Appendix B: Benefit Cost Anaylsis

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Benefit-Cost Analysis

FY 2017 TIGER Grant Application

As prepared by

The Northwestern Indiana
Regional Planning Commission

October 10, 2017

Executive Summary

The Benefit-Cost Analysis (BCA) for the proposed 29.7-mile TIGER-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 TIGER and INFRA Applications (July 2017). 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 2022, constructed in 2023 and 2024, and open by 2025 with 20-year lives ending in 2044. Also, the projects are expected to affect an area of within 1.5 miles from the projects.

In summary, the proposed $35.5 million Marquette Greenway projects will conservatively provide up to $186.7 million in economic benefits (Exhibit 1). This results in a benefit-cost ratio of 8.85:1 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 TIGER Projects
Recreation Benefit	$153,510,887
Mobility Benefit	$652,694
Health Benefit	$5,403,570
Decreased Auto Use Benefit	$87,847
Safety Benefit	$27,043,958
Total Benefit	**$186,698,956**
Design/Engineering Cost	($3,236,491)
Right-of-Way Cost	($478,770)
Construction Cost	($17,380,829)
Total Cost	**($21,096,090)**
Benefit-Cost Ratio	**8.85**

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 TIGER Projects
Recreation Benefit	$292,401,959
Mobility Benefit	$1,243,229
Health Benefit	$10,292,524
Decreased Auto Use Benefit	$167,327
Safety Benefit	$51,512,348
Total Benefit	**$355,617,387**
Design/Engineering Cost	($4,067,745)
Right-of-Way Cost	($625,105)
Construction Cost	($23,574,523)
Total Cost	**($28,267,372)**
Benefit-Cost Ratio	**12.58**

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 12.58:1. 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 1.79:1 and 2.54:1 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 TIGER Projects
Recreation Benefit	$9,564,766
Mobility Benefit	$652,694
Health Benefit	$355,595
Decreased Auto Use Benefit	$63,888
Safety Benefit	$27,043,958
Total Benefit	**$37,680,902**
Design/Engineering Cost	($3,236,491)
Right-of-Way Cost	($478,770)
Construction Cost	($17,380,829)
Total Cost	**($21,096,090)**
Benefit-Cost Ratio	**1.79**

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 TIGER Projects
Recreation Benefit	$18,218,619
Mobility Benefit	$1,243,229
Health Benefit	$677,324
Decreased Auto Use Benefit	$121,692
Safety Benefit	$51,512,348
Total Benefit	**$71,773,212**
Design/Engineering Cost	($4,067,745)
Right-of-Way Cost	($625,105)
Construction Cost	($23,574,523)
Total Cost	**($28,267,372)**
Benefit-Cost Ratio	**2.54**

Project Costs

Total project costs were compiled by engineers working in the area 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 TIGER-funded Marquette Greenway projects. The breakdown of the projected costs is included in the Marquette Greenway TIGER application narrative and Exhibit 2 below. Note all costs are in 2016 dollars.

Total Estimated Project Costs: $35,489,400
Already awarded federal funds: $2,277,200
TIGER Request: $24,250,000

Exhibit 2: Project Costs Associated with Marquette Greenway Projects (2016 $)

Project	Design/ Engineering Cost	Right-of-Way Cost	Construction Cost	Total Cost
Project #1 South Chicago Trail	$82,000	$0	$436,000	$518,000
Project #2 Hammond Trail	$184,600	$0	$1,008,000	$1,192,600
Project #3 Hammond/East Chicago Cantilever	$173,000	$0	$1,400,000	$1,573,000
Project #4 Gary Sidepath	$460,000	$0	$2,500,000	$2,960,000
Project #5 Gary Rail Underpass	$20,000	$0	$120,000	$140,000
Project #6 National Lakeshore Rail Corridor	$732,000	$0	$3,910,000	$4,642,000
Project #7 National Lakeshore Paved Stone Trail	$250,000	$0	$1,410,000	$1,660,000
Project #8 National Lakeshore Bridge 1	$52,000	$00	$528,700	$580,700
Project #9 National Lakeshore Bridge 2	$12,000	$0	$115,000	$127,000
Project #10 Portage Rail Corridor	$84,000	$0	$405,000	$489,000
Project #11 Portage Trail	$179,000	$0	$1,023,700	$1,202,700
Project #12 Portage Bridge	$54,000	$0	$461,200	$515,200
Project #13 Portage Historic Bridge	$70,000	$0	$615,000	$685,000
Project #14 Portage Bridge and Boardwalk	$190,000	$0	$1,430,000	$1,620,000
Project #15 Burns Harbor Boardwalk	$454,000	$0	$4,957,400	$5,411,400
Project #16 Porter Trail	$95,000	$0	$508,500	$603,500
Project #17 Porter County Paved Stone Path	$490,000	$0	$2,700,000	$3,190,000
Project #18 Michigan City Trail	$696,000	$318,800	$3,480,000	$4,494,800

Project	Design/ Engineering Cost	Right-of-Way Cost	Construction Cost	Total Cost
Project #19 New Buffalo Township Boardwalk	$149,000	$250,000	$1,500,000	$1,899,000
Project #20 City of New Buffalo Boardwalk	$130,500	$200,000	$1,355,000	$1,685,500
Environmental Entire Route	$300,000			$300,000
Total	**$4,857,100**	**$768,800**	**$29,863,500**	**$35,489,400**

It is assumed that all design/engineering costs will be expended in 2022 (3 years before projects being open), that right-of-way costs will be expended in 2023 (2 years before projects being open), and that construction costs will be expended in 2024 (1 year before projects being open).

Benefits

Recreation

Within 1.5 miles of the Marquette Greenway projects, approximately 13.6% of households do not have access to a vehicle.[1] This means that an estimated 18,028 residents 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 $1,551,258 (2016 $) beginning in 2025 and a medium annual estimate is $24,897,105.[2] This corresponds to a Net Present Value of $9,564,766 for a low estimate or $153,510,887 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.[3] Currently, 0.2 percent of commuters in the 1.5-mile radii of Marquette Greenway projects bicycle to work. This corresponds to about 85 existing bicycle commuters in the 1.5-mile radii of projects and about 26 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 $105,857 (2016 $).[4] This corresponds to a Net Present Value of $652,694 over the 20-year lives of the projects using a 7 percent discount rate.

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[1] American Community Survey, 2011-2015 5-year Estimates Table B25044 for Block Groups within 1.5 miles of projects

[2] http://www.pedbikeinfo.org/bikecost/step1.cfm using input parameters of Metro Area: Suburban Chicago, Mid-Year of Construction: 2024, Facility Type: Off-Street Bicycle Trail, Commute Share: 0.1602%, Residential Density within 800 m: 582, between 800 m and 1600 m: 1484, between 1600 m and 2400 m: 2025, Facility Length: 47797.52 meters.

[3] NCHRP Report 552

[4] http://www.pedbikeinfo.org/bikecost/step1.cfm using same input parameters as in Footnote 2.

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 451 (low estimate) to 6,847 (medium estimate) new bicyclists from these projects, which includes 26 new bicycle commuters.[5]

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 $57,672 (2016 $), while the tool's medium estimate model values the annual health benefits at $876,376 (2016 $). Applying a 7 percent discount rate, these figures correspond to Net Present Value of the health benefits of $677,324 and $10,292,524 respectively over the 20-year lives of the projects.

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 26 new bicycle commuters.[6]

This analysis assumes that the total amount of new bicycle commuter mileage is a reasonable number to use to represent the total amount of 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 91 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 9.58 miles.[7]

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 26 new bicyclists per year by the average commute distance of 9.58 miles by twice per day commuting by 261 work days per average year results in annual monetized decreased auto use benefits of $10,362 for the low estimate and $14,247 for the medium estimate (2016 $). Applying a 7 percent discount rate, the Net Present Values of these benefits are $63,888 and $87,847 respectively over the 20-year lives of the projects.

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[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.

[7] Cross-tabulation in the 2007-2008 Household Travel Tracker Survey for Work Trips with Commute Mode of Bicycle

Safety

Injury and fatality numbers involving bicyclists and pedestrians used for the benefit calculation were pulled from the Chicago Crash Browser (for Illinois crashes), the Automated Reporting Information Exchange System (ARIES for Indiana crashes), and the Michigan Traffic Crash Facts (MTCF for Michigan crashes).[8] The average annual bicycle and pedestrian-involved crashes within 1.5 miles of the Marquette Greenway projects were estimated from 2010 to 2016 (2009 to 2014 in the case of Illinois crashes). Per the USDOT's Benefit-Cost Analysis Guidance for TIGER and INFRA Applications 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.[9] Since neither the Illinois nor Indiana crashes documented injury severity, a value corresponding to MAIS level 2 (Moderate) was monetized for each injury, which is reasonably conservative. 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 $4,386,114 annually (2016 $) beginning in 2025 or a Net Present Value of $27,043,958 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 $6,111,263 and a medium estimate for the total annual benefits of the Marquette Greenway projects is $30,279,699 (2016 $). 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 3 shows the benefits in both low and medium-case scenarios.

Exhibit 3: 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	$1,551,258	$24,897,105
Annual Mobility Benefit	$105,857	$105,857
Annual Health Benefit	$57,672	$876,376
Annual Decreased Auto Use Benefit	$10,362	$14,247
Annual Safety Benefit	$4,386,114	$4,386,114
Total Annual Benefit	**$6,111,263**	**$30,279,699**
20-Year Recreation Benefit	$9,564,766	$153,510,887
20-Year Mobility Benefit	$652,694	$652,694
20-Year Health Benefit	$355,595	$5,403,570
20-Year Decreased Auto Use Benefit	$63,888	$87,847
20-Year Safety Benefit	$27,043,958	$27,043,958
Total 20-Year Benefit	**$37,680,902**	**$186,698,956**

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

[8] http://chicagocrashes.org; https://www.ariesportal.com/Public/Home.aspx; https://www.michigantrafficcrashfacts.org/querytool

[9] 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.

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.