,737.90	\$ 13,044,431.61
7	2023	-	-	\$ -	\$ -	\$ -
8	2024	-	-	\$ -	\$ -	\$ -
9	2025	-	-	\$ -	\$ -	\$ -
10	2026	-	-	\$ -	\$ -	\$ -
11	2027	-	-	\$ -	\$ -	\$ -
12	2028	-	-	\$ -	\$ -	\$ -
13	2029	-	-	\$ -	\$ -	\$ -
14	2030	-	-	\$ -	\$ -	\$ -
15	2031	-	-	\$ -	\$ -	\$ -
16	2032	-	-	\$ -	\$ -	\$ -
17	2033	-	-	\$ -	\$ -	\$ -
18	2034	-	-	\$ -	\$ -	\$ -
19	2035	-	-	\$ -	\$ -	\$ -
20	2036	-	-	\$ -	\$ -	\$ -
21	2037	-	-	\$ -	\$ -	\$ -
22	2038	-	-	\$ -	\$ -	\$ -
23	2039	-	-	\$ -	\$ -	\$ -
24	2040	-	-	\$ -	\$ -	\$ -
25	2041	-	-	\$ -	\$ -	\$ -
26	2042	-	-	\$ -	\$ -	\$ -
Totals		\$ 83,892,006.98	\$ -	\$ 83,892,006.98	\$ 76,480,801.42	\$ 68,212,490.26

Note: O&M costs savings due to improvements and not having a “no-build” situation would further increase benefits. An annual O&M savings was not used due to lack of available information on current cost of operations and maintenance on downtown roadways and flood maintenance.