BENEFIT-COST ANALYSIS

Forest County Potawatomi Community

Carter to Wabeno Pathway

March 2025

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Benefit-Cost Analysis Narrative Supplement

1. Introduction

This Benefit-Cost Analysis (BCA) summary supports the Carter to Wabeno pedestrian/cyclist pathway as proposed by the Forest County Potawatomi Community. Details of the proposed project are included in the project narrative; however, in summary, this project proposes the construction of a new approximately 4-mile shared-use pathway that would connect the towns of Carter and Wabeno in Forest County, Wisconsin. The pathway is planned to be a 10-ft-wide, asphalt path that would be accessible for both pedestrians and cyclists. Three independent alternative pathway designs were proposed for this project. This narrative summary provides supporting information relevant to the input assumptions and calculations for determining project costs and benefits and details the results of these analyses.

The following information can be found in subsequent sections of this narrative:

- Section 2 details information found within the attached BCA spreadsheet
- Section 3 describes the general approach and methodology for establishing the baseline and project scenarios
- Section 4 provides the costs associated with the proposed project
- Section 5 provides the benefits determined for the proposed project and details the methodology utilized for benefit calculations
- Section 6 provides a final summary of the analyses
- Section 7 details results from a sensitivity analysis

Additional information is provided within the attached BCA spreadsheets, including all inputs and calculations used to determine all quantified costs and benefits.

2. BCA Spreadsheet Information

Each pathway alternative, detailed below, was evaluated independently and thus, calculations for each are included in separate spreadsheets. The BCA spreadsheets accompanying this report are each divided into several tabs which present the methodologies, inputs, and data sources used to calculate the costs and benefits. Table 1 provides a breakdown of each tab in the spreadsheet. A separate attached spreadsheet details the calculations and assumptions regarding the determinations for pedestrian and cyclist trip data (detailed below).

Table 1. Benefit-Cost Analysis Spreadsheet Information.

Tab Name	Costs/Benefits Included	Overview
Total Summary	All Costs/Benefits	All categories, in 2023 $ and discounted rates. Total NPV and BCR values also included
Capital Expenditures	Project Costs	Detailed breakdown for capital expenditures by type and year

Commented [JM1]: BCA directs Cost/Benefits to be discounted to 2023 $ for standardization - will update if/when required

Construction Disbenefits – Travel Time	Impacts of construction of pathways on vehicular traffic	Calculations for reduction in travel time due to proposed project
Health Benefits	Mortality Reduction Benefits	Calculations for mortality reduction benefits for pedestrians and cyclists using the proposed pathways
Facility Improvements	Facility Improvement Benefits	Calculations for pedestrian and cyclist benefits from facility improvements within the proposed project
Safety – Avoided Trips	Avoided vehicular crash risk along pathway route	Calculations for risk reduction of vehicular crashes reduced by proposed project
Operating Cost – Avoided Trips	Avoided vehicle operating costs of travel along pathway route	Calculations for reduction of vehicular operating costs reduced by proposed project
Emissions Benefits – Avoided Trips	Avoided vehicle emissions costs of travel along pathway route	Calculations for reduction of emissions reduced by proposed project

3. Approach and Methodology

The approach used for assessing costs and benefits of the proposed project followed guidelines detailed in the 2024 USDOT BCA Guidance for Discretionary Grant Programs[5]. Following this guidance, a baseline (i.e., no-build) scenario was established to be compared to the improvements and cost of the proposed project. The net benefits between the scenarios were compared to evaluate the proposed project's expected impact.

3.1. Evaluated Scenarios

3.1.1. Baseline (No-Build) Scenario

Within both towns of Wabeno and Carter there currently is some level of infrastructure usable for pedestrians specifically, but also to some degree cyclists (Figure 1). Wabeno has existing sidewalks on both sides of SH32, which runs through the middle of town. The sidewalk on the south side of the highway spans much of the length of town; however, it is relatively narrow (5 ft) and lies just off of the curb. This immediate adjacency to the highway and narrow width makes this sidewalk unsuitable for cyclists and carries a heightened risk for pedestrians. The northern sidewalk, much of which was reconstructed in the past 2 years, spans a smaller region primarily along the center and west sides of Wabeno.

The Nicolet State Trail, a 12-ft-wide, gravel trail primarily used for ATV travel, runs generally parallel to SH32 about a block north of the highway and spans the full length of the town of Wabeno. This trail continues to the south connecting with and continuing past the town of Carter. The current trail, while providing the only current pathway between the two towns, deviates quite a ways from parallel to the highway and does not directly connect with much of the infrastructure of Carter. Also, while the trail is relatively well maintained, the gravel

surfacing is generally not preferred by pedestrians or cyclists and comes with the safety risk of shared use with ATVs.

Within the town of Carter itself, there is a recently constructed sidewalk that provides access between many of the housing additions to the primary town and tribal infrastructure, including tribal buildings and Powwow grounds, the FCPC Casino and hotel, and the local convenience store. There is no direct connection between this path and any pathways within the town of Wabeno, forcing any user who travels the full distance to traverse either the ATV trail or along the highway itself.

Baseline information on existing users and safety risks for the current infrastructure was determined to allow for quantification of benefits stemming from the proposed project. Details on the collection of this data and any underlying assumptions are provided in the relevant sections below.



Figure 1. General project location map including the towns of Wabeno and Carter, Forest County, Wisconsin.

3.1.2. Proposed Project (Build) Scenarios – 3 Pathway Alternatives

Three alternative pathways were proposed for the Carter to Wabeno shared-use pathway project (Figure 2), each representing viable alternatives based on existing infrastructure. For each alternative, the typical section consists of a 10-ft, asphalt pathway with 2 feet of grass, 6:1 shoulders and 3:1 side slopes beyond that. Within this section we discuss the specifics of each alternative and their strengths and weaknesses relative to this benefit-cost analysis.

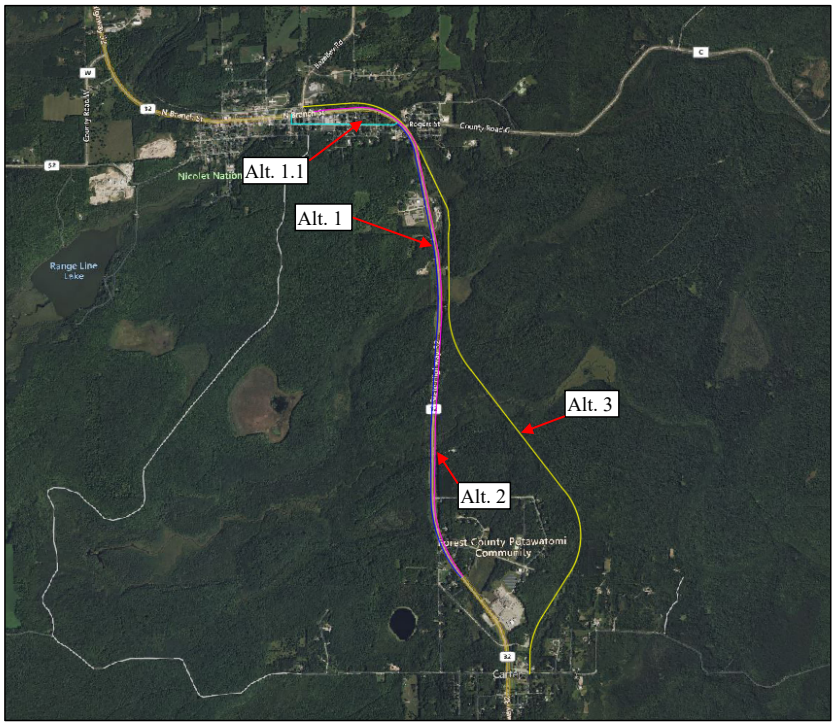


Figure 2. Proposed pathway alternatives for the Carter-Wabeno shared-use pathway project.

Alternative 1 generally spans the south and west sides of SH32 connecting the existing sidewalk on the far east side of Wabeno to the pathway just north of the casino in Carter. Additionally, the proposed pathway runs approximately ¾ mile west along River Street, from its intersection with SH32, up to and north along Crandon Ave to the highway (alternative 1.1). The proposed plans also call for a marked crosswalk at this point to provide a safer crossing of SH32. For the purpose of this analysis, alternatives 1 and 1.1 are analyzed as a single alternative (i.e., alternative 1).

Alternative 2 follows the north and east side of SH32 from Wabeno to Carter. This alternative begins further west within Wabeno than alternative 1, again connecting to existing sidewalks. This alternative would also provide marked crosswalks across SH32 in Wabeno at Crandon Ave. and the eastern end of River Street. Alternative 2 ends at a point directly opposite

of alternative 1 north of the casino in Carter, both tying into the existing pathway there. This proposed pathway does not include the improvements along River Street as for alternative 1. Each of these alternatives, however, would be placed at varying distances offset from the shoulder of the highway, providing a safe pathway for users.

The final proposed pathway alternative, 3, follows the existing alignment of the Nicolet State Trail. Improvements are proposed to begin at the intersection with County Highway H in Wabeno and end at Ferry Ranch Road in Carter. The typical section for alternative 3 runs parallel to the existing ATV trail, offset 5 feet from the edge of trail to the grass shoulder of the asphalt pathway. While this alternative provides relatively good access to the north side of Wabeno, it does not have many direct connections with the primary infrastructure and housing within Carter.

3.2. Determinations of Potential Pathway Users/Trips

The primary task to the development of this BCA and quantifying benefits was first determining the user base of each alternative pathway, eventually deriving a total number of potential trips made annually. Below is a summary of the process for determining the user/trip data for each project alternative which formed the basis for quantification of project benefits. The process involved a hierarchy of assumptions and determinations based on a starting point of the full population of each town—Wabeno and Carter—at each end of the pathways which will serve as the base for all potential users. A separate spreadsheet is included which details the calculations and assumptions to determine user data.

3.2.1. Total Potential Trips (includes all types, purpose, new and existing users)

The starting point in determining the total potential annual trips for the Carter to Wabeno pathway project was accessing population data for each town. U.S. Census and similar source data on these areas was inconsistent due to their relatively small size and ambiguous boundaries; however, the 2021 FCPC Bike-Pedestrian Plan[1] listed the population of Wabeno at 1,235 and Carter at 276. Annual growth factors for both the town of Wabeno and Forest County at large were quite mixed as well, showing both increasing and decreasing trends depending on the time period, neither of which showed a high nominal percentage either way. Based on these factors we did not apply any population growth factor for our analysis.

An additional source of potential users of the pathway are guests of the Potawatomi Casino and Hotel in Carter. Discussions with FCPC staff showed that hotel/casino guests frequently use the nearby Nicolet State Trail for recreation and would likely utilize any of the proposed pathway alternatives, specifically alternatives 1 and 2 which would directly adjoin to the casino parking lot. However, we were unable to directly quantify this population and thus they are not included in our calculations.

USDOT BCA guidance restricts quantification of some benefits, chiefly mortality reduction and facility improvement, to the 20-74 age group and further delineates some benefits between those 20-64 and 65-74. Thus, we chose to divide the total population of these towns based on age classification and limit total potential users of the proposed pathways to this population group. Again, the FCPC Bike-Pedestrian Plan provided demographic breakdown by age class within the FCPC, of which many of the residents of Wabeno and Carter comprise. The 20-64 age group made up 52% of the population, while the 65-74 age group was only 4% of the total population. This provided us with our total potential population for analysis.

From here, we determined an overall percentage use of the proposed pathways by the population, relying on data from the 2022 FCPC Pathway to Wellness Survey[3]. They reported for a similar project within the FCPC that only 50% of the population would be likely to utilize the pathways at all. Of those who used the pathways, 50% would use the pathways once per week, 25% 1-2 times per week, and 25% 3-6 times per week. We rounded these slightly for ease of calculation and to be a bit more conservative: 50% 1 trip per week, 25% 2 trips per week, and 25% 3 trips per week.

3.2.2. Seasonality Discount

Following the determination of total potential trips per week, we sought to estimate how these trips would fluctuate based on the weather and general conditions throughout the year. This region of Wisconsin has notable differences in seasons and a definitive "snow" season which would dramatically reduce use of any of the proposed pathways. Following the general notion and methodology of the FCPC Crandon Pathway BCA[2], we discounted total trips on a monthly basis based on general weather patterns for the region (Table 2). This discount was further done independently based on each age group (i.e., 20-64, 65-74). After this discount was applied, we annualized the total number of potential trips emanating from each town.

Table 2. Seasonality discount for total potential pathway use by month.

Pathway Use by Month (% of total)				
Month	**20-64 yo**	**65-74 yo**	**Wabeno (total)**	**Carter (total)**
Jan	50%	0%	1188	268
Feb	50%	0%	1188	268
Mar	60%	50%	1512	348
Apr	100%	85%	2520	580
May	100%	100%	2544	588
Jun	100%	100%	2544	588
Jul	100%	100%	2544	588
Aug	100%	100%	2544	588
Sep	85%	85%	2164	500
Oct	85%	60%	2120	488
Nov	85%	50%	2104	484
Dec	50%	0%	1188	268
Total Annual Trips			**24160**	**5556**

3.2.3. Travel Type and Trip Purpose

When quantifying benefits, cycling and pedestrian trips are evaluated differently based on the BCA guidance, and thus the total number of trips needed to be split by travel type. Survey responses for the FCPC Pathway to Wellness documented that 21% of potential trips would be cycling over pedestrian. Based on this figure, we divided the total annual trips determined previously based on mode of transportation, either cycling or pedestrian, with a few additional caveats. Cycling trips were assumed to only occur within the 20-64 age group, leaving trips within the 65-74 age group exclusively pedestrian. Additionally, cycling trips were only considered within the non-snow season (Apr-Nov). These trips were still assumed to occur outside of this time period, however, they were converted back to pedestrian trips during the

winter months. It should be noted these distinctions for travel type did not affect the total number of trips, only apportioned them into categories of cycling or pedestrian travel.

Similar to the division of total trips by travel type, we further classified total trips based on their potential purpose. For this we established three primary trip purposes, recreational, work, and personal (non-work, non-recreational). Recreational trips were those without a specific destination in mind and meant primarily for exercise or leisure. Based on survey[3] and traffic count data there was little to no cycling activity in either Carter or Wabeno, and thus all potential cycling trips induced by the proposed pathways was considered to be recreational in nature. Work and personal trips were those with a specific destination in mind but split based on whether that destination was solely for work or a separate non-work, non-recreational target (e.g., groceries, appointments, family/friend visit). We divided total pedestrian trips based on general percentages garnered from FCPC survey data[3]: 65% recreational, 10% work, and 25% personal.

3.2.4. Existing Users

The quantification of benefits based on USDOT BCA guidance for non-vehicular facility users is divided into those for existing users and those for new users. Thus, we had to determine the amount and frequency of existing pedestrian and cyclists along existing infrastructure within and between Wabeno and Carter. For this we utilized traffic count data collected by KL Engineering in November 2024.

Traffic counts were collected independently at multiple locations in both Carter and Wabeno along the existing Nicolet State ATV trail and SH32. Count type and duration differed between the two general locations and thus had to be treated somewhat differently to standardize counts for existing users. Traffic surveys on SH32 were collected in 12-hour durations, which we assumed corresponded to a full day of potential pedestrian/cyclist trips, thus, we used the raw count as the daily total. Conversely, traffic counts along the trails were for shorter, and varying, durations. For these counts we calculated trips/hour based on the raw data available. Then, based on an assumed 7-hour total for peak travel during the day based on active hours and similar to those surveyed (i.e., 7-9 am, 11am-1pm, 3-6pm), we multiplied the trips per hour by 7 to derive a total pedestrian trips/day. No cyclists were reported during these traffic counts, which further follows the FCPC Wellness Survey (citation) for existing cyclists. Thus, existing cyclists were assumed to be zero.

Based on this daily trip information, we annualized existing user trips by applying the same seasonal discounts for each month (detailed above) to derive a total existing annual pedestrian trip for each town. Since the surveys were completed in mid-November and our assumed discount for this month was 85%, we assumed that raw traffic counts were 85% of the total monthly traffic and adjusted monthly values accordingly. Based on these assumptions, we calculated existing annual pedestrian trips to be 763 for Wabeno and 89 for Carter.

Existing pedestrian trips were further subdivided by trip purpose, following the previously described percentages for recreation (65%), work (10%), and personal (10%). This was only completed for Wabeno, given that pedestrians were counted along both the highway and trail. In Carter, however, pedestrians were only counted along the Nicolet State Trail, and given its routing does not directly connect to any other features, all existing pedestrians in Carter were allotted to recreational use.

3.2.5. Utility of each alternative pathway by location/purpose

Each alternative pathway was evaluated for its potential use by users in both Carter and Wabeno, delineating use based on the purpose of their trip. We specifically looked at each pathway's connectivity to houses/subdivisions, potential workplaces, stores, schools, and the general distance for users to access each pathway. From this, we discounted each alternative pathway a set percentage of total users by trip purpose for each town (Table 3).

Table 3. Utility discount for each potential pathway by trip purpose.

Utility of each alternative path by location/use type			
	Alt. 1	Alt. 2	Alt. 3
Wabeno			
Recreation	100%	100%	100%
Work	100%	100%	75%
Personal	100%	100%	25%
Carter			
Recreation	60%	60%	75%
Work	60%	60%	0%
Personal	60%	60%	0%

Alternative 3, which follows the existing Nicolet State ATV trail, received the heaviest discounts of all pathway alternatives due to its physical separation from other existing features, specifically many of the housing units and businesses/schools. Access limitations in the town of Carter and the general distance of the trail to any specific destination resulted in even higher discounts in this town compared to Wabeno, which had similar issues, however not as severe.

Alternatives 1 and 2 allowed for good connectivity to nearly all features within Wabeno, providing access to multiple housing units, schools, and places of business. While there were differences in each alternative and the specific features each directly accessed, it was difficult to establish any significant difference in either pathway. Alternatives 1 and 2 were both discounted in the town of Carter specifically because their beginning point was generally past all existing features in the town, and much of the southern portion of the town would not be able to access it directly.

Following these discounts per alternative pathway, we derived a final dataset of potential annual user trips for both pedestrians and cyclists, broken down into existing and new trips (Table 4). This is the dataset that we could then derive the primary quantitative benefits from based on the USDOT BCA guidance (discussed below).

Table 4. Total potential trips for each alternative pathway, split by trip type and town.

Total Trips per Alternative				
Alternative	Town	Pedestrian	Cycling	Total Trips
1	Wabeno	20401	3759	24160
	Carter	2822	512	3334
2	Wabeno	20401	3759	24160

	Carter	2822	512	3334
3	Wabeno	16067	3759	19826
	Carter	2293	640	2933

3.2.6. Avoided Trips

Another subset of those utilizing the proposed pathways includes people who are switching from vehicular modes of transportation. In other words, how many of the new non-vehicular trips generated from each alternative pathway would be in place of a previous vehicular trip. These "avoided" trips, would be calculated by subtracting the number of existing trips from the total projected trips for each pathway, however, limited to just those for work or personal trip purposes. Recreational trips were assumed to always be non-vehicular in nature. These trips would potentially derive benefits from an increase in safety relative to the average risk of driving this route and decreases in vehicle operating costs and emissions. Annual avoided trips ranged between alternatives and users for each town (Table 5).

Table 5. Total potential trips for each alternative pathway, split by trip type and town.

Avoided Trips per Alternative			
Alternative	Town	Pedestrian	Cycling
1	Wabeno	6873	0
	Carter	988	0
2	Wabeno	6873	0
	Carter	988	0
3	Wabeno	2539	0
	Carter	0	0

3.2. Analysis Period

Commented [JM2]: Will update project timing and cost as needed if/when grant nofo requiring BCA are released

Our analysis period followed general recommendations within the 2024 USDOT BCA Guidance, beginning in 2024 when pre-construction activities, specifically the preliminary design of each pathway alternative, began. Additional pre-construction activities, including full project design, environmental review and clearance, permitting, and right-of-way acquisition were assumed to be completed in 2025 for all alternatives. Construction activities for all potential pathways were assumed to commence in 2026. Alternatives 1 and 2 would be projected to be completed in one construction season (prior to winter 2026), while alternative 3 would require two construction seasons and not be complete until the end of 2027.

Project benefits would not be recorded until construction for each alternative was completed; 2027 for alternatives 1 and 2, and 2028 for alternative 3. The benefit analysis period was set to coincide with the 20 years following the completion of pathway construction, based on USDOT averages for asphalt, shared-use pathways[4]. It is anticipated, however, that the benefits which accrue from the project, regardless of alternative, would continue to be seen long after this initial 20-year analysis period.

3.3. Inflation and Discounting Adjustments

The BCA analysis presented here incorporates the USDOT's guidelines for discounting adjustments in the calculations of the benefits and costs. All benefits and costs are estimated in 2023 dollars with future dollars discounted in compliance with the 2024 USDOT BCA Guidance[5], using a 3.1% real discount rate. Emissions reduction benefits followed a 2.0% real discount rate. Inflation adjustments were not needed as no work occurred prior to the 2023 baseline year for monetization.

4. Costs

4.1. Capital Expenditures

The capital expenditures are the primary costs associated with the proposed project. Capital expenditures related to the proposed project are connected to the construction of the individual elements, project design, environmental review and permitting, and the acquisition of right-of-way related to project construction. As detailed previously, capital expenditures were anticipated to last from project initiation in 2024 and continue until the end of all construction activities.

Pre-construction capital expenditures included general engineering/design by a contractor and potential oversight by the Wisconsin Department of Transportation (WisDOT) as well as all required right-of-way acquisition and environmental permitting. These costs are estimated to range from a little over $300k to over $500k based on the alternative, and average approximately 10% of total project costs. Direct construction and associated construction management costs comprise the majority of project costs and range from $2.6 million for alternatives 1 and 2 to around $5 million for alternative 3. A 20% cost contingency was added to estimated construction costs due to uncertainties in future costs of materials. Construction management costs were estimated based on 7% of total construction costs. Table 6 provides a detailed breakdown of capital expenditures by type and year of disbursement for each proposed alternative pathway.

Table 6. Capital expenditures by type and year, presented in 2023 $.

Commented [JM3]: 2023 $ required by the 2024 BCA guidelines - update as needed when submitting possible grant application required BCA

Capital Expenditures (by year)						
Alternative	**Year**	**Design**	**ROW**	**Construction**	**Construction Mgmt.**	**Total**
1	2024	$123,975.00	-	-	-	$123,975.00
	2025	$143,975.00	$100,000.00	-	-	$243,975.00
	2026	-	-	$2,479,503.60	$173,565.25	$2,653,068.85
	Total	$267,950.00	$100,000.00	$2,479,503.60	$173,565.25	**$3,021,018.85**
2	2024	$122,706.00	-	-	-	$122,706.00
	2025	$142,706.00	$0.00	-	-	$142,706.00
	2026			$2,454,121.20	$171,788.48	$2,625,909.68
	Total	$265,412.00	$0.00	$2,454,121.20	$171,788.48	**$2,891,321.68**
3	2024	$241,817.00	-	-	-	$241,817.00
	2025	$261,817.00	$0.00	-	-	$261,817.00
	2026	-	-	$2,418,171.60	$169,272.01	$2,587,443.61

	2027	-	-	$2,418,171.60	$169,272.01	$2,587,443.61
	Total	$503,634.00	$0.00	$4,836,343.20	$338,544.02	**$5,678,521.22**

4.2. Operations and Maintenance

The operations and maintenance costs were estimated based on the required maintenance of all major pathway components of each project alternative, including the surfacing and base of the pathways as well as maintenance of the vegetation surrounding the pathways. Following the completion of construction activities for each alternative there would be an estimated annual operations and maintenance cost (2023$) of $8,000.00 for 20 years. After the 20 years, more significant maintenance activities such as a full asphalt overlay would be expected, thus again reinforcing our analysis time period. Total operations and maintenance costs for the full analysis period, discounted 3.1% annually, would be **$104,370.54** for all pathway alternatives.

5. Benefits

Benefits documented within this BCA follow the general categories presented in the 2024 USDOT BCA Guidance for Discretionary Grant Programs[5], which is the source of the majority of the multipliers and calculations employed herein.

The principal benefits, and primary purpose, for the proposed project stem from the projected increase in pedestrian and cyclist traffic within and between the towns of Carter and Wabeno, Wisconsin. These benefits result from the addition of the new, shared-use facility which will provide direct benefits to new and existing users as well as indirect health benefits. These benefits will accrue for both new and existing pedestrians/cyclists. There will be an additional safety benefit to existing pedestrian/cyclists who will now have a dedicated facility separated from the roadway.

Additional benefits were quantified based on the total vehicular trips avoided by new pedestrian/cyclist users of each pathway who would previously have used vehicular means of travel. These include a safety benefit based on the vehicular crash risk and operating/emissions cost savings. Details on the methodology, assumptions, and calculations for each benefit type are included in subsections below. An overview of the benefits derived from this project is included in Table 7 below.

Table 7. Associated Project Benefit Summary

USDOT Benefit Category	Project Area Addressed	Type of Impact	Affected Population	Summary of Annual Benefits (2023$)
Construction Disbenefits	Impacts of construction of pathways on vehicular traffic	Travel time reductions due to slower speed in construction zones	Existing vehicular traffic	- Alt. 1: -$113,244 - Alt. 2: -$113,244 - Alt. 3: $0
Mortality Reduction (Health)	Providing a safer, paved shared-use facility for	Improves residents' health per induced trip	New pedestrians/ cyclists	- Alt. 1: $214,734 - Alt. 2: $214,734 - Alt. 3: $176,570

	community members to recreate			
Facility Improvements	Providing pedestrian/cycling facilities connecting residential areas each side of the BNSF railway	Benefit of new facilities	New and existing pedestrians/ cyclists	- Alt. 1: $18,648 - Alt. 2: $18,648 - Alt. 3: $16,565
Safety	Risk to existing pedestrians/cyclists utilizing unsafe facilities	Improves safety for pedestrians/ cyclists	Existing pedestrians/ cyclists	NOT QUANTIFIED
	Vehicular crash risk along pathway route	Reduces risk for those choosing non-vehicular alternatives	New, non-recreational pedestrians/ cyclists	- Alt. 1: $2,173 - Alt. 2: $2,173 - Alt. 3: $703
Operating Cost Savings	Vehicle operating costs of travel along pathway route	Reduction in operating costs for those choosing non-vehicular alternatives	New, non-recreational pedestrians/ cyclists	- Alt. 1: $3,785 - Alt. 2: $3,785 - Alt. 3: $1,222
Emissions Benefits	Vehicle emissions costs of travel along pathway route	Reduction in emissions for those choosing non-vehicular alternatives	New, non-recreational pedestrians/ cyclists	- Alt. 1: $7-900 - Alt. 2: $7-900 - Alt. 3: $2-300

5.1. Mortality Reduction (Health) Benefits

The USDOT, in their 2024 BCA guidance document[5] states: "The use of active transportation modes (e.g., walking and cycling) can also lead to improved cardiovascular health and other positive outcomes for users. A key health outcome from increased physical activity is a reduction in mortality risks for those users that are induced to active transportation modes from inactive modes." Thus, for this analysis, "induced" trips were limited to only new trips (previously discussed) that were determined for each alternative pathway. USDOT recommends a value of $8.06 for all induced pedestrian trips and $7.18 per cycling trip. They further limit benefits for each to specific age groups, 20-74 for pedestrian trips and 20-64 for cyclists, which corresponds to how we established potential trips. Annual benefits (2023$) ranged from $214,734.52 for alternatives 1 and 2 to $176,570.42 for alternative 3. Total discounted benefits across the full 20-year analysis period were $2,888,340.92 and $2,303,593.65, respectively.

5.2. Facility Improvement Benefits

The quantification of facility improvement benefits stems from revealed preference studies showing a monetary benefit to improving certain aspects of pedestrian and cycling facilities. The primary aspect of the proposed alternative pathways of benefit to users is the addition of new sections of pathway that currently do not exist. While other aspects such as reductions in slope

and establishing marked crosswalks are occurring with the proposed project, they were not quantified due to limitations in assumptions or volume of traffic along the existing roadway.

Benefits to pedestrians were calculated using the USDOT recommended value of $0.11 per person-mile walked for each foot of added width of the new pedestrian facility. Although each pathway is close to 4 miles in total length, we were not able to directly establish an average length of trip per pedestrian user. Therefore, we followed the USDOT recommended average trip length for pedestrians of 0.86 miles, multiplying this value by the total number of pedestrian trips to gain a total length. Each of the pathway alternatives proposed a 10-ft-wide asphalt pathway, and given this was all new facility, this number was used as the width multiplier for pedestrian benefits.

Cyclists derived benefits from new facilities based on the value per cycling mile, without regard to a specific width, but based on the type of facility. We used the USDOT recommended value of $1.70 for cycling path with at-grade crossings facility type. The majority of the length of each pathway alternative is actually devoid of any crossings, regardless of grade, with only 1-2 actual at-grade crossings. However, we chose the more conservative value due to lack of data and assumption that most users would not travel the full length of any given pathway. Similar to the pedestrian trip data, we generally used the USDOT recommended trip length for cyclists, though slightly more conservative, of 2.0 miles/trip.

Benefits for both pedestrians and cyclists accrue independently based on whether the trips are for existing users or new users. Existing users follow the basic formulae detailed above: *Existing Pedestrian benefits = Existing Pedestrian trips * 0.86 miles/trip * 10-ft width * $0.11/ft-width*; *Existing Cyclist Benefits = Existing Cyclists trips * 2.38 miles/trip * $1.70*. For additional (new) users of each proposed facility, USDOT recommends applying the rule of half. This rule provides a simplifying assumption that when evaluating the benefits of a project, roughly half of the potential new users (induced demand) will actually utilize the project, resulting in only half of the potential benefit being realized in calculations, and providing a more conservative estimate of benefits. Thus, to calculate new user benefits for both pedestrians and cyclists we applied the same general formulae as above, but restricting user data to new users then dividing the total benefit in half.

Annual facility improvement benefits (2023$) for pedestrians and cyclists combined, ranged from $18,648.18 for alternatives 1 and 2 to $16,565.58 for alternative 3. Total discounted benefits across the full 20-year analysis period were $250,831.99 and $216,119.75, respectively.

5.3. Safety Benefits

Monetization of safety benefits followed the general formula of ***Safety benefits = Baseline Risk * Expected Consequences * Risk Reduction***. Baseline risks, as detailed below, existed for two independent groups, current pedestrians utilizing existing facilities and those potential pathway users who currently use vehicular travel for personal and/or work trips. The first group, existing users, assume a risk of using existing infrastructure that varies in levels of security from adjacent vehicular traffic. The second group, based on avoided trips (detailed above), currently accepts the baseline risk of vehicular traffic through the proposed pathway corridor. Each of these groups were evaluated separately and details for each are included in the following sections.

5.3.1. Existing Users

The first group for which an existing safety risk exists are current pedestrians and cyclists along the proposed alternative pathways. This group regularly traverses this region, which contains a mix of existing infrastructure with varying suitability and safety levels. Some areas have existing sidewalks; however, most exist directly adjacent to the roadway curb without any separation from traffic lanes. For most of the proposed pathway route between Wabeno and Carter the only option for non-vehicular traffic is directly along the shoulder of the roadway, which has an extremely heightened safety risk. The only other alternative is to traverse the existing ATV, which, while providing a generally safer option, does not directly intersect with many potential destinations and carries its own risk due to ATV traffic.

Each of the proposed pathway alternatives would likely provide a net safety benefit to existing pedestrians and cyclists due to the physical separation of travel from vehicular traffic. However, establishing a baseline risk was not possible due to the lack of data on pedestrian and cyclist crash encounters with vehicles in the region. Additionally, there was little data on the location of existing user travel within the project corridor. Therefore, although there would be a safety benefit from the proposed project for this group, it was not able to be directly quantified.

5.3.2. Avoided Trips

The baseline safety risk for the avoided trips user group was based on the average vehicular crash risk along the 4 miles from Wabeno to Carter, specifically along SH32. To determine this risk, we reviewed 10 years (2015-2024) of crash data from the Community Maps online portal[8]. We used a 10-year analysis period to determine an average annual crash risk due to the low population and AADT of the project area and to help reduce the bias of any single year's data. To asses the risk per individual avoided trip for potential pathway users, we further had to establish the annual vehicular crash risk per driver-mile. Thus, we divided the average crash risk per year by the mileage of the route (4 miles) and the annualized traffic (AADT*365). Table 8 details these calculated risk values.

Table 8. Associated Project Benefit Summary

Baseline Vehicular Crash Risk – SH32 Wabeno to Carter				
Crash Type	2015-2024	Crash/yr	Crash/yr/mile	Crash/yr/ driver-mile
Property Damage Only (O)	42	4.2	1.05	7.77E-07
Possible Injury (C)	4	0.4	0.10	7.40E-08
Non-Incapacitating Injury (B)	4	0.4	0.10	7.40E-08
Incapacitating Injury (A)	2	0.2	0.05	3.70E-08
Fatality (K)	1	0.1	0.03	1.85E-08

Expected consequences stem from the cost associated with each type of crash. USDOT BCA guidance[5] provides these estimates for each crash level based on the KABCO crash ratings. When applying these recommended values to each crash type based on the risk per year/driver/mile the result is a monetized risk value of $0.32 per mile traveled in a vehicle within this corridor.

The total amount of estimated avoided trips (Table 5) for each pathway alternative was multiplied by the USDOT recommended value of 0.86 miles/trip for pedestrian trips. Again, the assumption for avoided trips was these stemmed from new personal and work pedestrian trips along each proposed pathway that previously would have been vehicular travel. The total mileage avoided by each alternative was multiplied by the calculated risk per mile to derive an annual safety benefit of $2,173.01 for alternatives 1 and 2 and $702.99 for alternative 3.

5.4. Operating Cost Savings

Savings from reductions in vehicle operating costs were quantified for each proposed pathway alternative based on the new pathway users that are assumed to choose active transportation over vehicular modes following construction (i.e., avoided trips). Operating cost savings were derived similarly to those detailed above for safety benefits of avoided trips. Avoided trips stemming from each community were multiplied by the average trip length of 0.86 miles to determine a total avoided miles per year. We then multiplied this by the USDOT recommended value per mile of $0.56 for light duty vehicles to derive an annual operating cost savings per alternative.

Alternatives 1 and 2 each had the same number of estimated avoided trips and so had equal annual savings for operating costs of $3,785.86. Alternative 3 had a relatively lower estimate of avoided trips and so annual operating cost savings for this proposed alternative were only $1,222.78. Over the course of the 20-year analysis period, total discounted operating cost savings were $50,922.63 for alternatives 1 and 2 and $15,952.81 for alternative 3.

5.5. Emissions Reductions Benefits

Following the general assumptions for avoided trips detailed for the benefits above, we also quantified the reduction in emissions due to the proposed project. We, again, determined the total vehicular miles avoided from people switching modes of transportation to the pathways for each alternative. However, to convert these values into metric tons of emissions we had determined the amount of fuel used per mile and amount of pollutant emitted per gallon of gasoline.

We used the national average of 28 miles per gallon of gasoline[6] and determined values for 2 major pollutants—nitrous oxides (NO_x) and carbon dioxide (CO^2)—based on their emissions per gallon of gasoline[7]. USDOT BCA guidance[5] provided a schedule by year for monetizing emissions per metric ton. Unlike for other quantified costs and benefits, USDOT recommended annual discounting of emissions at a rate of 2%. In total, discounted emissions savings were $12,543.37 for alternatives 1 and 2 and $4,020.59 for alternative 3.

5.6. Construction Disbenefits

In addition to the benefits detailed above, there are disbenefits (non-capital costs) associated with the construction of the proposed pathway alternatives. This disbenefit primarily is the result of reduced vehicular travel time of those vehicles traveling through the construction work zone for each pathway. Alternatives 1 and 2 are both proposed to run parallel of SH32 from Wabeno to Carter, and although they are offset a safe distance for anticipated users, there will likely be work zones established along the highway for construction vehicles and personnel safety. Alternative 3, conversely, lies almost exclusively outside of the influence of any vehicular traffic—outside of ATV traffic—and as such its construction would not likely have a determinable effect on vehicular travel time.

To determine the negative effects of project construction on vehicular travel time along SH32 we assessed existing traffic patterns including average daily travel, speed limits, and total travel distance. The average daily traffic for the 4 miles from River Street in Wabeno to Ferry Ranch Lane in Carter was 3,700 vehicles per day. The posted speed limits along this route had 0.5 miles each of 25 mph and 35 mph as well as 3 miles of 55 mph. Based on this, we determined an average speed along this span to be 48.75 mph and an average travel time of 0.8 hr. To simulate potential construction activities, we reduced the posted speed limits 10 mph for the lower speeds through Wabeno and 15 mph along the main stretch of highway to Carter. This reduced the average speed to 35 mph and increased the average travel time to 0.11 hr.

We applied this 0.3 hr/vehicle/day increase to the daily total traffic across an estimated construction season of 180 days. The USDOT monetized value for travel time savings of $21.10 per vehicle-hour for general vehicular travel was applied to this total increase in travel time during construction. Lastly, we discounted this total by 25% under the assumption that construction zone impacts would not occur across the entire 4 miles for the duration of construction but rather impact 1 mile (of the 4) at a time. Thus, construction disbenefits for both alternatives 1 and 2 equaled $113,244.40 (2023 $), which when discounted based on their occurrence in 2026 totaled $103,333.40.

6. Benefit-Cost Analysis Summary

The Forest County Potawatomi Community's proposed Carter to Wabeno shared-use pathway project provides an improvement to existing pedestrian and cyclist infrastructure which will lead to increased health and safety outcomes for local residents. As detailed previously, facility improvements and mortality reduction benefits were the primary monetary benefits quantified for the proposed pathway alternatives. An independent benefit-cost ratio and net-present-value was calculated for each proposed alternative pathway, and differences between them represent the variations is potential utility of each alternative and the estimated cost for each.

Overall, benefits emanating from each of the proposed pathway alternatives were relatively similar and each did derive a fair amount of benefit to the community. Alternative 3 held the lowest monetary benefit, mostly due to its more isolated location and lack of connections with existing destinations. This alternative was also the costliest, and thus only had a benefit-cost ratio of 0.49 with a net present value that exceeded total monetized benefits. Alternatives 1 and 2 derived the same amount of total benefits based on their similar positioning and accessibility to users in both Wabeno and Carter. Differences between these two alternatives lay solely in the estimated costs of each. Thus alternative 2, with its lower total cost, held the highest benefit-cost ratio, although both alternatives 1 and 2 held ratios over 1, indicating benefits outweighing costs for each of these alternatives. A summary of costs and benefits by category is included in Table 9 below.

Table 9. Summary of Total Benefits and Costs of the Proposed Project.

Total Discounted Value (2024-2053)			
Category	**Alternative 1**	**Alternative 2**	**Alternative 3**
Capital Expenditures	$2,770,647.16	$2,649,363.42	$5,131,853.24
Operating and Maintenance Costs	$107,606.02	$107,606.02	$104,370.54

Total Costs	***$2,878,253.19***	***$2,756,969.44***	***$5,236,223.78***
Construction Disbenefits	-$103,33.40	-$103,33.40	$0.00
Health Benefits	$2,888,340.92	$2,888,340.92	$2,303,593.65
Facility Improvements	$250,831.99	$250,831.99	$216,119.75
Safety - Avoided Trips	$29,228.64	$29,228.64	$9,171.37
Operating Cost Savings – Avoided Trips	$50,922.63	$50,922.63	$15,952.81
Emissions Reductions – Avoided Trips	$12,541.19	$12,541.19	$4,020.59
Total Benefits	***$3,128,534.15***	***$3,128,531.98***	***$2,548,858.16***
Net Present Value	**$250,280.97**	**$371,562.53**	**-$2,687,365.61**
Benefit-Cost Ratio	**1.09**	**1.13**	**0.49**

7. Sensitivity Analysis

The results of the benefit-cost analysis presented above are based on a wide set of assumptions that, while rooted in localized data from the community and USDOT BCA guidance[5], may not represent the full potential of the proposed project. Multiple assumptions and baseline data are flexible to interpretation and could be replaced with different data points. Within this section, we present the results of a sensitivity analysis which presents alternate results for the benefit-cost analysis based on shifting central assumptions. The primary assumptions reviewed include the use of the USDOT recommended 'rule of half', inclusion of avoided trips, and the percentage of the population that would use the pathways.

7.1. 'Rule of Half' for Facility Improvement Benefits

The first analysis reviewed removing the use of the 'rule of half', which was briefly presented in USDOT BCA guidance under their calculations for facility improvement benefits of new users. There was no real discussion of the use of this rule within the guidance document and it was not directly mandated as such. We used this rule to provide more conservative estimates for our analysis; however, we do feel that the reductions we have already made to the potential population of users of the proposed pathway alternatives are still relatively conservative.

We re-evaluated the facility improvements benefit for each pathway alternative, removing the 'rule of half' reduction for total benefits. In so doing, the total discounted benefits across the 20-year analysis period for both alternatives 1 and 2 increased to $490,822.78. With just this update, the benefit-cost ratio increased for each alternative to 1.17 and 1.22, respectively. Similar changes to benefits for alternative 3 increased total discounted facility improvement benefits to $421,724.28 and the overall benefit-cost ratio to 0.53.

7.2. Removal of Avoided Trips Benefits

We made the assumption that there was a portion of new pathway users that would be undergoing a modal shift from vehicular travel, specifically those using the pathways for work and personal travel. This modal shift led to benefits accruing based on the reduction of vehicular travel for multiple categories including safety benefits, operating cost savings, and emissions

reductions. While the underlying assumption is valid, it may not be practical to include as a quantifiable benefit.

Thus, we calculated benefit-cost ratios for each pathway alternative, removing all benefits stemming from these avoided trips. This reduction had very little impact on the results for alternative 3, which had very few avoided trips, resulting in an identical benefit-cost ratio of 0.49 and a slightly increased net-present value. Alternatives 1 and 2 both saw notable reductions in benefit-cost ratios with the loss of avoided trip benefits. Alternative 1 had a ratio of 1.05 and alternative 2 a 1.10.

7.3. Percentage of Population Utilizing Pathways

The last factor we analyzed for its effect on the benefit-cost ratio was the percentage of local residents that would potentially utilize the proposed pathway alternatives. The simplest way to evaluate this was to manipulate the total new user trip data by a set percentage—not changing the relevant assumptions that led to this initial calculation. We reduced new and avoided trips by 10% for all relevant benefit calculations for each alternative. For alternative 1 this led to a negative net-present value and a benefit-cost ratio of 0.98. Alternative 2 was able to maintain a positive net-present value even with this reduction and a benefit-cost ratio over 1 (1.02). Lastly, the benefit-cost ratio for alternative 3 was reduced to 0.44.

8. Literature Cited

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