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Bridging the Gap: Capping Fort Washington Way

Benefit Cost Analysis Technical Report

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Executive Summary

A benefit-cost analysis (BCA) was conducted for the **Bridging the Gap: Capping Fort Washington Way Project ("the Project")** for submission to the U.S. Department of Transportation (U.S. DOT) as a requirement for the 2023 Reconnecting Communities and Neighborhoods Program. The analysis was conducted in accordance with the benefit-cost methodology as outlined by U.S. DOT in the Benefit-Cost Analysis Guidance for Discretionary Grant Programs, released in January 2023. The period of analysis corresponds to 26 years and includes 6 total years of design and construction (2025-2030) and 20 years of benefits (2031-2050).

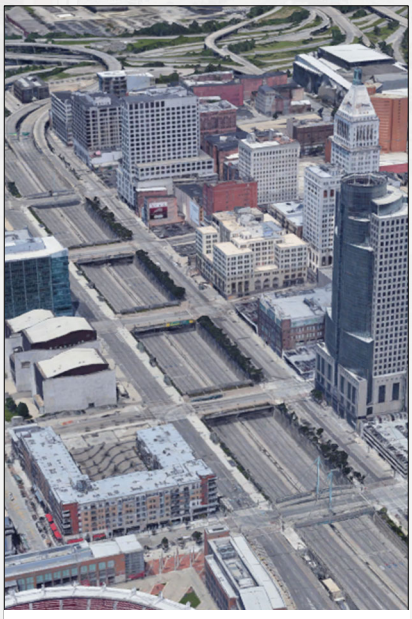

Figure 1: Project Location

The City of Cincinnati is requesting $149.4 million in Reconnecting Communities and Neighborhoods Program Capital Construction Grant funding to be matched by $37.8 million in local funds from the City of Cincinnati, Hamilton County, and the Cincinnati Chamber of Commerce to fully fund design and construction. If successfully funded, the City will be able to realize the vision – 30 years in the making – of reconnecting Cincinnati's Central Business District to The Banks riverfront district by providing a five-acre civic park space and plaza over the Fort Washington Way Interstate that acts as a barrier between downtown and the Banks District - removing this significant barrier to access, mobility, and economic development.

Once constructed this project will provide the following benefits:

- Create over five total acres of new civic park space in the heart of Cincinnati's central business district (CBD);
- Improve access to jobs in Cincinnati's CBD, especially for transit users;
- Improve safety for all pedestrians travelling between the CBD and Riverfront District; and
- Create an opportunity to create affordable housing in an area that saw displacement in the 1960s.

In addition to funding all final design and environmental work, the Project scope will include the following physical elements:

- Construct an elevated cap park structure over Interstate 71 / U.S. Route 50 (locally known as Fort Washington Way) between Race Street and Walnut Street;
- Construct all interior Tunneling Operating Systems; and
- Construct multimodal improvements and traffic safety countermeasures along surface roads and intersections within the Project area.

COSTS

Total capital costs for the Project, including previously expended costs, are expected to be $150.8 million in undiscounted 2021 dollars, or $94.7 million in discounted 2021 dollars using a 7 percent real discount rate. Table ES-1 shows how these costs are allocated across time and major expense categories. Note that these costs differ from those reported in the Project Narrative due to the use of 2021 dollars rather than year-of-expenditure dollars.

Table ES-1: Project Costs by Category and Year, in Millions of 2021 Dollars

Year	Design	Right-of-Way	Utilities	Construction	Contingency	Total	Total, 7% Discounted
2023	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M
2024	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M
2025	$6.2 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$6.2 M	$4.7 M
2026	$3.1 M	$0.0 M	$0.0 M	$11.0 M	$5.7 M	$19.7 M	$14.1 M
2027	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$22.2 M
2028	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$20.7 M
2029	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$19.4 M
2030	$0.0 M	$0.0 M	$0.0 M	$16.4 M	$8.5 M	$25.0 M	$13.6 M
Total	**$9.2 M**	**$0.0 M**	**$0.0 M**	**$93.1 M**	**$48.4 M**	**$150.8 M**	**$94.7 M**

Source: City of Cincinnati Department of Transportation and Engineering (DOTE)

BENEFITS

In 2021 dollars, the Project is expected to generate $98.7 million in discounted benefits. When compared to discounted costs of $94.7 million, this results in a Net Present Value (NPV) of $4.0 million and a Benefit Cost Ratio (BCR) of 1.04 as summarized by Table ES-2. This BCA quantified benefits using the latest Project information and available data. Many other economic benefits, including reduced community exposure to noise and emissions from the Interstate as well as the social and environmental benefits of trees, are not quantified in absence of detailed data. While these benefits would further increase the benefit cost ratio, they are discussed qualitatively within the BCA.

Table ES-2: Benefit-Cost Analysis Results

Key Financial Metrics	Undiscounted	Discounted (7%)
Total Benefits (2021 $M)	$296.1 M	$98.7 M
Total Costs (2021 $M)	$150.8 M	$94.7 M
Net Present Value (2021 $M)	$145.3 M	$4.0 M
Benefit-Cost Ratio	1.96	1.04
Payback Period	12.0 yrs	
Internal Rate of Return	7.6%	

Source: WSP Analysis 2023

The overall project benefit matrix for the Project can be seen in Table 1.

Table 1: Project Impacts and Benefits Summary, Millions of 2021 Dollars

Current Status & Problem to be Addressed	Change to Baseline	Outcome Criteria	Economic Benefit	Summary of Results (at 7% discount rate)	Page Reference in BCA
The Bridging the Gap project site is located within Hamilton County, which has been identified at the county-level as an Area of Persistent Poverty by U.S. DOT. At the Census Tract level, the project site is within Census Tract 265, which is also identified as an Area of Persistent Poverty and an Opportunity Zone. Interstate 71 / U.S. Route 50 (locally known as Fort Washington Way) currently acts as a barrier between Cincinnati's Central Business District (CBD) and The Banks riverfront district. The open space over the highway presents a significant barrier to access, mobility, and economic development between two high-activity economic areas.	The Bridging the Gap project will provide approximately four acres of open green space and up to 1.65 acres of plaza space over the Fort Washington Way Interstate. This project intends to design and construct the highway cap structure, integrated tunnel safety systems below, and a vibrant civic park space above – all supported by the structural pilings included during the original reconstruction of Fort Washington Way. This continued investment will create a regional civic space that reconnects the CBD to the riverfront while also replacing existing infrastructure to ensure a long-term state of good repair along Fort Washington Way for decades to come.	Access	Improved Vehicle Safety	$12.6 M	Page 9
			Improved Pedestrian Safety	$5.7 M	Page 10
		Facility Sustainability	Cycling Facility Improvements	$0.3 M	Page 12
			Repurposed Right-of-Way	$2.9 M	Page 11
			Commercial Property Value Uplift	$64.3 M	Page 12
			Residual Value	$12.7 M	Page 13
			O&M Cost Savings	$0.3 M	Page 14
		Equitable Development	Access to Areas of Persistent Poverty	*Not Monetized*	Page 14
		Climate and Environment	Progression Towards Climate Goals	*Not Monetized*	Page 15

Source: WSP Analysis 2023

1. Introduction

1.1. BCA FRAMEWORK

A BCA is an evaluation framework to assess the economic advantages (benefits) and disadvantages (costs) of an investment alternative. Benefits and costs are broadly defined and are quantified in monetary terms to the extent possible. The overall goal of a BCA is to assess whether the expected benefits of a project justify the costs from a national perspective. A BCA framework attempts to capture the net welfare change created by a project, including cost savings and increases in welfare (benefits), as well as disbenefits where costs can be identified (e.g., project capital costs), and welfare reductions where some groups are expected to be made worse off as a result of the proposed project.

The BCA framework involves defining a Base or "No-Build" Case, which is compared to the "Build" Case, where the grant request is awarded, and the project is built as proposed. The BCA assesses the incremental difference between the No-Build Case and the Build Case, which represents the net change in welfare. BCAs are forward-looking exercises which seek to assess the incremental change in welfare over a project lifecycle. The importance of future welfare changes is determined through discounting, which is meant to reflect both the opportunity cost of capital as well as the societal preference for the present.

The analysis was conducted in accordance with the benefit-cost methodology as recommended by USDOT in the 2023 Benefit-Cost Analysis Guidance for Discretionary Grant Programs.[1] This methodology includes the following analytical assumptions:

- Defining existing and future conditions under a No-Build Case and under the Build Case;
- Estimating benefits and costs during project construction and operation, including 20 years of operations beyond the Project completion when benefits accrue;
- Using USDOT recommended monetized values for reduced injuries, travel time savings, and emissions, while relying on best practices for monetization of other benefits;
- Presenting dollar values in real 2021 dollars. In instances where cost estimates and benefits valuations are expressed in historical or future dollar years, using an appropriate inflation factor to adjust the values; and
- Discounting future benefits and costs with a real discount rate of 7 percent, consistent with USDOT guidance.

The BCA produces several important measures to assess the cost-effectiveness of the proposed Project. The benefit-cost ratio (BCR), calculated by dividing the Project's discounted societal benefits by its discounted Project capital costs, measures the societal return on each dollar spent in Project costs. A BCR of more than 1.0 indicates that for each dollar spent, more than one dollar worth of benefits will be generated by the Project. Another important measure is the net present value (NPV), calculated by subtracting the discounted Project costs from the discounted societal benefits created by the Project. This measure indicates the present value of the net social worth created by the Project, after accounting for its costs.

[1] U.S. Department of Transportation. Benefit-Cost Analysis Guidance for Discretionary Grant Programs. January 2023. *https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance*

However, the BCR and NPV only account for benefits that can be successfully quantified and monetized; some benefits generated by a Project may be difficult to quantify or monetize and are therefore excluded from the measures described above. It is important that the BCR and NPV of a Project be considered in conjunction with other criteria when judging a Project's overall worth.

1.2. REPORT CONTENTS

This report provides technical information on the BCA conducted in support of the Reconnecting Communities and Neighborhoods Program Capital Construction Grant application for the Bridging the Gap: Capping Fort Washington Way Project ("the Project"). The report is structured as follows:

- **Section 2 - Project Overview** contains a description of the Project, information on the general assumptions made in the analysis, and a description of the No-Build and Build scenarios;
- **Section 3 - Project Costs** provides a summary of the anticipated capital and operations and maintenance costs;
- **Section 4 - Project Outcome Criteria** reviews the expected economic benefits the Project would generate, including a review of the assumptions and methodology used to calculate the benefits; and
- **Section 5 - Summary of Results** reports the high-level results of the BCA;

2. Project Overview

2.1. DESCRIPTION

The City of Cincinnati is requesting $149.4 million in Reconnecting Communities and Neighborhoods Program Capital Construction Grant funding to be matched by $37.8 million in local funds from the City of Cincinnati, Hamilton County, and the Cincinnati Chamber of Commerce to fully fund design and construction. If successfully funded, the City will be able to realize the vision – 30 years in the making – of reconnecting Cincinnati's Central Business District to The Banks riverfront district by providing a five-acre civic park space and plaza over the Fort Washington Way Interstate that acts as a barrier between downtown and the Banks District - removing this significant barrier to access, mobility, and economic development.

Once constructed this project will provide the following benefits:

- Create over five total acres of new civic park space in the heart of Cincinnati's central business district (CBD);
- Improve access to jobs in Cincinnati's CBD, especially for transit users;
- Improve safety for all pedestrians travelling between the CBD and Riverfront District; and
- Create an opportunity to create affordable housing in an area that saw displacement in the 1960s.

In addition to funding all final design and environmental work, the Project scope will include the following physical elements:

- Construct an elevated cap park structure over Interstate 71 / U.S. Route 50 (locally known as Fort Washington Way) between Race Street and Walnut Street;
- Construct all interior Tunneling Operating Systems; and
- Construct multimodal improvements and traffic safety countermeasures along surface roads and intersections within the Project area.

The Project is comprised of the bridge replacements and cap structure, tunnel systems, and park space and street safety improvements. The scope is further described as follows:

- **Bridge replacements and cap structure:** Replacement of the three bridges that span FWW, each 23 years through their 50-year useful life. The structure for the bridges and highway cap will be similar to the existing bridge structures across FWW in design. This structural system will take advantage of the foundation pilings that were installed when FWW was reconstructed to support the Project's civic park space on top of it.
- **Tunnel Systems:** Tunnel construction to span the highway that includes all necessary tunnel systems. These tunnel systems include tunnel ventilation system, fire protection systems, electrical power systems, special system & traffic control systems, and tunnel roadway lighting.
- **Park Space and Street Safety Improvements:** The Project will provide approximately four acres of open green space, 1.65 acres of plaza space, and streetscape improvements with improved safety elements. The Project will redesign each street to include traffic calming measures and pedestrian safety improvements, such as curb bump-outs, new crosswalks, modernized accessible pedestrian signals (APS), leading pedestrian intervals, on-street parking, and landscaping treatments. Also included is the construction of a new 0.5-mile two-way protected bike lane which will connect the civic park space to the City's proposed 5.5-mile downtown bike network and the larger regional bike network, including the CROWN trail system.

2.2. GENERAL ASSUMPTIONS

The BCA makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. Specifically, the assumptions include:

- The period of analysis corresponds to 26 years and includes 6 total years of design and construction (2025-2030) and 20 years of benefits (2031-2050);
- Dollar figures in this analysis are expressed in constant 2021 dollars (2021$);
- The real discount rate of 7.0 percent consistent with USDOT guidance for 2023; and
- Unless specified otherwise, the results shown in this document correspond to the effects of the build scenario.

2.3. NO-BUILD AND BUILD SCENARIO

Currently, Interstate 71 / U.S. Route 50 (locally known as Fort Washington Way) acts as a barrier between Cincinnati's Central Business District (CBD) and The Banks riverfront district. The open space over the highway presents a significant barrier to access, mobility, and economic development between two high-activity economic areas. At the Census Tract level, the project site is within Census Tract 265, which is also identified as an Area of Persistent Poverty and an Opportunity Zone.

In the Build scenario, the Project will provide approximately four acres of open green space and up to 1.65 acres of plaza space over the Fort Washington Way Interstate. This Project intends to design and construct the highway cap structure, integrated tunnel safety systems below, and a vibrant civic park space above – all supported by the structural pilings included during the original reconstruction of Fort Washington Way.

This continued investment will create a regional civic space that reconnects the CBD to the riverfront while also replacing existing infrastructure to ensure a long-term state of good repair along Fort Washington Way for decades to come.

3. Project Costs

3.1. CAPITAL COSTS

Total capital costs for the Project, including previously expended costs, are expected to be $150.8 million in undiscounted 2021 dollars, or $94.7 million in discounted 2021 dollars using a 7 percent real discount rate. Note that these costs differ from those reported in the Project Narrative due to the use of 2021 dollars rather than year-of-expenditure dollars.

Table 2: Project Costs by Category and Year, in Millions of Dollars

Year	Design	Right-of-Way	Utilities	Construction	Contingency	Total	Total, 7% Discounted
2023	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M
2024	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M
2025	$6.2 M	$0.0 M	$0.0 M	$0.0 M	$0.0 M	$6.2 M	$4.7 M
2026	$3.1 M	$0.0 M	$0.0 M	$11.0 M	$5.7 M	$19.7 M	$14.1 M
2027	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$22.2 M
2028	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$20.7 M
2029	$0.0 M	$0.0 M	$0.0 M	$21.9 M	$11.4 M	$33.3 M	$19.4 M
2030	$0.0 M	$0.0 M	$0.0 M	$16.4 M	$8.5 M	$25.0 M	$13.6 M
Total	**$9.2 M**	**$0.0 M**	**$0.0 M**	**$93.1 M**	**$48.4 M**	**$150.8 M**	**$94.7 M**

3.2. OPERATIONS AND MAINTENANCE COSTS

The Project will replace three bridges that span FWW, along Race Street, Vine Street, and Walnut Street. Annual operations and maintenance (O&M) costs will increase as the bridges approach 30 years old in 2030 and will begin to experience cracking, spalling, delamination, and other issues until ultimately needing to undergo reconstruction before 2050. Through replacing these three bridges as they approach the 30-year mark, the Project will ensure a long-term state of good repair and will put the bridges on a similar timeline as the FWW cap structure for future maintenance and eventual replacement after 50 years of use. Replacing the bridges as part of the project will minimize future disruptions to the civic park space and highway due to planned maintenance and eventual replacement.

The O&M costs are lower in the Build scenario, so these calculations have been included as a benefit in the BCA.

4. Project Outcome Criteria

The Project generates benefits primarily by:

- **Improving Safety for Pedestrians and Vehicles** through improving 10 intersections with traffic calming and pedestrian safety measures such as curb bump-outs, new crosswalks, modernized accessible pedestrian signals (APS), leading pedestrian intervals, and on-street parking;
- **Repurposed Right-of-Way** through creating four acres of open green space, up to 1.65 acres of plaza space over the Fort Washington Way Interstate, and streetscape improvements with improved safety elements, and
- **Residual Value** of the structure assets.

The following sub-sections provide the assumptions used to calculate benefits as well as the monetized and quantified benefits for each of the applicable merit criteria. Benefit estimates reflect the variance between the No-Build and Build scenario, where positive benefits reflect Project improvements compared to the No-Build scenario. Benefits that were not quantified or monetized due to lack of methodology or data are described qualitatively in this report.

4.1. ACCESS

Consistent with the Notice of Funding Opportunity (NOFO) criteria for Access, the Project provides and ensures safe accommodation for all users through improving 10 intersections with traffic calming and pedestrian safety measures such as curb bump-outs, new crosswalks, modernized accessible pedestrian signals (APS), leading pedestrian intervals, and on-street parking. Table 3 and Table 4 provide the Project area crash history for vehicle and pedestrian crashes, respectively.

Table 3: Project Area Crash History, Vehicle Injuries (2020-2022)

Year	Fatalities	Serious Injuries	Non Serious Injuries	Possible Injuries	Property Damage Only (PDO) Crashes
2020	0	0	13	6	153
2021	0	0	9	6	118
2022	0	0	11	10	180
Total	**0.0**	**0.0**	**33.0**	**22.0**	**451.0**
Annual Average	**0.0**	**0.0**	**11.0**	**7.3**	**150.3**

Source: WSP Analysis using City of Cincinnati Department of Transportation and Engineering (DOTE) crash data

Table 4: Project Area Crash History, Pedestrian Injuries (2018-2022)

Year	Fatalities	Serious Injuries	Non Serious Injuries	Possible Injuries	No Injuries
2018	0	1	3	1	4
2019	0	0	4	3	6
2020	0	0	0	0	0
2021	0	1	1	0	2
2022	0	0	3	0	3
Total	**0.0**	**2.0**	**11.0**	**4.0**	**15.0**
Annual Average	**0.0**	**0.4**	**2.2**	**0.8**	**3.0**

Source: WSP Analysis using City of Cincinnati Department of Transportation and Engineering (DOTE) crash data

This BCA monetized benefits from improved vehicle and pedestrian resulting from the safety countermeasures. The following sections provide summaries for each benefit category.

Improved Vehicle Safety

Vehicle crash data was obtained from the ODOT Crash Analysis Module from 2020-2022 within the project area. This historical crash data was used to derive an estimate of average annual injuries by severity. Forecasts by severity were obtained by growing the estimated counts at the AADT growth rate of 5.75%.

Crashes in the Build scenario were estimated by multiplying the No-Build crashes by the relevant crash modification factor (CMF) of 0.87 for signal phasing improvements. Resulting reductions in crashes were multiplied by crash costs by severity to obtain annual benefit estimates.

Table 5 shows the assumptions used in estimating improved vehicle safety benefits.

Table 5: Improved Vehicle Safety Benefit Assumptions

Variable	Unit	Value	Source
AADT Growth Rate (CAGR 2017-2022)	%/year	5.75%	Calculated using Ohio Department of Transportation Traffic Count Data Viewer.
Crash Modification Factor	Factor	0.72	Crash Modification Factors Clearinghouse. Implement a Leading Pedestrian Interval. CMF ID: 9908
Cost per Fatality	2021$/fatality	$11,800,000	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Incapacitating Injury	2021$/injury	$564,300	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Non-incapacitating Injury	2021$/injury	$153,700	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Possible Injury	2021$/injury	$78,500	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Property Damage Only (PDO) Crash	2021$/vehicle	$4,800	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023

The resulting avoided crashes and monetized estimates are presented in Table 6.

Overall, the Project's lifecycle vehicle crash reduction benefits amount to $12.6 million in discounted 2021 dollars. These results are conservative given the multiple safety improvements being implemented as part of the Project scope. As a result, there are additional safety benefits that are not fully captured within the BCA.

Table 6: Improved Vehicle Safety Benefits

Benefit	Reductions in Injuries (2031-2050)	Undiscounted (Millions of 2021$)	Discounted (Millions of 2021$)
Reduced Fatalities	0.0	$0.0 M	$0.0 M
Reduced Incapacitating Injuries	0.0	$0.0 M	$0.0 M
Reduced Non-incapacitating Injuries	182.4	$28.0 M	$7.1 M
Reduced Possible Injuries	121.6	$9.5 M	$2.4 M
Reduced Property Damage Only Crashes	2,492.9	$12.0 M	$3.0 M
Total	**2,796.9**	**$49.5 M**	**$12.6 M**

Source: WSP Analysis, 2023

Pedestrian Safety

Pedestrian crash data was obtained from the ODOT Crash Analysis Module from 2018-2022 within the project area. This historical crash data was used to derive an estimate of average annual injuries by severity. Forecasts by severity were obtained by growing the estimated counts at the AADT growth rate of 5.75%.

Crashes in the Build scenario were estimated by multiplying the No-Build crashes by the relevant crash modification factor (CMF) of 0.41 for signal phasing improvements. Resulting reductions in crashes were multiplied by crash costs by severity to obtain annual benefit estimates.

Table 7 shows the assumptions used in estimating improved pedestrian safety benefits.

Table 7: Improved Pedestrian Safety Benefit Assumptions

Variable	Unit	Value	Source
AADT Growth Rate (CAGR 2017-2022)	%/year	5.75%	Calculated using Ohio Department of Transportation Traffic Count Data Viewer.
Crash Modification Factor	factor	0.41	Crash Modification Factors Clearinghouse. Implement a Leading Pedestrian Interval. CMF ID: 1993
Cost per Fatality	2021$/fatality	$11,800,000	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Incapacitating Injury	2021$/injury	$564,300	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Non-incapacitating Injury	2021$/injury	$153,700	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per Possible Injury	2021$/injury	$78,500	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Cost per No Injury	2021$/injury	$4,000	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.

The resulting avoided crashes and monetized estimates are presented in Table 8.

Overall, the Project's lifecycle pedestrian crash reduction benefits amount to $5.7 million in discounted 2021 dollars. These results are conservative given the multiple safety improvements being implemented as part of the Project scope. As a result, there are additional safety benefits that are not fully captured within the BCA.

Table 8: Improved Pedestrian Safety Benefits

Benefit	Reductions in Injuries (2031-2050)	Undiscounted (Millions of 2021$)	Discounted (Millions of 2021$)
Reduced Fatalities	0.0	$0.0 M	$0.0 M
Reduced Incapacitating Injuries	13.9	$7.8 M	$2.0 M
Reduced Non-incapacitating Injuries	76.5	$11.8 M	$3.0 M
Reduced Possible Injuries	27.8	$2.2 M	$0.6 M
Reduced No Injuries	104.3	$0.4 M	$0.1 M
Total	**222.5**	**$22.2 M**	**$5.7 M**

Source: WSP Analysis, 2023

4.2. FACILITY SUITABILITY

The BCA quantified costs associated with annual operations and maintenance of the new bridge cap, bridge infrastructure and remaining residual value. These benefit categories are discussed in the following sections.

Repurposed Right-of-Way

The Project will provide approximately 4 acres of open green space and up to 1.65 acres of plaza space over the Fort Washington Way Interstate. This newly created land, or repurposed right-of-way, presents value to residents through unlocking benefits of recreation, green space, and improved mobility.

Following US DOT guidance for 'Repurposed Right-of-Way', this BCA selected comparable land parcels to derive land values per acre for the proposed facility. Smale Riverfront Park, which is located in proximity to the Project along the Ohio River, was selected as a comparable and representative property. Property values for Smale Riverfront Park was provided by the City of Cincinnati Department of Transportation and Engineering (DOTE) based on an analysis of Hamilton County Auditor data.

It's noted that the underlying property value of the proposed cap does not fully reflect the social recreational value and health benefits arising from access to large greenspaces. These values are typically generated through local willingness-to-pay (WTP) surveys and Ecological Goods and Services (EGS) studies and provide an additional layer of insight into benefits arising from a proposed investment. This BCA assumes that 'Repurposed Right-of-Way' serves as a proxy for the social value derived from the Project, however it underestimates the true value of the investment.

This benefit was realized in a single year per US DOT guidance, which was the project opening year (2031) for the purposes of this BCA. The assumptions in estimating re-purposed right-of-way used are shown in Table 9.

Table 9: Repurposed Right-of-Way Assumptions

Variable	Unit	Value	Source
Comparable Land Value	2023$/acre	$993,665	City of Cincinnati Department of Transportation and Engineering (DOTE) Analysis of Hamilton County Auditor data
New Cap Acreage	acres	5.65	City of Cincinnati Department of Transportation and Engineering (DOTE), Including Green Space and Plaza Space

Overall, the Project's lifecycle recreational land value benefits amount to $2.9 million in discounted 2021 dollars.

Table 10: Repurposed Right-of-Way Benefits

Benefit	Project Lifecycle (2031-2050)	
	Undiscounted (Millions of 2021$)	Discounted (Millions of 2021$)
Repurposed Right-of-Way	$5.6 M	$2.9 M

Source: WSP Analysis, 2023

Commercial Property Value Uplift

The Project provides four acres of open green space and 1.65 acres of plaza space, which is empirically documented to improve mental and physical health and increase productivity. This greenness and urban landscape architecture has an impact to the economic state of surrounding commercial building valuation. The property value premium captured in this BCA is correlated with the street-level greenness of the commercial property measured through a novel Green View Index (GVI). A financial impact study of street-level greenery on commercial buildings concluded that there was an 8.9 percent to a 10.5 percent economically and positive transaction premium.

For the purposes of this BCA, the upper bound estimate of 10.5 percent was used due to the close proximity of the commercial buildings in the analysis. The analysis accounts for commercial building offices within a half-mile from Vine St. between 2nd and 3rd street. The assumptions used in estimating the commercial property value uplift are shown in Table 11.

Table 11: Commercial Property Value Uplift Assumptions

Variable	Unit	Value	Source
Project Area Cumulative Commercial Property Value	2021$	$1,205.6 M	WSP Analysis of Hamilton County Auditor, 2021 Real Estate Tax Valuation Data. Properties within 0.5 mile radius from Vine St between 2nd and 3rd St were selected.
Commercial Value Uplift Premium	percent	10.5%	The Financial Impact of Street-Level Greenery on New York commercial buildings, Yang et al.

Overall, the Project's lifecycle commercial property uplift benefits are $64.3 million in discounted 2021 dollars.

Table 12: Commercial Property Value Uplift Benefits

Variable	Project Lifecycle	
	Undiscounted (Millions of 2021$)	Discounted (7% Millions of 2021$)
Commercial Property Uplift	$126.6 M	$64.3 M

Cycling Facility

The Project will add an additional two-way protected bike facility along 2nd and/or 3rd Street, which will improve pedestrian safety along the street and provide a connection to trails, bridges, and the Central Parkway protected bike lane.

Annual cyclist counts were derived by applying an estimated bicycle share of the AADT derived from the ODOT public traffic viewer. The assumptions used in estimating improved cycling facility benefits are shown in Table 13.

Table 13: Cycling Facility Improvement Assumptions

Variable	Unit	Value	Source
Bike Path Installation Distance	miles	0.50	Project Information; Google Maps
Cycling Path with At-Grade Crossings	2021$/cycle-mile	$1.49	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
AADT Count (2021)	vehicles/year	12,964	ODOT Public Traffic Viewer
Bicycle Share of AADT	percent	0.50%	Conservative evaluation for potential share in urban area for shopping/errands, work, and other trips. NHTS, 2017.

Overall, the Project's lifecycle cycling facility improvements are $0.3 million in discounted 2021 dollars.

Table 14: Cycling Facility Improvement Benefits

Benefit	Bicycle Miles (2031-2050)	Undiscounted (Millions of 2021$)	Discounted (Millions of 2021$)
Cycling Improvements	686,594	$1.0 M	$0.3 M

Source: WSP Analysis, 2023

Residual Value

Due to the time period considered for the analysis, the remaining (or residual) value of the new infrastructure asset is not fully captured. As a result, the residual value of the structural infrastructure is monetized.

The estimated infrastructure lifespan was deducted from the benefit cost analysis benefit period to obtain the service life outside the study period. The remaining service life, as a factor of the estimated asset service life, was multiplied by the Project structural cost estimates to derive the estimate.

Assumptions and benefits are presented in Table 15 and Table 16 respectively.

Table 15: Residual Value Assumptions

Variable	Unit	Value	Source
Useful Life of Bridges	years	50	American Society of Civil Engineers, 2021 Infrastructure Report Card
Remaining Useful Life	years	30	Calculated from Project Information
Project Cost Estimate	2021$	$150.8 M	City of Cincinnati Department of Transportation and Engineering (DOTE)

Table 16: Residual Value Benefits

Variable	Project Lifecycle	
	Undiscounted (Millions of 2021$)	Discounted (7% Millions of 2021$)
Residual Value	$90.5 M	$12.7 M

Source: WSP Analysis, 2023

Change in O&M

The Project will replace three bridges that span FWW, along Race Street, Vine Street, and Walnut Street. Annual operations and maintenance (O&M) costs will increase as the bridges approach 30 years old in 2030 and will begin to experience cracking, spalling, delamination, and other issues until ultimately needing to undergo reconstruction before 2050. Through replacing these three bridges as they approach the 30-year mark, the Project will ensure a long-term state of good repair and will put the bridges on a similar timeline as the FWW cap structure for future maintenance and eventual replacement after 50 years of use. Replacing the bridges as part of the project will minimize future disruptions to the civic park space and highway due to planned maintenance and eventual replacement.

Table 17: O&M Cost Assumptions

Maintenance Activity	Amount (2021$)	Interval
Bridge Painting	$666,950	25 years
Membrane Replacement	$281,037	15 years
Planter (waterproofing)	$341,869	12 years
Planter Drainage Repair	$4,446	1 years

Source: City of Cincinnati Department of Transportation and Engineering (DOTE). Forecasted expenditures based on anticipated maintenance activities.

It's assumed annual O&M costs in the Build scenario will be 50 percent of the No-Build O&M costs. The net O&M cost savings amount to $0.7 million in undiscounted 2021 dollars, or $0.3 million in discounted 2021 dollars as summarized in Table 18.

Table 18: O&M Cost Savings

Benefit	Project Lifecycle (2031-2050)	
	Undiscounted (Millions of 2021$)	Discounted (Millions of 2021$)
O&M Cost Savings	$0.7 M	$0.3 M

Source: WSP Analysis, 2023

4.3. EQUITABLE DEVELOPMENT

The Project is located within Hamilton County, which has been identified at the county-level as an Area of Persistent Poverty by U.S. DOT. At the Census Tract level, the project site is within Census Tract 265, which is also identified as an Area of Persistent Poverty and an Opportunity Zone.

The Project will provide a regional park that is easily accessible to most city residents via public transit. Of SORTA's 48 bus routes, 41 provide service within a one-quarter mile walking distance of the project site. More importantly, however, the project location is accessible via nine SORTA bus routes that have been classified as frequent routes, defined as routes that provide service every

20 minutes or better. Of the 76 census tracts within Hamilton County that are classified as areas of persistent poverty, 56 (73.7%) are within a one-quarter mile walking distance of one of the nine frequent SORTA bus routes which provide service within a five-minute walk of the Bridging the Gap project site. People residing within these communities will be able to rely on a frequent network of transit to connect them to this new regional civic space. These benefits from improved access to transit, specifically improved connectivity to employment centers and services, are difficult to capture in absence of detailed travel demand modelling data and are captured qualitatively.

With SORTA's future plans to continue to increase bus frequencies and to build out a network of BRT lines connecting directly to FWW, frequent and reliable transit access between historically underserved communities and the Bridging the Gap project site will only continue to improve in the years and decades to come.

4.4. CLIMATE AND ENVIRONMENT

Climate change is having an alarming impact across the world. In Cincinnati, "urban heat island" areas — those with many impermeable surfaces like parking lots and large buildings — can reach up to 12 degrees warmer than those with more tree canopies and green spaces. As of April 2020, Cincinnati had experienced nine 100-year rainstorm events in the past decade, according to data from OES. The City had spent more than $150 million to address basement flooding and hill-slide issues related to excessive rainfall in recent years.

The Project will create four acres of new permeable greenspace bound by trees; improves access to high-quality choices for lower-carbon travel like walking, cycling, rolling, and transit; and reduces the noise and visual pollution caused by an interstate. These benefits, particularly social value from new trees, reduced decibels, and exposure to Interstate emissions, provide significant social value to the community. In absence of detailed Project data and remaining conservative, these benefits are qualitatively.

Through funding the Project, US DOT will be directly addressing several of Cincinnati's environmental concerns, including urban heat island effects and flooding. Primarily the Project will help achieve the following goals:

- Increase the number of residents within a quarter mile of safe bike and pedestrian infrastructure by 50 percent from 2022 levels by 2030;
- Expand the tree canopy by 10% in the Central Business District; and
- Increase access to greenspaces so that every resident has a greenspace within a half-mile walk by 2028.

5. Summary of Results

5.1. EVALUATION MEASURES

The benefit-cost analysis converts potential gains (benefits) and losses (costs) from the Project into monetary units and compares them. The following common benefit-cost evaluation measures are included in this BCA:

- **Net Present Value (NPV)**: NPV compares the net benefits (benefits minus costs) after being discounted to present values using the real discount rate assumption. The NPV provides a perspective on the overall dollar magnitude of cash flows over time in today's dollar terms.
- **Benefit Cost Ratio (BCR)**: The evaluation also estimates the benefit-cost ratio; the present value of incremental benefits is divided by the present value of incremental costs to yield the benefit-cost ratio. The BCR expresses the relation of discounted benefits to discounted costs as a measure of the extent to which a project's benefits either exceed or fall short of the costs.
- **Internal Rate of Return (IRR)**: The IRR provides the real discount rate which makes the NPV from the project equal to zero and the BCR is equal to one. In other words, it is the discount rate at which the project breaks even. Generally, the greater the IRR, the more desirable the project.
- **Payback Period**: The payback period refers to the period of time required to generate net benefits equal to the capital costs expended on the project.

5.2. BCA RESULTS

The table below presents the evaluation results for the Project. Results are presented in undiscounted terms and discounted at 7 percent as prescribed by the U.S. DOT. All benefits and costs were estimated in constant 2021 dollars over an evaluation period extending 26 years and includes 6 total years of design and construction (2025-2030) and 20 years of benefits (2031-2050).

In 2021 dollars, the Project is expected to generate $98.7 million in discounted benefits. When compared to discounted costs of $94.7 million, this results in a Net Present Value (NPV) of $4.0 million and a Benefit Cost Ratio (BCR) of 1.04.

This BCA quantified benefits using the latest Project information and available data. Many other economic benefits, including reduced community exposure to noise and emissions from the Interstate as well as the social and environmental benefits of trees, are not quantified in absence of detailed data. While these benefits would further increase the benefit cost ratio, they are discussed qualitatively within the BCA.

Table 19: Summary of Benefit Cost Analysis Results, Millions of 2021 Dollars

Benefit Category	Undiscounted	Discounted
Improved Vehicle Safety	$49.5	$12.6
Improved Pedestrian Safety	$22.2	$5.7
Cycling Facility Improvements	$1.0	$0.3
Repurposed Right-of-Way	$5.6	$2.9
Commercial Property Value Uplift	$126.6	$64.3
Residual Value	$90.5	$12.7
O&M Cost Savings	$0.7	$0.3
Total Benefits	**$296.1**	**$98.7**
Total Costs	**$150.8**	**$94.7**
Net Present Value (NPV)	$145.3	$4.0
Benefit Cost Ratio (BCR)	1.96	1.04
Internal Rate of Return (IRR)	7.6%	
Payback Period (Years)	12 yrs	

Source: WSP Analysis, 2023