

APPENDIX D: BENEFIT-COST ANALYSIS METHODOLOGY MEMO



Englewood Line Trail

*Making Green Healthy
Neighborhoods a Reality*



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1. EXECUTIVE SUMMARY

This benefit-cost analysis (BCA) was conducted for the proposed **Englewood Line Trail** for submission to the U.S. Department of Transportation (USDOT) as a requirement of a discretionary grant application for the FY 2022 RAISE program. The analysis was conducted in accordance with the benefit-cost methodology as outlined by USDOT in the Benefit-Cost Analysis Guidance for Discretionary Grant Programs, released in March 2022. The project analysis period of 20 years begins in 2027, following a 2-year construction period, at which point the full benefits of the project begin.

This appendix describes the methods used to calculate the project benefits, costs, and BCA results. Project benefits are assumed to be incurred after the project is completed in 2027 for a 20-year time span to 2046. Table 1, below, summarizes the project description, benefits, and costs.

TABLE 1 EXECUTIVE SUMMARY OF PROJECT DESCRIPTION, BENEFITS, AND COSTS

Project Description	Project Benefits	Project Costs
<p>A 1.75-mile multiuse path built on an abandoned elevated railroad right-of-way, serving the Englewood and West Englewood neighborhoods.</p>	<p>Improved traffic safety for pedestrians and cyclists by providing a dedicated right-of-way.</p> <p>Property value benefits resulting from the new multiuse path.</p> <p>Property value benefits as a result of environmental remediation of both the adjacent parcel and the pathway.</p>	<p>Construction includes rehabilitation of the railway bridges, remediation of the pathway and adjacent parcel, and components such as landscaping, drainage, signing, and lighting.</p>

2. PROJECT BENEFITS

There were four benefits from the Englewood Line Trail that were quantified for this BCA. These included benefits to active transportation users, or pedestrians and cyclists, and property value benefits in the surrounding neighborhoods. The operations and maintenance cost is included as a negative benefit. The following sections describe the methods used to calculate these benefits.

Operations and Maintenance

Operations and maintenance of the trail is expected to cost \$1 million per year for the Englewood Line Trail. Applied to the 20 year analysis period, from the trail opening in 2027 to 2046, this equals a total of \$20 million. Discounted to 2020 dollars, the grand total of operations and maintenance is \$7,059,239. O&M costs are treated as a negative benefit.

Traffic Safety Benefits

As discussed in the project narrative, the Englewood Line Trail is expected to improve traffic safety within the neighborhood by providing a dedicated right-of-way to its users. In order to determine the specific impacts on traffic safety, CDOT collected data on pedestrian and cyclist crashes within a certain distance of the proposed project. Crash data from the Illinois Department of Transportation (IDOT) was utilized, and catchment buffers from the proposed project were established for cyclists and pedestrians – a half mile and quarter mile, respectively. The data, which ranged from 2016 to 2020, were filtered to focus on incidents of fatalities and injuries. Results from this data collection are shown below, in Table 2.

TABLE 2 OBSERVED CRASH DATA FOR PROJECT AREA (2016-2020)

Year	Pedestrian Injuries and Fatalities (1/4 mile)		Cyclist Injuries and Fatalities (1/2 mile)	
	Injury	Fatal	Injury	Fatal
2016	20	0	8	0
2017	6	0	6	0
2018	9	1	4	0
2019	4	0	1	0
2020	5	1	4	0

Source: IDOT Crash Data (2016-2020)

Once these data were assembled, the average injury and fatality crash rates were calculated for the observed five-year period. It was determined that the injury crash rate was 13.4 per year and the fatality crash rate was 0.4 per year.

Using these data, traffic safety benefits were calculated based on a publication in Environmental Health, *The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature*¹, which examined various studies related to the impact of different infrastructure elements on bicyclist safety, including bike lanes. One of the studies examined, Lott and Lott (1976), found bike lanes to result in an estimated 53% reduction in

¹https://www.researchgate.net/publication/38026876_The_impact_of_transportation_infrastructure_on_bicycling_injuries_and_crashes_A_review_of_the_literature

collision frequency. This reduction value was applied to the injury and fatality crash rates, resulting in improved crash rates of approximately 7.1 injury crashes per year and 0.2 fatal crashes per year, or an annual reduction of 6.3 and 0.2, respectively.

The USDOT monetized values for fatalities and injuries, provided in the March 2022 BCA guidance document, were multiplied by these reduction rates to determine the total benefit for the analysis period (2027-2046). After applying the 7% discount rate, the total traffic safety benefit for reductions of injuries and fatalities was \$25,308,639.

Property Value Benefits

Aside from traffic safety benefits, the Englewood Line Trail will provide the community with a valuable asset, which can be expected to improve surrounding property values. In order to calculate these benefits, property assessment data was collected from the Cook County Assessor's Office open data portal. The Cook County Property Assessments² dataset provided assessed values from 2010 to 2020. Values were filtered to the year 2020 before further analysis was done.

Property value benefits were based on a publication in the Journal of the American Planning Association, *Two Approaches to Valuing Some of Bicycle Facilities Presumed Benefits*³, which looked at the effects of bicycle trails on home property values. The study estimated a 0.34% increase in property values within one mile of a bike path.

In order to apply the benefits from this study to the Englewood Line Trail project extent, a one mile buffer was selected around the trail for the Cook County Property Assessment data. The sum of the total property values within this one mile buffer equaled approximately \$107 million in 2020 dollars. Using a 3% inflation rate, this figure was inflated to 2027 dollars, resulting in approximately \$130 million. Applying the 0.34% property value increase factor resulted in an expected benefit of approximately \$442,000, or \$275,241 when discounted to 2020 dollars.

Remediation Benefits

In addition to property value benefits from the construction of a new bicycle path facility, property value benefits are also expected through the brownfield remediation portion of this project. As discussed in the Project Narrative, construction of the Englewood Line Trail will require the remediation of the Loomis Cluster parcel.

The same dataset used to quantify the property value benefits from construction of the trail, discussed in the previous subsection, was used to quantify the property value benefits from brownfield remediation. This data consisted of 2020 assessment values from the Cook County Assessor's Office.

² <https://datacatalog.cookcountyiil.gov/Finance-Administration/Cook-County-Property-Assessments/tnes-dgyi>

³ <https://www.tandfonline.com/doi/abs/10.1080/01944360608976753>

Property value benefits attributed to remediation were based on a publication in the National Bureau of Economic Research, *The Value of Brownfield Remediation*.⁴ This study was also cited by the US Environmental Protection Agency.⁵ This study analyzed a sample of brownfield remediations to determine the impact on property values. The results showed an average property value increase between 5% and 11.5% within 5 kilometers (approximately 3 miles) of remediated brownfields. In order to account for the variability in the size of brownfields within the study, a value of 8.25% was used. Therefore, a three-mile buffer was selected around the Loomis Cluster remediation site. The total property value was equal to approximately \$761 million, and applying the 8.25% property value improvement factor resulted in an increase of approximately \$63 million. Applying a discount rate of 7% brought the final property value benefit to \$39,081,167, in 2020 dollars.

Project Benefit Summary

Table 3, below, provides a summary of the life cycle costs associated with the Englewood Line Trail. These includes operations and maintenance (treated as a negative benefit) traffic safety, environmental remediation, and property value benefits. Estimates are provided in both nominal and discounted 2020 dollars and more specific details are available in the BCA Spreadsheet.

TABLE 3 SUMMARY OF PROJECT LIFE CYCLE BENEFITS

Year	Undiscounted Benefits	Discounted benefits (\$2020)
2027	\$65,703,059	\$40,916,563
2028	\$2,505,269	\$1,458,090
2029	\$2,505,269	\$1,362,701
2030	\$2,505,269	\$1,273,552
2031	\$2,505,269	\$1,190,235
2032	\$2,505,269	\$1,112,370
2033	\$2,505,269	\$1,039,598
2034	\$2,505,269	\$971,587
2035	\$2,505,269	\$908,025
2036	\$2,505,269	\$848,621

⁴ <https://www.nber.org/papers/w20296>

⁵ <https://www.epa.gov/brownfields/brownfields-program-environmental-and-economic-benefits>

Year	Undiscounted Benefits	Discounted benefits (\$2020)
2037	\$2,505,269	\$793,104
2038	\$2,505,269	\$741,219
2039	\$2,505,269	\$692,728
2040	\$2,505,269	\$647,409
2041	\$2,505,269	\$605,055
2042	\$2,505,269	\$565,472
2043	\$2,505,269	\$528,479
2044	\$2,505,269	\$493,905
2045	\$2,505,269	\$461,594
2046	\$3,505,269	\$431,396
Total	\$114,303,178	\$57,041,703

3. PROJECT COSTS

Construction cost estimates provided in this BCA are given in 2020 dollars. The total cost of the Englewood Line Trail is \$45,715,928 in 2020 dollars. A detailed breakdown of capital costs can be within the BCA Spreadsheet, within the “Project Capital Costs” tab.

Capital Construction

Design and Construction Engineering

The Design and Construction Engineering for the Englewood Line Trail accounts for a total of approximately \$12.5 million, with \$5,775,000 programmed in the TIP for FY 2023, or \$5,044,109 when discounted to 2020 dollars, and another \$7,414,091 in 2020 dollars included in the project construction cost.

Environmental Remediation

Environmental remediation of the Loomis Cluster parcel is required for construction of the Englewood Line Trail. The Loomis Cluster parcel will require \$2,550,000 and remediation of the land along the trail itself will require \$426,000, totaling \$4,037,629 in 2026 dollars. When discounted to 2020 dollars, the total remediation cost is equivalent to \$2,690,442. These costs will occur during construction in 2026.

ROW Acquisition

The Englewood Line Trail will also require 14 Right-of-Way acquisitions along the corridor. These total \$248,999 in value, which will occur during construction in 2026. This value equals \$165,918 when discounted to 2020 dollars.

Construction

Construction of the Englewood Line Trail itself includes various elements, such as viaduct and retaining wall rehabilitation, site clearing and preparation, landscaping, the pathway itself, drainage, signage, and lighting. These costs, which will occur during construction in 2026, equal a total grand total of \$39,710,539, or \$24,729,728 when discounted to 2020 dollars.

Contingency

A \$8,799,433 contingency, or 20% of the total construction cost, is included in the total cost of the Englewood Line Trail. This cost is expected to occur during construction in 2026. When discounted to 2020 dollars, this contingency equals \$5,671,639.

Project Life Cycle Costs Analysis

Table 4, below, provides a summary of the life cycle costs associated with the Englewood Line Trail. These include capital construction, which would occur in 2022 and 2026. Estimates are provided in both nominal and discounted 2020 dollars and more specific details are available in the BCA Spreadsheet.

TABLE 4 SUMMARY OF PROJECT LIFE CYCLE COSTS

Year	Undiscounted Costs	Discounted Costs (\$2020)
2022	\$5,775,000	\$5,044,109
2026	\$62,461,854	\$40,671,819
Total	\$68,236,854	\$45,715,928

4. BCA RESULTS

This section provides the overall results of the BCA, which combine the monetary gains from the benefits and the monetary project costs.

Table 5, below, presents the Net Present Value (NPV), or the overall cash value of the benefits minus the costs, and the Benefit Cost Ratio (BCR), or the value of the overall benefits value divided by the costs.

TABLE 5 PROJECT BENEFIT COST ANALYSIS SUMMARY

Costs and Benefits	Nominal Total Value	NPV Discounted to \$2020 (7%)
Costs		
Capital Construction	\$68,236,854	\$45,715,928
Total Costs	\$68,236,854	\$45,715,928
Benefits		
Operations & Maintenance	-\$20,000,000	-\$7,059,236
Traffic Safety Benefits	\$70,105,388	\$24,744,534
Property Value Benefits	\$441,976	\$275,241
Remediation Benefits	\$62,755,814	\$39,081,167
Total Benefits	\$113,303,178	\$57,041,703
Net Present Value (NPV)	\$45,066,324	\$11,325,775
Benefit Cost Ratio (BCR)	1.66	1.25