



2023 Highway 4 & Highway 10 Roadway Improvement Project

CASS COUNTY, NORTH DAKOTA

PROJECT COSTS

Cass County is requesting \$24,693,601 in RAISE grant funding. This is a Rural grant application making it eligible for 100 percent federal funding, however the County is prepared to match this grant at 20 percent. If actual construction costs exceed the RAISE grant funding, Cass County will dedicate available state and local funds. The local match on these projects is already included in Cass County’s 2023–2027 CIP.

FUNDING	
Cass County - Local Funds	\$8,256,923
RAISE (Federal)	\$24,693,601
Total	\$32,950,523

Project Costs by Phase and Source

Cass County will use 100 percent of the RAISE funds for construction cost. All Preliminary engineering, Right of Way and Final Design/Construction Engineering are paid from local sources.

TOTAL PROJECT COSTS		FUNDING SOURCE
Preliminary Engineering/Environmental	\$1,543,350	100% Local
Right of Way	\$308,670	100% Local
Final Design/Construction Engineering	\$231,503	100% Local
Construction (incl. 15% contingency)	\$30,867,001	80% Federal/20% Local
Total	\$32,950,523	

The Project is split between three Census Tracts 401, 402 and 403.

CENSUS TRACT(S)	COST BY TRACT
Census Tract 401	\$17,172,727
Census Tract 402	\$7,889,201
Census Tract 403	\$7,889,201



BENEFIT COST

Overview

The Benefit-Cost Analysis (BCA) was performed to evaluate the public benefits generated by the Cass County Safety and Mobility Improvement Project within the State of North Dakota. The BCA demonstrates the cost effectiveness of the project for which the project sponsor Cass County is seeking Federal support, measured in terms of a benefit-cost ratio (BCR). The Project has independent utility with benefits exceeding cost.

Based upon the BCA presented, the project is expected to generate \$38.0 million in total discounted user benefits and cost \$33.0 million in capital expenditures. Therefore, the project generates a Benefit/Cost Ratio of 1.15:1. **Table 1** below summarizes the long-term outcomes calculated in this BCA.

Table 1 Summary of Benefit/Cost Analysis

CAPITAL EXPENDITURES	TOTAL BENEFITS	BENEFIT/ COST RATIO
\$ 32,950,523	\$ 38,043,233	1.15:1

Project Background

Table 2 lists the major elements of the proposed build design that were modeled and monetized for the benefit/cost analysis and how those elements compare to a no build scenario. The project is broken down into three segments within western Cass County.

Table 2 Segment Location Description

Segment Description	Starting at	Ending at	Length
Cass County Route 4	ND 18	County Route 11	6.0 miles
Cass County Route 10 West	County Route 1	ND 38	5.9 miles
Cass County Route 10 Buffalo	ND 38	County Route 5	1.0 mile



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The BCA approach and methodology used in this analysis is consistent with the U.S. Department of Transportation, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023. **Figure 1** shows the categories that were monetized for BCA analysis. **Table 3** gives a short explanation of the categories, methodologies, and assumptions.

Figure 1 Summary of Benefit/Cost Monetized Categories

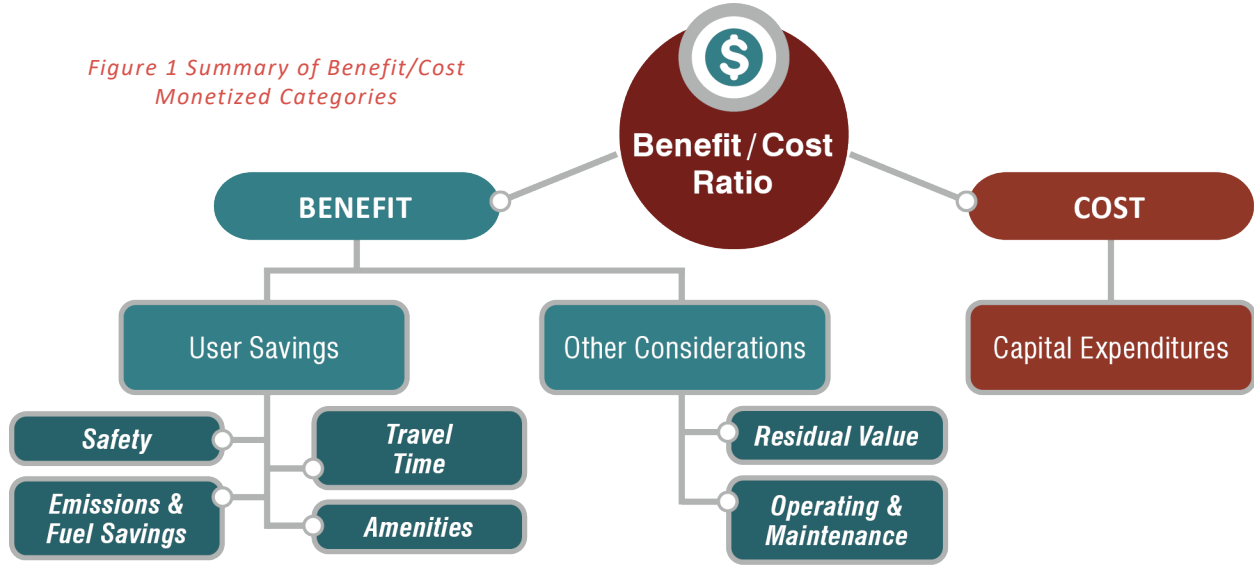


Table 3 Summary of Benefit/Cost Analysis Methodology

Category	Methodology Overview
Safety	Five-year crash data gathered from NDDOT. Future crash costs were calculated with the annual average crash rate over the 5-year history. Crash cost factors from CMF Clearinghouse were used to estimate safety benefits for the proposed build.
Travel Time	Travel time, Fuel, and Emission benefits from flood improvements at the Maple River culvert on the West CR 10 Segment were calculated from the added detour time and distance. EPA guidance was used to quantify the total emission. The other two segments are assumed to have no change in travel time or delay, therefore zero related benefits or costs.
Emissions & Fuel Savings	
Amenities	Preliminary layouts used to define amenity quantities for bike and pedestrian facilities. Annual pedestrian and bicycle trips were estimated with engineering judgment.
Residual Value	Appraisal of remaining value at the design year based on expected infrastructure life and linear approximation of loss in value.
Operating & Maintenance	Estimate of yearly operating and maintenance costs based on studies for roadway maintenance and multimodal facility maintenance snow removal.
Capital Expenditures	Preliminary layouts and straightforward quantity takeoff methods



BCA Results Summary

The results of the BCA analysis indicate a positive Benefit-Cost Ratio of 1.15:1. All costs in this summary are discussed in 2021 dollars and account for the appropriate discount rate of 7 percent.

Total discounted benefits before Maintenance and Residual Value are estimated to be over \$35.3 million. The results of the four categories used to monetize user benefit in the benefit/cost analysis are described as follows and shown in **Table 4**:

- **Safety.** Crashes among all injury severities is forecasted to decrease by 51 percent and crash costs by 62 percent. Crash cost reduction in this project is primarily attributed to adding left turn lanes to ND 18 at CR 4 and adding 6-foot shoulders plus centerline rumble strips to CR 10.
- **Travel Time.** By raising CR 10 over Maple River, detouring during flood events, and alleviating detouring during flood events, is predicted to save travelers over \$16,000 over the 20-year analysis period.
- **Emissions.** Along with travel time savings, raising CR 10 at Maple River will cut down CO₂ emissions by 6 tons in 20 years and save users \$1,000
- **Amenities.** Adding 6-foot shoulders along CR 4 and CR 10 and improving the existing sidewalks in Buffalo, total amenity benefits for pedestrians and bicyclists were calculated to be over \$222,000.

Additional and detailed Analysis can be viewed within the Benefit Cost Analysis Narrative.

In addition to user benefits, operating & maintenance costs and residual value are included in the numerator of the benefit/cost ratio. Total maintenance was expected to incur a cost of \$32,100 for the build condition compared to no build over 20 years. The expected residual value of the project infrastructure at the design year (2046) is over \$2.7 million.

When user benefits are added to operating & maintenance costs and residual value, the total benefits from the completion of the project are expected to be \$38.0 million as listed in **Table 5**. Total Capital Costs are estimated to be \$33.0 million, producing a benefit/cost ratio of 1.15:1.



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Table 4 Summary of Discounted User Benefits in 2021 Dollars

Calendar Year	Safety Benefits	Travel Time Benefits	Emissions Benefits	Amenities Benefits	Total User Benefits
2027	\$3,096,627	\$1,444	\$83	\$16,891	\$3,115,044
2028	\$2,894,044	\$1,350	\$78	\$16,101	\$2,911,573
2029	\$2,704,714	\$1,261	\$74	\$15,349	\$2,721,398
2030	\$2,527,770	\$1,179	\$70	\$14,632	\$2,543,651
2031	\$2,362,402	\$1,102	\$67	\$13,948	\$2,377,518
2032	\$2,207,852	\$1,030	\$63	\$13,296	\$2,222,241
2033	\$2,063,413	\$962	\$59	\$12,675	\$2,077,110
2034	\$1,928,424	\$899	\$56	\$12,083	\$1,941,462
2035	\$1,802,265	\$840	\$53	\$11,518	\$1,814,677
2036	\$1,684,360	\$785	\$51	\$10,980	\$1,696,176
2037	\$1,574,168	\$734	\$48	\$10,467	\$1,585,417
2038	\$1,471,185	\$686	\$46	\$9,978	\$1,481,894
2039	\$1,374,939	\$641	\$43	\$9,511	\$1,385,135
2040	\$1,284,990	\$599	\$41	\$9,067	\$1,294,697
2041	\$1,200,925	\$560	\$39	\$8,643	\$1,210,168
2042	\$1,122,360	\$523	\$37	\$8,239	\$1,131,160
2043	\$1,048,935	\$489	\$35	\$7,854	\$1,057,313
2044	\$980,313	\$457	\$34	\$7,487	\$988,291
2045	\$916,180	\$427	\$32	\$7,137	\$923,777
2046	\$856,243	\$399	\$31	\$6,804	\$863,477
Total	\$35,102,108	\$16,369	\$1,040	\$222,662	\$35,342,179

Table 5 Benefit/Cost Ratio Summary

Total User Benefits	Operating & Maintenance Costs	Residual Value	Total Benefits	Capital Expenditures	Benefit/Cost Ratio
\$35,342,179	-\$32,102	\$2,731,268	\$38,043,233	\$32,950,523	1.15