

Appendix B: Benefit Cost Analysis

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COMPLETING THE VISION THE MARQUETTE GREENWAY

Benefit-Cost Analysis

FY 2021 RAISE Grant Application



As prepared by
The Northwestern Indiana Regional
Planning Commission

July 12, 2021

Executive Summary

The Benefit-Cost Analysis for the proposed 23.8-mile RAISE-funded Marquette Greenway projects adheres to the National Cooperative Highway Research Program Report 552: Guidelines for Analysis of Investments in Bicycle Facilities (NCHRP 552) and the U.S. Department of Transportation's (USDOT's) Benefit-Cost Analysis Guidance for Discretionary Grant Programs (February 2021).

In summary, the economic value was estimated for the proposed Marquette Greenway projects in terms of improvements to recreation, mobility, health, decreased auto use, and safety benefits. The assumptions are that the projects will be developed in 2024, constructed in 2025 and 2026, and open by 2027 with a 20-year lives ending in 2046. Also, the projects are expected to affect an area of within 1.5 miles from the projects. In summary, the proposed \$38.8 million Marquette Greenway projects will conservatively provide up to \$170.4 million in economic benefits (Exhibit 1). This results in a benefit-cost ratio of 7.95:1 when a 7 percent discount rate is applied to the costs for their estimated year of expenditures. The projects are also expected to accumulate hard to estimate benefits in tourism and increased property values.

Exhibit 1: Net Present Value Benefits and Costs of Marquette Greenway Projects with a 7 Percent Discount Rate (Medium Scenario for Recreation, Health, and Decreased Auto Use Benefits)

Category	Marquette Greenway RAISE Projects
Recreation Benefit	\$172,616,801
Mobility Benefit	\$918,757
Health Benefit	\$6,081,739
Decreased Auto Use Benefit	\$59,139
Safety Benefit	\$28,069,382
Total Benefit	\$207,745,817
Design/Engineering Cost	(\$3,151,612)
Right-of-Way Cost	(\$1,377,166)
Construction Cost	(\$20,134,552)
Operations and Maintenance Cost	(\$1,483,737)
Total Cost	(\$26,147,067)
Benefit-Cost Ratio	7.95

Exhibit 2: Net Present Value Benefits and Costs of Marquette Greenway Projects with a 3 Percent Discount Rate (Medium Scenario for Recreation, Health, and Decreased Auto Use Benefits)

Category	Marquette Greenway RAISE Projects
Recreation Benefit	\$316,502,836
Mobility Benefit	\$1,684,593
Health Benefit	\$11,151,218
Decreased Auto Use Benefit	\$108,435
Safety Benefit	\$51,466,826
Total Benefit	\$380,913,909
Design/Engineering Cost	(\$3,812,989)
Right-of-Way Cost	(\$1,730,875)
Construction Cost	(\$26,288,623)
Operations and Maintenance Cost	(\$2,720,516)
Total Cost	(\$34,553,003)
Benefit-Cost Ratio	11.02

As shown in Exhibit 2, if a 3 percent discount rate is applied instead, the Marquette Greenway projects will yield a benefit-cost ratio of 11.02:1. As explained in the benefits section later, if a more conservative scenario for recreation, health, and decreased auto use benefits is assumed, then the Marquette Greenway projects still result in a benefit-cost ratio of 1.54:1 and 2.14:1 for 7 percent and 3 percent discount rates respectively as shown in Exhibits 3 and 4.

Exhibit 3: Net Present Value Benefits and Costs of Marquette Greenway Projects with a 7 Percent Discount Rate (Low Scenario for Recreation, Health, and Decreased Auto Use Benefits)

Category	Marquette Greenway RAISE Projects
Recreation Benefit	\$10,904,664
Mobility Benefit	\$918,757
Health Benefit	\$410,736
Decreased Auto Use Benefit	\$43,101
Safety Benefit	\$28,069,382
Total Benefit	\$40,346,639
Design/Engineering Cost	(\$3,151,612)
Right-of-Way Cost	(\$1,377,166)
Construction Cost	(\$20,134,552)
Operations and Maintenance Cost	(\$1,483,737)
Total Cost	(\$26,147,067)
Benefit-Cost Ratio	1.54

Exhibit 4: Net Present Value Benefits and Costs of Marquette Greenway Projects with a 3 Percent Discount Rate (Low Scenario for Recreation, Health, and Decreased Auto Use Benefits)

Category	Marquette Greenway RAISE Projects
Recreation Benefit	\$19,994,329
Mobility Benefit	\$1,684,593
Health Benefit	\$753,107
Decreased Auto Use Benefit	\$79,028
Safety Benefit	\$51,466,826
Total Benefit	\$73,977,883
Design/Engineering Cost	(\$3,812,989)
Right-of-Way Cost	(\$1,730,875)
Construction Cost	(\$26,288,623)
Operations and Maintenance Cost	(\$2,720,516)
Total Cost	(\$34,553,003)
Benefit-Cost Ratio	2.14

Project Costs

Total project costs were compiled by engineers working in the area (Butler, Fairman & Seufert) using estimates based on actual costs of bicycle trail and bridge projects currently under construction or completed within the last three years, including various segments of already existing or funded portions of the Marquette Greenway outside the proposed RAISE-funded Marquette Greenway projects. The breakdown of the projected costs is included in the Marquette Greenway RAISE application narrative and Exhibit 5 below. Note all costs are in 2019 dollars.

- Total Estimated Project Costs: \$38,818,745
- Local Obligation and Already Awarded Federal Funds: \$16,824,135
- RAISE Request: \$21,944,610 (nominal request is \$23,119,971 in 2021 dollars for the purposes of this grant application)

Exhibit 5: Project Costs Associated with Marquette Greenway Projects (2019 \$)

	Entity	Segment Detail	Design/ Engineering Cost	Right-of- Way Cost	Construction Cost (plus 10% Contingency)	Total Cost
1	Chicago	0.6 mi trail along roadway	\$91,327	\$0	\$501,348	\$592,675
2	Gary	Restore 400' railroad bridge	\$225,923	\$0	\$1,299,057	\$1,524,980
3	Gary	3.8 mi trail	\$515,905	\$475,663	\$2,966,449	\$3,958,017
4	Gary	300' bridge & abutment	\$676,850	\$0	\$3,891,893	\$4,568,743
5	National Park	6.0 mi trail (Gary & Porter)	\$455,685	\$0	\$3,645,478	\$4,101,163
6	National Park	280' bridge (exist. abut.)	\$49,468	\$0	\$502,966	\$552,434
7	National Park	65' bridge (exist. abut.)	\$11,416	\$0	\$109,402	\$120,818
8	Ogden Dunes	0.8 mi trail	\$62,026	\$0	\$558,238	\$620,264
9	Portage	1.5 mi trail open	\$114,159	\$0	\$910,418	\$1,024,577
10	Portage	575' Boardwalk Trail	\$42,810	\$0	\$420,961	\$463,771
11	Portage	230' new bike/ped bridge	\$87,998	\$0	\$879,976	\$967,974
12	Portage	165' historic bridge restoration	\$139,369	\$0	\$1,394,262	\$1,533,631
13	Burns Harbor	3,450' trail & bridge	\$332,964	\$0	\$3,805,301	\$4,138,265
14	Porter County	3.77 mi trail	\$713,494	\$0	\$1,426,988	\$2,140,482
15	Michigan City	3.9 mi trail	\$33,296	\$1,115,429	\$6,548,520	\$7,697,245
16	New Buffalo Township	2.5 mi trail + boardwalk	\$711,439	\$475,663	\$2,845,756	\$4,032,858
17	City of New Buffalo	0.44 mi trail + boardwalk	\$156,170	\$0	\$624,678	\$780,848
	Total		\$4,420,299	\$2,066,755	\$32,331,691	\$38,818,745

It is assumed that design and engineering costs will be expended in 2024 (3 years before projects being open), that right-of-way costs will be expended in 2025 (2 years before projects being open), and that construction and inspection costs will be expended in 2026 (1 year before projects being open). It is also assumed that operations and maintenance costs will be \$6,500 per mile per year (2002 \$) in accordance with the National Cooperative Highway Research Program and Minnesota Department of Transportation's Benefit-Cost Analysis of Bicycle Facilities Tool, which translates to \$224,897 per year of the trail's operation for the entire 23.8-mile project (2019 \$).¹

¹ https://www.pedbikeinfo.org/bikecost_x/step1.cfm using input parameters of Metro Area: Suburban Chicago, Mid-Year of Construction: 2026, Facility Type: Off-Street Bicycle Trail, Improvement Type: Trail Asphalt.

Benefits

Recreation

Within 1.5 miles of the Marquette Greenway projects, approximately 13.8% of households do not have access to a vehicle.² This means that an estimated 10,070 households will gain readily available access to the recreation opportunities afforded by these projects. Using the National Cooperative Highway Research Program and Minnesota Department of Transportation's Benefit-Cost Analysis of Bicycle Facilities Tool, a low annual estimate of the recreation benefit expected to result from the projects is \$1,652,868 (2019 \$) beginning in 2027 and a medium annual estimate is \$26,164,290.³ This corresponds to a Net Present Value of \$10,904,664 for a low estimate or \$172,616,801 for a medium estimate with a 7 percent discount rate over the 20-year lives of the projects.

Mobility

Bicyclists are willing to travel additional distances to avoid biking in traffic. The National Cooperative Highway Research Program finds that bicyclists are willing to travel up to 22 additional minutes to use an off-street bicycle path if one is available instead of the shortest path in mixed traffic.⁴ Currently, 0.2 percent of commuters in the 1.5 mile radii of Marquette Greenway projects bicycle to work. This corresponds to about 88 existing bicycle commuters in the 1.5-mile radii of projects and about 27 additional bicycle commuters expected to be added as a result of the projects being built.

The National Cooperative Highway Research Program and Minnesota Department of Transportation's Benefit-Cost Analysis of Bicycle Facilities Tool estimates that annual mobility benefits are expected to be \$139,260 (2019 \$).⁵ This corresponds to a Net Present Value of \$918,757 over the 20-year lives of the projects using a 7 percent discount rate.

Health

A more physically active population will enjoy lower health care costs. NCHRP 552 shows how to monetize the annual per-capita cost savings from increased physical activity caused by the increased bicyclists expected to result from the Marquette Greenway projects. It is estimated that there will be an additional 385 (low estimate) to 5,705 (medium estimate) new bicyclists from these projects, which includes 27 new bicycle commuters.⁶

The National Cooperative Highway Research Program and Minnesota Department of Transportation's Benefit-Cost Analysis of Bicycle Facilities Tool applies a formula that monetizes the health benefits using a low, medium, and high model. To be conservative, only the low and medium model estimates are used in this valuation. The tool's low estimate model values the annual health benefits at \$62,257 (2019 \$), while the tool's medium estimate model values the annual health benefits at \$921,836 (2019 \$). Applying a 7 percent discount rate, these figures correspond to Net Present Value of the health benefits of \$410,736 and \$6,081,739 respectively over the 20-year lives of the projects.

² American Community Survey, 2015-2019 5-year Estimates Table B25044 for Block Groups within 1.5 miles of projects

³ https://www.pedbikeinfo.org/bikecost_x/step1.cfm using input parameters of Metro Area: Suburban Chicago, Mid-Year of Construction: 2026, Facility Type: Off-Street Bicycle Trail, Commute Share: 0.2009%, Residential Density within 800 m: 582, between 801 m and 1600 m: 1484, between 1601 m and 2400 m: 2025, Facility Length: 39107 meters.

⁴ NCHRP Report 552

⁵ <http://www.pedbikeinfo.org/bikecost/step1.cfm> using same input parameters as in Footnote 2.

⁶ <http://www.pedbikeinfo.org/bikecost/step1.cfm> using same input parameters as in Footnote 2.

Decreased Auto Use

New bicycle commuters taking advantage of the Marquette Greenway projects would avoid adding to congestion, air pollution and excess user costs associated with otherwise driving motorized vehicles. NCHRP 552 finds that new recreational bicyclists do not replace motor vehicles, so no decreased auto use benefits are monetized for this group. The National Cooperative Highway Research Program and Minnesota Department of Transportation's Benefit-Cost Analysis of Bicycle Facilities Tool estimates that the Marquette Greenway projects will generate 27 new bicycle commuters.⁷

This analysis assumes that the total amount of new bicycle commuter mileage is a reasonable number to use to represent the total amount of now bicycle riding substituting for driving. This is assumed to be a conservative assumption because a very high proportion of commuters within 1.5 miles of the proposed projects currently drive in a motor vehicle to work. The American Community Survey finds that 88 percent of commuters drive in a motor vehicle, so there is a high potential for growth in bicycle commuting. The average commute distance by bicycle in the Northwestern Indiana Regional Planning Commission (NIRPC, the Metropolitan Planning Organization for most of the project area) region of Lake, Porter, and LaPorte Counties in Indiana is 4.59 miles.⁸

NCHRP 552 estimates congestion savings to be \$0.00 to \$0.05 per mile, pollution savings to be \$0.01 to \$0.05 per mile depending on conditions, and user costs to be \$0.03 per mile during peak congested periods and \$0.00 per mile during all other times of day. The analysis here provides both a low estimate of overall decreased auto use savings of \$0.08 per mile (\$0.02 per mile in congestion savings, \$0.03 per mile in pollution savings, and \$0.03 in user cost savings) and a medium estimate of overall decreased auto use savings of \$0.11 per mile (\$0.03 in congestion savings, \$0.05 per mile in pollution savings, and \$0.03 in user costs savings). Multiplying these decreased auto use savings by the estimated 27 new bicyclists per year by the average commute distance of 4.59 miles by twice per day commuting by 261 work days per average year results in annual monetized decreased auto use benefits of \$6,533 for the low estimate and \$8,964 for the medium estimate (2019 \$).⁹ Applying a 7 percent discount rate, the Net Present Values of these benefits are \$43,101 and \$59,139 respectively over the 20-year lives of the projects.

Safety

Injury and fatality numbers involving bicyclists and pedestrians used for the benefit calculation were pulled from the Chicago Data Portal (for Illinois crashes), the Automated Reporting Information Exchange System (ARIES for Indiana crashes), and the Michigan Traffic Crash Facts (MTCF for Michigan crashes).¹⁰ The average annual bicycle and pedestrian-involved crashes within 1.5 miles of the Marquette Greenway projects were estimated from 2016 to 2020 (2019 to 2021 midyear in the case of Illinois crashes). Per the USDOT's Benefit-Cost Analysis Guidance for Discretionary Grant Programs document, a crash modification factor (CMF) of 0.93, representing an expected 7% reduction in crashes involving bicyclists and pedestrians as a result of the Marquette Greenway projects being constructed, was applied.¹¹ Since the Indiana crashes did not document injury severity, a value of \$150,200 was monetized for each injury in accordance with the USDOT's Benefit-Cost Analysis Guidance for

⁷ <http://www.pedbikeinfo.org/bikecost/step1.cfm> using same input parameters as in Footnote 2.

⁸ Cross-tabulation in the 2018 My Daily Travel Household Travel Survey - NIRPC for Work Trips with Commute Mode of Bicycle.

⁹ Conversion to 2019 \$ using the CPI Inflation Calculator from 2006, the year NCHRP 552 was published.

¹⁰ <https://data.cityofchicago.org/Transportation/Traffic-Crashes-Crashes/85ca-t3if>; <https://www.ariesportal.com/>; [https://www.michigantrafficcrashfacts.org/querytool#q1;0;2020](https://www.michigantrafficcrashfacts.org/querytool#q1;0;2020;);;

¹¹ <http://www.cmfclearinghouse.org> using the Countermeasure: Installation of a cycle track over 5m from the side of the main road with cyclist priority at intersections.

Discretionary Grant Programs document, which is reasonably conservative. Illinois and Michigan injury crashes were assessed KABCO Level severities and monetized accordingly. The final estimated valuation of the safety benefit after applying the CMF factor and monetizing bicycle and pedestrian injury and fatal crashes is \$4,254,600 annually (2019 \$) beginning in 2027 or a Net Present Value of \$28,069,382 over the 20-year lives with a 7 percent discount rate.

Total Benefits

Including recreation, mobility, health, decreased auto use, and safety benefits, a low estimate for the total annual benefits of the Marquette Greenway projects is \$6,115,518 and a medium estimate for the total annual benefits of the Marquette Greenway projects is \$31,488,950 (2019 \$). In particular, recreation, health, and decreased auto use benefits are analyzed with both low and medium-case estimation models because they can vary greatly depending on the estimation model. Exhibit 6 shows the benefits in both low and medium-case scenarios.

Exhibit 6: Total Economic Benefits of Marquette Greenway Projects in Low and Medium Scenarios (7 percent Discount Rate applied to 20-Year Benefits)

Benefit	Low Scenario	Medium Scenario
Annual Recreation Benefit	\$1,652,868	\$26,164,290
Annual Mobility Benefit	\$139,260	\$139,260
Annual Health Benefit	\$62,257	\$921,836
Annual Decreased Auto Use Benefit	\$6,533	\$8,964
Annual Safety Benefit	\$4,254,600	\$4,254,600
Total Annual Benefit	\$6,115,518	\$31,488,950
20-Year Recreation Benefit	\$10,904,664	\$172,616,801
20-Year Mobility Benefit	\$918,757	\$918,757
20-Year Health Benefit	\$410,736	\$6,081,739
20-Year Decreased Auto Use Benefit	\$43,101	\$59,139
20-Year Safety Benefit	\$28,069,382	\$28,069,382
Total 20-Year Benefit	\$40,346,639	\$207,745,817

In both a low scenario and a medium scenario for expected benefits, the benefits significantly exceed the project costs. In the cases of recreation, health, and decreased auto use benefits, there could even be a high scenario that is not shown here where those benefits would be even higher, so the low scenario is very conservative and the medium scenario is somewhat conservative. Furthermore, there are expected to be additional benefits to tourism and property value increases, but these are difficult to quantify and excluded in this case since the other benefits are already estimated to significantly outweigh the costs.