

Appendix B: Benefit-Cost Analysis

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**RE-CONNECTING CLEVELAND: PATHWAYS TO OPPORTUNITY
CLEVELAND, OHIO
TIGER GRANT APPLICATION
BENEFIT-COST ANALYSIS**

April 15, 2016



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Executive Summary

This benefit-cost analysis was completed for the Re-Connecting Cleveland project, and was based on the National Cooperative Highway Research Program as described in their Report 552: Guidelines for Analysis of Investments in Bicycle Facilities. In summary, the economic value was estimated for the proposed Re-Connecting Cleveland project in terms of improvements to mobility, health, recreation, decreased auto use, and safety benefits.

In summary, the proposed \$16.45 million project will conservatively provide up to \$54.6 million in economic benefits (Exhibit 1). This results in a benefit cost ratio of 3.32:1. The projects are also expected to generate tourism and enhanced property values which are more difficult to quantify.

A Project Matrix describes the current condition, proposed changes, types of impacts, population affected, and economic benefits for each of the projects. See Exhibit 2 on the following page for the Re-Connecting Cleveland Project Matrix.

Exhibit 1. Net Present Value Benefits 3 Percent

Category	Re-Connecting Cleveland
Mobility Benefit	\$4,964,545
Recreation Benefit	\$7,901,959
Health Benefit	\$5,847,355
Safety Benefit	\$35,551,188
Decreased Auto Use Benefit	\$331,335
Total Benefit	\$54,596,382

Exhibit 2. Re-Connecting Cleveland Project Matrix

Project	Current Status/Baseline & Problem to be Addressed	Change to Baseline/Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Results	Page Reference
Re-Connecting Cleveland	<p>New bridge to Wendy Park will provide new and safe access across several railroad tracks for residents of nearby public housing and for regional trail users; The Red Line Greenway will provide safe, alternative commuter route to several close-by employment centers and safe route to school alternative for children attending nine nearby schools; The Cleveland Lakefront Bikeway Connector and Canal Basin Park Connector will link the Cleveland Foundation Centennial Trail to existing and planned trail infrastructure, closing gaps; The Whiskey Island Connector will provide safe transportation link between two of Cleveland's premier lakefront parks.</p>	<p>Provide 6,909 meter extension of trails and 1 new and 1 modified bridge removing pedestrians from local roads and railroad tracks</p>	<p>Reduce bike/ped accidents; increase bike commuting; new recreational access; improve health; decrease auto use; mobility</p>	<p>66,875 residents within 1.5 miles</p>	<p>Monetized value of mobility, health, recreation, decreased auto use, and safety benefits; qualitative discussion of tourism, and enhance property value</p>	<p>Estimated value of mobility, health, recreation, decreased auto use, and safety benefits</p>	<p>pp. 3-7</p>

Project Costs

Total project costs were compiled by Cleveland Metroparks using estimates based on actual costs of shared use projects currently under construction or completed within the last three years, including the first phase of the Cleveland Foundation Centennial Trail, which has recently been completed. The breakdown of the projected costs is included in the Re-Connecting Cleveland TIGER application narrative and Exhibit 3 below.

Total Estimated Project Costs: \$16,450,000

TIGER Request: \$9,450,000

Exhibit 3. Re-Connecting Cleveland TIGER Project Costs

Project	Cost
Project #1 Wendy Park Bridge	\$6,000,000
Project #2 Whiskey Island Connector	\$3,100,000
Project #3 Cleveland Lakefront Bikeway Connector	\$530,000
Project #4 Canal Basin Park Connector	\$220,000
Project #5 Red Line Greenway Phases 1 and 2	\$6,600,000
Total	\$16,450,000

Benefits

Reduction in Pedestrian Injuries and Fatalities

Injury and fatality numbers used for this calculation were drawn from the Ohio Department of Transportation Crash Analysis Module (CAM) for the city of Cleveland. The average annual pedalcycle (bicycle) and pedestrian accidents within 1.5 miles of the Re-Connecting Cleveland projects were estimated from 2011 to 2015. The CAM accident numbers were then scaled using the formula provided in the TIGER Benefit-Cost Analysis Resource Guide. Using the values provided in that guide, the Estimated Total Value of Pedalcycle and Pedestrian Fatalities and Injuries were developed.

The number of residents living within 1.5 miles of the Re-Connecting Cleveland TIGER projects was calculated. If the projects could reduce the chance of a pedalcycle or pedestrian accident for all residents within 1.5 miles of the projects, the value of those reduced injuries and fatalities would average \$2,611,179 a year. This estimate relies on two assumptions: (1) that a pedestrian's chance of an injury causing accident drops to nearly zero if they are on a shared use path; and (2) that 100 percent of the pedestrians will complete all of their miles on the new shared use path rather than the road. The support for the first assumption comes from another TIGER grant

applicant, the City of Houston, Texas.¹ The City of Houston analyzed data provided the National Highway Traffic Safety Administration in its June 2008 National Pedestrian Crash Report and estimated 0.01% of all pedestrian crash fatalities occur on bike paths. The City of Houston concluded that a pedestrian's chance of an injury causing traffic accident drops to nearly zero. This assumption is transferred to Cleveland for purposes of calculating benefits from pedestrian safety. The second assumption comes from user surveys conducted by the Ohio Department of Natural Resources and Cleveland Metroparks. Additional shared used trails consistently rank highest in additional desired park facilities and represent some of the highest usage throughout the state.

The reduction in pedestrian injuries and fatalities benefit is estimated to be \$2,611,179 per year, beginning in 2020 and continuing for 20 years. The present value of the safety benefit is \$35,551,188 at a 3 percent discount rate and \$22,581,136 at 7 percent discount rate. Calculations can be found in the "Safety" tab of the supporting Excel spreadsheet.

Reduced Auto Use

The National Cooperative Highway Research Program's Report 552 calculates the benefits of reduced auto use to include reduced congestion, reduced air pollution, and user cost savings. Report 552 calculates these benefits for commuter and other utilitarian travel only because it is assumed that recreational riding does not replace auto travel. Report 552's lead was followed in calculating the benefit only for the new bicycle commuters. Using the University of Minnesota's formula for demand the TIGER projects will generate 96 new bicycle commuters.

It is assumed that the total amount of new bike commuter mileage is a reasonable number to use to represent the total amount of new bike riding substituting for driving. This is believed to be a conservative assumption because a high proportion of Cleveland commuters drive. According to the American Community Survey, 83.6 percent of all Ohio commuters drive to work in a single-occupancy car, truck or van, and, therefore, there is a high potential for growth in bicycle commuting.² In order to estimate the average commute, an average Cleveland Metropolitan Statistical Area commute distance compiled by the Brookings Institute of 7.8 miles was used.³

Report 552 calculates congestion savings to be \$0.00 to \$0.05 per mile and pollution savings to be \$0.01 to \$0.05 per mile depending on conditions. It then assumes the high end of this range for central city areas. A final assumption is that all commuting and utilitarian trips are during congested periods. User cost savings were determined to be \$0.03 per mile during congested peak periods and \$0.00 otherwise.

Overall, the savings per mile is \$0.13 in urban areas. Since all of the TIGER projects occur within the city of Cleveland, the estimated savings of \$0.13 a mile was used to calculate the reduced auto use benefit. Finally, it was assumed that new bicycle commuters commute to work five days a week, 50 weeks a year.

¹ City of Houston, Houston Regional Bike/Ped Connections to Transit TIGER IV Application Benefit-Cost Analysis.

² U.S. Census Bureau, 2013 American Community Survey 1-Year Estimates. Ohio Commuting Characteristics.

³ Kneebone, Elizabeth and Natalie Holmes. The growing distance between people and jobs in Metropolitan America. Brookings Metropolitan Policy Program. March 2013. Available at http://www.brookings.edu/~media/research/files/reports/2015/03/24-job-proximity/srvy_jobsproximity.pdf

The reduced auto use benefit is estimated to be \$24,336 a year, beginning in 2020 and continue for 20 years. The present value of the reduced auto use benefit is \$331,335 at a 3 percent discount rate and \$210,455 at a 7 percent discount rate. Calculations can be found in the “AutoUse” tab of the supporting Excel spreadsheet.

Mobility

People are willing to travel to avoid biking in traffic. The National Cooperative Highway Research Program’s Report 552 states “on average respondents are willing to travel about 22 additional minutes if an off-road bike path is available if the alternative is to bike in traffic.” For the Re-Connecting Cleveland TIGER projects, the alternative to the proposed shared use path is to bike in traffic. Currently 1.3 percent of commuters in the 1.5 mile radius bicycle to work.

The University of Minnesota’s formula estimates the mobility benefits to be \$364,638 per year, beginning in 2020 and continue for 20 years. The present value of the mobility benefit is \$4,964,545 at a 3 percent discount rate and \$3,153,343 at a 7 percent discount rate. Calculations can be found in the “Mobility” tab of the supporting Excel spreadsheet.

Health

People who are physically active have reduced health care costs. The National Cooperative Highway Research Program’s Report 552 allows us to value the annual per-capita cost savings from physical activity of new bicyclists.

The University of Minnesota’s formula provides low, medium, and high estimates the health benefits. To be conservative only the low and medium estimates were used. The health benefits are estimated to be \$48,288 per year using the low model, and \$429,479 using the medium model. Health benefits begin accruing in 2020 and continue for 20 years. The present value of the low health benefit is \$657,441 at 3 percent and \$417,588 at 7 percent. The present value of the medium health benefit is \$5,847,355 at a 3 percent discount rate and \$3,714,079 at a 7 percent discount rate. Calculations can be found in the “HealthLow” and “HealthMedium” tabs of the supporting Excel spreadsheet.

Recreation

Many of the households within 1.5 miles of Re-Connecting Cleveland TIGER projects had severely limited recreational access. Recreation for households without a vehicle required a long walk (i.e., greater than 1.5 miles) or a ride with someone else with a vehicle. About 29 percent of households in the project radius do not have a vehicle. Once completed, the Re-Connecting Cleveland projects will provide new recreational access to the households without a vehicle. It is estimated that 19,610 residents will gain new recreational access.

It is assumed that the residents with new access will participate in recreation at the same levels as the rest of Cuyahoga County. Based on the 2013 study of the economic benefits of the Cleveland Metroparks system conducted for Cleveland Metroparks by The Trust for Public Land (study available at <https://www.tpl.org/clevelandeconbenefits>) 83.9 percent of children and 71.2 percent of adults use parks and trails. An additional 3,606 children and 10,902 adults are estimated to participate in recreational activities as a result of the TIGER projects. Each child with new access will visit a recreational site 14.6 times per year, while an adult will visit 9.8 times. An additional

52,643 child visits, 106,842 adult visits, or 159,485 total visits are estimated will occur annually because of the TIGER projects.

It is assumed that residents with new access will have the same economic value as the rest of Cuyahoga County (also from Metroparks benefits analysis). The study found the average value for recreational use to be \$3.82 for children and \$3.55 for adults.

A total annual recreational value of the new access provided by TIGER projects will be \$580,386. Recreational benefits begin accruing at the end of project construction 2020 and last for 20 years. The present value of the recreational benefit is \$7,901,959 at a 3 percent discount rate and \$5,019,107 at a 7 percent discount rate. Calculations can be found in the “Recreation” tab of the supporting Excel spreadsheet.

Tourism

Investments in the TIGER project will support the robust tourism economy in Cleveland. Tourists visit parks and trails in Cleveland and Cuyahoga County to participate in a wide variety of activities. In *The Economic Benefits of Cleveland Metroparks*, The Trust for Public Land utilized information provided by Tourism Ohio to measure the value of parks and trails in Cuyahoga County’s tourism economy. The Trust for Public Land determined tourists spend over \$6.66 billion in Cuyahoga County each year, with approximately \$733 million in spending each year attributable to the parks and trails that make the outdoors accessible to tourists. Spending by these park-related visitors generates \$21.3 million and \$29.1 million in local and state tax revenues, respectively. While this analysis cannot estimate the additional tourism value that the trail connectors will provide, it can be conservatively assumed that it will generate additional visitor spending, helping to support local jobs and tax revenues.

The proposed projects will also provide a direct linkage via the Cleveland Foundation Centennial Trail to the Ohio & Erie Canal Towpath Trail as well as the Cuyahoga Valley National Park. Currently, over 2.5 million people use the more than 85 miles of the Towpath Trail on an annual basis. It is anticipated that several hundred thousand of these pedestrians and cyclists will take advantage of the new trail projects once they are completed, thereby boosting the economies of the Flats, Downtown, Tremont and Ohio City neighborhoods in the city of Cleveland as they visit restaurants, hotels, bed and breakfasts, and other retail establishments in these areas.

Enhanced Property Values

Study after study has shown that trails have a positive impact on nearby residential property values. All things being equal, most people are willing to pay more for a home close to a nice trail. The property value added by trail areas is separate from the direct recreational use value gained; property value goes up even if the resident never visits the trail.

Based on previous studies, it is anticipated that the TIGER project trails will have a positive impact on neighboring home values. Property values of homes in neighborhoods with trails have been shown to increase 2 percent to 14 percent.⁴ In Cleveland specifically, The Trust for Public

⁴ Greg Lindsey, Joyce Man, Seth Payton, and Kelly Dickson, “Property Values, Recreation Values, and Urban Greenways” (Journal of Park and Recreation Administration 22, no. 3, 2004, pp.69-90). Found a residential property value premium of 14 percent within one-quarter of a mile of a trail in Indianapolis, Indiana; Harrison Campbell and Darla Munroe, “Greenways and Greenbacks: The Impact of the Catawba Regional Trail on Property Values in Charlotte, North Carolina” (Southeastern Geographer 47, no. 1, 2007, pp.118-137). Found a residential property

Land, using a conservative 2 percent market value premium for homes within 500 feet of trails, estimated for 2012 that \$9.65 million in residential property value exists because of proximity to trails. While this analysis does not estimate enhanced property value for existing and likely new development that would occur because of the TIGER projects, it is anticipated that it will generate significant property value benefits.

Long-Term Benefits

Re-Connecting meets all TIGER program primary and secondary criteria, as explained in the application:

- **State of Good Repair** - The existing bicycle and pedestrian infrastructure in the project vicinity, while improving through initiatives such as the City of Cleveland's bike lane striping program, does not adequately serve many area residents;
- **Economic Competitiveness** - The project will strongly enhance the multimodal transportation options for many of the residents of Cleveland's near west side, as well as Downtown Cleveland and the Flats East Bank, including the 29.3% of households in the project area without access to a personal vehicle; it will also promote economic development opportunities, stimulate re-development and increase property values along the proposed pathway routes.
- **Quality of Life** - In addition to providing safe and cost effective transportation alternatives for Cleveland residents, Re-Connecting Cleveland will improve "last mile" connections to the transit network as well as direct linkages to employment, shopping and recreation opportunities; it will also greatly enhance the quality of life for the 1,946 residents of nearby public housing projects who will be able to directly access waterfront greenspace after decades of isolation.
- **Environmental Sustainability** - The project will improve environmental sustainability by providing additional non-motorized transportation options, thereby reducing traffic congestion and air pollution from automobiles, and will incorporate green infrastructure to reduce storm water runoff. It will also improve resident health by providing access to outdoor recreation and active transportation, consistent with the Department of the Interior's Let's Move Outside! program.
- **Safety** - Separated pathways proposed in the Re-Connecting Cleveland projects will provide safe buffers from traffic, thereby significantly improving safety in an area plagued by high numbers of pedestrian/vehicular accidents and will serve as safe routes to school for students of two high schools and six elementary and middle schools located within the project area.
- **Innovation** - The project demonstrates innovation through the integration of bicycle and pedestrian options that connect to a robust public transit system creating a truly multimodal transportation network that enhances the quality of life and promotes ladders of opportunity for residents of the city of Cleveland.
- **Partnership** - Re-Connecting Cleveland builds on a long-term partnership of Cleveland Metroparks, the Trust for Public Land, LAND studio, the Cleveland-Cuyahoga County Port Authority, the Greater Cleveland Regional Transit Authority, and the City of Cleveland.

value premium of three percent within 5,000 feet of a greenway in Charlotte, North Carolina; Paul Asabere and Forrest Huffman, "The Relative Impacts of Trails and Greenbelts on Home Price" (Journal of Real Estate Finance and Economics 38, 2009, pp. 408-419). Found residential property value premiums of two, four, and five percent for trails, greenbelts, and both trails and greenbelts, respectively, within the neighborhood containing the amenity.

Benefit-Cost Ratio

Total Benefits by Project

The Re-Connecting Cleveland projects will conservatively provide up to \$54.6 million in economic benefits (Exhibit 4). The projects are also expected to generate tourism, enhanced property value, and economic competitiveness benefits, which are more difficult to quantify.

Exhibit 4. Total Benefits Each Scenario and Discount Rate

Scenario	Net Present Value	Benefit
Low	3%	\$49,406,467
	7%	\$31,381,628
Medium	3%	\$54,596,382
	7%	\$34,678,119

Total Construction Costs

The proposed Re-Connecting Cleveland projects will cost a total of \$16.45 million (Exhibit 5).

Exhibit 5. Total Construction Cost by Project

Project	Cost
Project #1 Wendy Park Bridge	\$6,000,000
Project #2 Whiskey Island Connector	\$3,100,000
Project #3 Cleveland Lakefront Bikeway Connector	\$530,000
Project #4 Canal Basin Connector	\$220,000
Project #5 Red Line Greenway Phase 1 and 2	\$6,600,000
Total	\$16,450,000

Net Benefits

The proposed \$16.45 million project will conservatively provide up to \$54.6 million in economic benefits. This results in a benefit cost ratio of 3.32:1 (Exhibit 6). The projects are also expected to generate tourism, enhanced property value, and economic competitiveness benefits, which are more difficult to quantify.

Exhibit 6. Re-Connecting Cleveland Benefit Cost Ratio by Scenario and Discount Rate

Scenario	Discount Rate	Benefits	Costs	Ratio
Low	3%	\$49,406,467	\$16,450,000	3.00
	7%	\$31,381,628	\$16,450,000	1.91
Medium	3%	\$54,596,382	\$16,450,000	3.32
	7%	\$34,678,119	\$16,450,000	2.11



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