Memorandum

To: Kelly Grissman, Director of Planning
Three Rivers Park District

From: Nick Semeja, PE
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Subject: Three Rivers Park District Active Transportation Network: Connecting Greater Minneapolis Communities through Sustainability, Equity, and Mobility – 2023 RAISE Program Application Benefit-Cost Analysis Memorandum

Introduction

This memorandum summarizes the assumptions, methodology and results developed for the benefit-cost analysis of the No Build and Build Alternatives evaluated as part of the Three Rivers Park District Active Transportation Network: Connecting Greater Minneapolis Communities through Sustainability, Equity, and Mobility – 2023 RAISE Grant Program Application. The objective of a benefit-cost analysis (BCA) is to bring all the direct effects of a transportation investment into a common measure (dollars), and to account for the fact that benefits accrue over an extended period while costs are incurred primarily in the initial years. The primary elements monetized in this analysis are quality of life, remaining capital value, air quality, operating cost savings and maintenance costs. The benefit-cost analysis can provide an indication of the economic desirability of an alternative, but decision-makers must weigh the results against other considerations, effects, and impacts of the project.

Three Rivers Park District Active Transportation Network: Connecting Greater Minneapolis Communities through Sustainability, Equity, and Mobility (herein referred to as "the Project") will improve the regional trail network through a series of strategic interventions identified through technical analysis and extensive community outreach. The Project will construct 5.5 miles of new regional trail, reconstruct 9.4 miles of existing trails and sidewalks, improve wayfinding and amenities along 2.4 miles, and improve 89 trail crossings. The Project will address existing regional trails in need of reconstruction, establish new north-south connections between existing east-west routes, and fill gaps in the existing regional trail network. Collectively, these improvements will spur active transportation and enable new connections and travel patterns.

Description of Alternatives

For the purpose of this analysis, a No Build and Build Alternative were under consideration.

No Build Alternative

The No Build Alternative includes leaving the Three Rivers Park District trail system in its current configuration and operational state. Trails that are undergoing reconstruction under the Build Alternative were assumed to receive minimal maintenance under no Build conditions and were assumed to close to users once the end of their expected service lives (assumed to be 30 years after initial construction or last reconstruction based on Three Rivers Park District maintenance schedules) are reached.

Build Alternative

The Build Alternative assumes numerous additions and improvements to the regional trail network. Project components are described in more detail below.

Improvements that were quantified in the BCA:

- New trail construction: strategically linking state, regional, and local trails with new trail segments. The resulting connectivity will expand trail access to bicycle and pedestrian friendly destinations like jobs, schools, recreation and shopping destinations, and public transit lines.
- Trail reconstruction: updating end-of-life and substandard trail segments, to maintain a good state of repair on existing routes as well as consistent and reliable facility design. Three Rivers is a nationwide leader in infrastructure maintenance, which extends the life of trail pavement and improves user safety and satisfaction.

Improvements that were not quantified but are likely to increase usership and provide benefits to existing users on the Regional Trail network:

- Upgrading trails: trail amenities such as benches, bicycle parking, and bicycle fix-it stations welcome trail users of all ages, abilities, and experience levels, improving quality of life throughout the service area. Maps and signage help new users navigate the trail system and encourage multimodal transportation.
- Improved trail crossings: signalization, striping, wayfinding, and other strategies to ensure the trail network interfaces safely with other modes of transit as well as local and state trail and sidewalk systems. Surveys of regional trail users consistently rank 'improving or eliminating road crossings' to be a top intervention to increase trail use.

Table 1 provides a summary of project lengths in miles associated with each improvement type and the trails in which they are proposed.

Table 1 – Project Summary

	Construct New Trail	Reconstruct Existing Trail	Improve Existing Trail	Total Trail Length	Improved Crossing	APS Signal Upgrade	Accessible Bus Stop Landing	Trail Counter	eBike Charger
Bassett Creek Regional Trail		1.1		1.1	6			1	
CP Rail Regional Trail - North	3.7		1.1	4.8	48	3	2		
CP Rail Regional Trail - South	1.3	3.4		4.7	11	4	3	1	2
Eagle Lake Regional Trail	0.5	1.4	1.3	3.2	11	1	3	1	2
Medicine Lake Regional Trail		2.3		2.3	5		1	1	2
Shingle Creek Regional Trail		0.8		0.8	7	2		1	
Twin Lakes Regional Trail		0.4		0.4	1				
Project Total	5.5	9.4	2.4	17.3	89	10	9	5	6

BCA Methodology

The following methodology and assumptions were used for the benefit-cost analysis:

1. **Main Components**: The main components analyzed included:
   - Vehicle operating costs
   - Air quality and emissions
   - Quality of life benefits:
     - Bicyclists' mobility
     - Bicyclists' and walkers' health
     - Bicyclists' and walkers' recreation
     - Reduced auto-use: congestion, emissions, and vehicle operating costs
     - Facility and amenities
   - Initial capital costs
   - Remaining capital value: value of improvement beyond the analysis period
   - Maintenance and rehabilitation costs: These costs include scheduled rehabilitation activities and annual routine maintenance.

2. **Analysis Years**: The analysis assumed that construction of each trail would take between years 2028 and 2030. Construction is expected to be completed in stages with some trail projects occurring before others. It was assumed that benefits will be accrued from each trail project starting within the following year of project completion. The analysis focused on the estimated benefits up to year 2050, i.e. a twenty-year period beyond the opening of the last constructed project. The present value of all benefits and costs was calculated using 2021 as the year of constant dollars.

3. **Economic Assumptions**: All economic values and analysis methodology were obtained from the *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated January 2023[1], unless otherwise stated in the ensuing sections of this document. The analysis was completed using an assumed discount rate of seven percent.

4. **Quality of Life Benefits:** Since the project includes multi-use paths and bicycle and pedestrian infrastructure, it is important to quantify the quality of life benefits the improvements will bring to the community.

Cycling Walking Demand - New and Existing Users

To determine existing user demand, demographic data for the Three Rivers Park District trails was collected and organized to determine the number of existing annual visits, percentage of cyclists, and percentage of hikers/walkers/runners.[2] In addition, the data provided information on trip purpose, such as the percentage of users who commute to work via the trails. To obtain estimates of project impacts on the trail usage of each project component, users per mile of existing trail were calculated using the count and survey data. Some trails did not have detailed count and demographic data available. In these instances, the total district trail data was used to determine an average number of users per mile of trail. District values were verified to be reasonable by comparing the total district users per mile to the individual trail users per mile where available, as demonstrated in the "Users per Mile" tab in the BCA Workbook.

Existing users per mile were applied to the new trail construction length and trail reconstruction length of each project to determine the number of new users induced to the facility and the number of existing users impacted, respectively. Benefits to existing users were only quantified for years in which the existing trail would be closed if maintenance and rehabilitation assumed in the Build Alternative would not occur. Benefits for new trail users were quantified once the new trail is expected to be operational. Furthermore, users were broken down by mode (walkers or cyclists) and purpose (recreational or commuting) based on the survey data.

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[1] https://www.transportation.gov/sites/dot.gov/files/2023-01/Benefit%20Cost%20Analysis%20Guidance%202023%20Update.pdf

[2] Trail count and survey data was collected by Three Rivers Park District staff and is provided in the BCA Workbook

Year 2040 visitation projections were developed by Three Rivers Park District staff. Projected visitation was developed by comparing population data from the 2020 Census and 2040 population projections within the influence area of each project. Additionally, existing use data based on population proximity to each trail project was applied to 2040 population projections by TAZ for use in the 2040 visitation estimates. More detail on the existing and projected visitation for each trail is provided in the "Annual Use" tab in the BCA Workbook.

A few trail projects are expected to have relatively larger visitation growth than the others. The methodology used to develop visitation projections is using assumptions and data that most accurately reflect current land use plans in the region. However, the BCA Workbook is set up to allow for sensitivity testing of results if visitation growth is higher or lower than anticipated.

Mobility Benefits

To estimate the value bicyclists place on mobility, NCHRP Report 552[3] was referenced to determine value placed on using off-street trails compared to other facilities. The NCHRP recommends applying the value of time to the additional travel time bicycle commuters are willing to travel out of their way to get to the facilities. Researchers defined five facility types as:

A) Off-road facilities,
B) In-traffic facilities with bike lane and no on-street parking,
C) In-traffic facilities with a bike lane and on-street parking,
D) In-traffic facilities with no bike lane and no on-street parking, and
E) In-traffic facilities with no bike lane but with on-street parking

These facility types were used to conduct a stated preference survey. The resultant logit model suggests that bicyclists were willing to travel an additional 21.6 minutes to use an off-street facility instead of a street with no facility and no on-street parking. 0 summarizes some of NCHRP's suggested mobility benefits that are relevant to the project.

Table 2. Mobility Benefits of Different Bicycle Facility Improvements

Base facility	Improved facility	Minutes
B	A	5.2
D	A	21.6
E	A	30.5
E	C	16.4

The project area's existing conditions are assumed to be a 'D' facility type and the Build Alternative is assumed as category A. An adjustment factor was added to the NCHRP

[3] See Chapter 4: https://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_552.pdf

method to account for the potential of existing facilities in the proximity of the trail projects, which can be considered conservative since users were based on existing per mile users in the area.

Health Cost Savings

Exercise helps to keep people healthy, thereby reducing their risk of mortality. USDOT estimates the value of an average 0.86-mile walking trip is worth $7.20 and the value of an average 2.38-mile cycling trip is worth $6.42 (in year 2021 dollars). These values were applicable to age ranges of 20 to 74 years of age and 20 to 64 years of age for each active mode of transportation, respectively. Percentages in applicable age ranges from the trail count and survey data were applied to existing and new users to determine the number of users impacted.

Cycling Amenity Benefits

The value of providing a cycling path for users was estimated based on project length for existing (compared to No Build once existing trail would close) and new users. All trail projects assumed at-grade crossings. Amenities were valued in accordance with *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated January 2023.

Recreation Benefits

Examining the value people place on different recreational activities, the NCHRP estimates that one hour of bicycle recreation is worth $10 (dollars were inflated from year 2006 dollars to year 2021 dollars). The BCA assumed that a "typical" day of bicycling included one hour of activity. The value of recreation was applied to existing and new recreational trail users.

Reduced Auto Congestion Benefits

As the new bicycle facilities encourage a mode shift to bicycle commuting from automobile commuting, it was assumed that the region would see benefits related to reduced congestion. These benefits include lower travel times through improved traffic flow, reduced emissions, and operational savings for bicyclists. The NCHRP estimated that the benefit derived per commuter is $0.13 per mile for city centers and $0.08 for suburban areas. Given the project location, land use, congestion and air pollution level, an average of these two values, 10.5 cents (in year 2006 dollars), was used. This value was calculated to be the minimum value of either the exiting trail length or the estimated cycling trip length of 2.38 miles, as provided in the USDOT guidance.

5. **Environmental and Air Quality Impacts:** A reduction of VMT is expected due to the induced mode shift adding trails has on the regional transportation network. Change in VMT was estimated based only on cycling users of the trail projects that commute. This may be a conservative estimate on modal shift as users serving a different purpose may also shift from using a vehicle to a bicycle. Average emission rates per passenger vehicle were obtained from the Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES)

version 3. Emission rates per vehicle type are provided in the attached BCA Workbook. Total change in emissions was valued in accordance with the *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated January 2023.

6. **Vehicle Operating Costs:** The change in VMT was also applied to vehicle operating costs to determine potential savings in vehicle operating costs for users. Operating costs per mile for passenger vehicles were applied to total project VMT reduction to determine project benefits. Vehicle operating costs were valued in accordance with *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated January 2023.

7. **Maintenance and Rehabilitation Costs**: Annual routine maintenance cost per mile of trail was obtained from Three Rivers Park District staff and was calculated for each year of operations through year 2050 (20-years beyond the opening of the last constructed trail). Rehabilitation (microsurfacing) was calculated for every seven years following their individual openings. Detailed costs for rehab and annual maintenance activities are provided in the BCA workbook.

8. **Calculation of Remaining Capital Value**: Each trail is expected to have a service life of 30 years before reconstruction is expected to be required. Since the benefit-cost analysis period extended for 20 years beyond the opening of the last constructed trail, the remaining value of infrastructure was calculated for the years of service remaining beyond year 2050. Each trail was assumed to have a linear depreciation; thus, the remaining capital value for each trail was equivalent to the total trail project cost multiplied by the percentage of useful life remaining (i.e. number of years remaining divided by 30-years of life). This value was expressed in terms of 2021 dollars and was added to other user benefits in accordance with USDOT guidance.

9. **Factors Not Quantified**: Several factors were not quantified as part of the analysis but have potential to provide additional benefits to the region. These factors included the following:
    - Quality of life and safety benefits from improvements being made at crossings throughout the trail projects.
    - Reduction in pedestrian and cycling crashes on roadways adjacent to or within the vicinity of trail projects that would pull trips to the new or improved trails.
    - Benefits associated with induced demand to trails that have higher pavement quality, as costs associated with routine maintenance and regularly scheduled rehabilitation were not assumed for the No Build Alternative.
    - Reduction in vehicle crashes due to expected modal shift to bicycles.
    - Induced pedestrian and cycling demand on trails that are adding or improving wayfinding and amenities (such as benches, bicycle parking, bicycle fix-it stations, etc.).
    - Equity, connectivity, and accessibility benefits by providing multimodal transportation options over a larger span of the region.

BCA RESULTS

The benefit-cost analysis provides an indication of the economic desirability of a scenario, but results must be weighed by decision-makers along with the assessment of other effects and impacts. Projects are considered cost-effective if the benefit-cost ratio is greater than 1.0. The larger the ratio number, the greater the benefits per unit cost. Results of the benefit-cost analysis are shown for the project in Table 2 below. See Attachment A for the complete benefit-cost analysis workbook.

Table 2 – Total Project Results

	Initial Capital Cost (2021 Dollars)	Project Benefits (2021 Dollars)	Benefit-Cost Ratio (7% Discount Rate)	Net Present Value (2021 Dollars)
No Build vs. Build	$14.5 million	$163.7 million	11.3	$149.2 million

Attachment

Benefit-Cost Analysis Worksheet