**Benefit-Cost Analysis: Methodology and Assumptions**

**Analysis Period**

The Benefit-Cost analysis period is 18 years beginning in 2022 through 2040. The majority of the preservation activities will extend the service life of the structure by 15 years after the completion of the project in 2025. More extensive superstructure repairs, such as a deck replacement or the installation of a new concrete culvert, will extend the service life of the structure by 20 years[[1]](#footnote-2).

Based on the year-built of the bridge structures in the Bridge Project four bridges (24%) were built between 1960 and 1969; five bridges (29%) were built between 1970 and 1979; seven bridges (41%) were built between 1980 and 1989; one bridge (6%) was built after 1990[[2]](#footnote-3). This data indicates that 53% of the bridges built from 1960 to 1979 have already exceeded or are soon to reach the end of their service life of 40 to 50 years[[3]](#footnote-4); the remaining 47% of the bridges will be approaching the end of their service life within the next ten to fifteen years. Refer to the MDOT SHA Structures Asset Management (SAM) on Exhibit 21 for supporting data.

The project preliminary design started in 2018 with the initial asset data analysis, site assessments, determination of repair priorities, development of construction documents, and cost estimates. The preliminary design was carried through 2021 and developed to the 60% Design Phase. Additional funds were allocated in 2022 by Prince George’s County DPW&T to update the preliminary documents with the latest condition rating for the structures and to prepare the design documents for the Bridge Grant Application. The project construction is estimated to be completed in 2025, thus resulting on a 15-year period after the initial project investment is made to realize the whole benefits of the project at the local level, and consequently across the entire community of Prince George’s County.

The residual value of the preservation work beyond the analysis period, computed as the expected service life minus the analysis period, will be discounted at its present monetized value for the last year of the analysis period[[4]](#footnote-5).

*Project Value per Year = Total Investment / Years of Service Life.*

*Residual Value = [Service Life - 18] x Project Value per Year*

**Alternative 1 – No-Build (Baseline)**

This alternative includes the minimal cost of operations and maintenance (O&M) for the structure to keep it open for traffic and in a safe condition for the travelling public. O&M includes activities such as debris removal, snow removal, and minor holding repairs which do not improve the condition rating of the bridge elements.

**COSTS:**

**Alternative 1 - Operating and Maintenance (O&M)**

Based on the 2022 Prince George’s County Operating Budget, the DPW&T operating budget is $43,351,205, of which 1% is allocated to roadway and bridge maintenance and 1/3 of that budget or approximately $144,504 is dedicated to the maintenance of NBIS bridges. Based on the SAM query on Exhibit 21, the number of bridges with elements in condition 5 or less is 63, deriving a maintenance cost of $2,294 per bridge structure per year. The trend on the Operating Budget was estimated at +10.9% mostly due to increase on operating cost of bus services, snow and ice control, fuel cost, and technology. For the O&M related budget, the trend will be considered equal to 0%.

Refer to Exhibit 21 for supporting data related to the Prince George’s County DPW&T Operating Budget.

The Prince George’s County DPW&T Operating Budget encompasses the following: Human resources, i.e., maintenance personnel, bridge program manager; and other related administrative cost, i.e., pavement and pothole repairs, trip hazard repairs, cleaning of drainage inlets, stabilization of minor erosion associated with the bridge structure, signage installation and repair, object markers, weight limit posting signs, vegetation control at bridge sites, etc.

**Alternative 1 - Construction Zone Cost:**

Construction zone road user cost is defined as the additional costs borne by motorists and the community at-large as a result of work zone activity. such as the user delay costs, vehicle operating costs (VOC), and emission costs. Additionally, other off-site components such as noise, business and local community impacts could also be a consequence of implementation of construction zones. These off-site impacts are hard to monetize and require in-depth analysis that are often site-specific. Based on FHWA research no generalized method or tool is yet available to determine these off-site impacts ([[5]](#footnote-6)).

For the purpose of this BCA analysis, the construction zone cost includes the cost incurred by users travelling on the roadway due to the additional time necessary to traverse the work zone at the lower posted speed; it correlates the upstream and work zone speed differential and length of the work zone under both unrestricted and restricted traffic flow.

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of personal travel X Number of passenger cars on personal travel*

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of business travel X Number of passenger cars on business travel*

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of trucks travel x Number of Trucks*

The Value of personal travel, business travel, and truck travel are assumed as follows:[[6]](#footnote-7)

Personal Travel = $16.20/hr. Vehicle occupancy for all travels = 1.67.

Business Travel = $29.40/hr. The distribution of personal / business travel is 88.2% personal, 11.8% business.

Trucks Travel = $32.00/hr. Vehicle occupancy = 1.00.

Assumed Work Zone Delay Time = distance traveled /speed reduction.

Speed reduction = 10 mph (assumed reduction from 40 mph to 30 mph).

Distance traveled (mi) = Work zone length = Bridge length + Buffer length + Taper Length

Bridge Length and ADT values were obtained from the bridge SI&A data sheet. Buffer length and Taper Length are based on MDOT SHA Standard Details for maintenance of traffic Detail No. 104.02-02, 104.02-04, 104.02-08, and 104.02-10 for shoulder work, lane shift, and flagging operations on a 2-lane 2-way roadway with prevailing speed less than 40 mph. A conservative value of 1000’ has been assumed for Buffer length + Taper Length at all bridge sites.

The number of users is obtained by multiplying the number of vehicles x the number of occupants, distributed by personal travel or business travel. For trucks, the number of users is directly obtained from the number of truck (occupancy factor is equal to 1.0). A growth rate of 2% on the ADT was assumed for the forecasting of travel volume beyond the ADT year from the SI&A. Refer to Alternative 2 – Bridge Preservation Construction Zone Cost for an example computation of Work Zone Travel Delay Cost.

**Alternative 1 - Loss of Service**

The loss of service is derived as a consequence of having loss of capacity to carry the Maryland Legal Loads. This loss in capacity is due to the deterioration of the main load carrying members to the point of partial failure or complete failure and the inability of the structure to redistribute the loading. The load posting on the structure to restrict the passage of vehicles/trucks exceeding the capacity of the bridge members constitute a direct loss of service for the facility in which the structure is located. Depending on the severity of the deterioration, the load posting and thus the loss of service can range from minor to significant to complete bridge closure. Loss of service is directly correlated to loss of connectivity between facility users and services, and negatively impacting the user’s perception of safety. Indirectly, the loss of service negatively affects the community’s economy by limiting connectivity through freight distribution routes and compounding the community’s perception of economic growth. Loss of service could increase the user’s travelling time and distance through alternate routes consequently increasing congestion on those detour routes.

By simple inspection, the connectivity provided by the bridges in this Bridge Project is as follows:

1. **Bridge No. P-0117, Cherrywood Ln. over I-95/I-495. ADT = 9,620 vpd. ADTT = 5%. Detour length = 2 mi. [[7]](#footnote-8)**

Cherrywood Lane is classified as an urban local road and provides direct entrance/exit route for the Greenbelt METRO Station in Greenbelt, MD. This structure also connects the local Route 201 (Kenilworth Avenue) and local Route 193 (Greenbelt Road) to many different businesses, Springhill Elementary school, apartment buildings, Springhill Recreation Center, and Franklin Park at Greenbelt Station. Bridge No. P-0117 spans Cherrywood Lane over I-95/I-495 serving as a link between the developed areas inside and outside of the I-95/I-495 beltway.

1. **Bridge No. P-0169, Contee Road over CSX**. **ADT = 22,202 vpd. ADTT = 5%. Detour length = 6 mi.**

Contee Roadconnects collector Route 1 Baltimore Avenue with Route 197 Laurel/Bowie Road and provides connectivity to residential areas, supermarket, pharmacy, Lanchdale Park, St. Nicholas Catholic Church, James H. Harrison Elementary School, Maryland National Memorial, and many private businesses. Contee Road crosses the CSX Railroad which divides the area from the north to the south. The nearest railroad crossing to the north or south is approximately 1.0 mile away.

1. **Bridge No. P-0185, Metzerott Road Over Paint Branch. ADT = 14,850 vpd. ADTT = 10%. Detour length = 1 mi.**

Metzerott Road connects collector Route 1 Baltimore Avenue with Route 193 University Blvd E in College Park, MD. Metzerott Road is considered a bicycle-friendly road with supports bicycle traffic between the dedicated bicycle lanes along University Blvd E and the Anacostia Tributary Trail System/Paint Branch Trail.  Metzerott Road provides connectivity between Acredale Community Park, College Park Dog Park, College Park North Campus Office Annex, Christian Community Church, residential areas, and private businesses.

1. **Bridge No. P-0190, Sellman Road over Little Paint Branch**. **ADT = 5,820 vpd. ADTT = 10%. Detour length = 2 mi.**

Sellman Road connects Cherry Hill Road to Montgomery Road and Rhode Island Avenue in Beltsville, MD. Sellman Road crosses Little Paint Branch and provides connectivity to the Beltsville Community Center, Little Paint Branch Park, park trails, walking trails along Sellman Road, Beltsville Branch Library, and residential areas.

1. **Bridges No. P-0198031 & P-0198041, Cherry Lane over CSX RR**. **ADT = 10,861 Eastbound & 10,860 vpd Westbound. ADTT = 10%. Detour length = 6 mi.**

Cherry Lane connects collector Route 1 Baltimore Avenue with Route 197 Laurel/Bowie Road and provides connectivity to residential areas, Cherry Lane Business Park, Self-Storage Facilities, Bear Brach Public Storage, Autumn Lake Healthcare at Cherry Lane, and many private businesses.

1. **Bridge No. P-0204 Ritchie Road over Southwest Branch. ADT = 22,445 vpd. ADTT = 10%. Detour length = 3 mi.**

Ritchie Road connects Route 214 Central Avenue on the north to Ritchie Marlboro Road on the south. Ritchie Road provides connectivity to Sacred Ground Praise and Worship Center, Amazon Hub Counter, Public Storage, Prince George's County Materials Recycling, and numerous residential and business areas.

1. **Bridge No. P-0205, Walker Mill Road** **over** **Southwest Branch. ADT = 39,421 vpd. ADTT = 5%. Detour length = 3 mi.**

Walker Mill Road connects Ritchie Road on the east to Route 458 on the west. Walker Mill Road provides connectivity to Walker Mill Regional Park and trails, Woodland Wonderland Playground, Walker Mill Regional Park Community Garden, and numerous residential and business areas.

1. **Bridge No. P-0220 Riverdale Road over** **Trib. To** **Northeast Branch. ADT = 5,000 vpd. ADTT = 10%. Detour length = 1 mi.**

Riverdale Road connects Route 201 Kenilworth Avenue on the east to Taylor Road on the west and flanked by the CSX railroad on the west. Riverdale Road crosses the Northeast Branch of the Anacostia River and the Northeast Branch Trail. Riverdale Road provides connectivity to multiple residential areas, Riverdale Elementary School, Riverdale Garden, Riverdale House Museum, Riverside Community Park and Playground, Tanglewood Park, and many residential and business areas.

1. **Bridge No. P-0273, Carter Ave.** **over Amtrak Railroad.** **ADT = 15,218 vpd. ADTT = 10%. Detour length = 2 mi.**

Carter Avenue connects Route 450 Annapolis Road on the east to Route 564 Lanham Severn Road on the west. Carter Avenue crosses the Amtrak railroad which divides the area from north to south. Connectivity is provided to numerous private businesses, pharmacy, MARC Metro Seabrook Station and Park and Ride, Seabrook Elementary School, Seabrook Public Bus Services and bicycle access along Route 564, and residential areas.

1. **Bridge No. P-0283, Lottsford Road** **over Western Branch.** **ADT = 18,846 vpd. ADTT = 10%. Detour length = 2 mi.**

Lottsford Road connects Route 193 - Enterprise Road on the east to Route 202 – Landover Road on the west. Lottsford Road provides connectivity to grocery stores, Enterprise Park, Enterprise Golf Course, University of Maryland Capital Region Medical Center, and numerous residential and business areas.

1. **Bridge No. P-0294, Decatur Street over Northeast Branch. ADT = 8,680 vpd. ADTT = 25%. Detour length = 1 mile. This bridge is currently posted for 48,000 lbs./ 54,000 lbs. single/combination.**

Decatur Street connects Route 201 Kenilworth Avenue on the east to US Route 1 Baltimore Avenue on the west. Decatur road is flanked by the CSX railroad on the west. Decatur Road

crosses the Northeast Branch of the Anacostia River and the Northeast Branch Trail. Decatur Road provides connectivity to multiple residential areas, Riverdale Elementary School, Riverdale Garden, Riverdale House Museum, Riverside Community Park and Playground, Tanglewood Park, and many residential and business areas.

1. **Bridge No. P-0396, Tucker Road over Henson Creek. ADT = 6,842 vpd. ADTT = 5%. Detour length = 2 mi.**

Tucker Road connects Livingston Road on the north to Palmer Road on the south; connectivity is provided to Henson Valley Christian Church, Tucker Road Community Center, Henson Creek Trail, Tucker Road Athletic Complex, and Ice Rink, Henson Creek Golf Course, Knights of Columbus, Oxon Hill Recreation Club, and numerous residential and business areas.

1. **Bridge No. P-0484, McKendree Road over Timothy Branch. ADT = 4,806 vpd. ADTT = 10%. Detour length = 4 mi.**

McKendree Road connects US Route 301 on the east to Route 373 on the west. McKendree Road provides connectivity to Aggregate Industries (sand and gravel supplier) and many other private business and residents.

1. **Bridge No. P-0490, Gallahan Road** **over Tinkers Creek. ADT = 3,793 vpd. ADTT = 10%. Detour length = 4 mi.**

Gallahan Road connects Piscataway Road on the east to Old Ford Road on the west. Gallahan Road is a bicycle-friendly roadway and provides connectivity to numerous residential areas continuing the bicycle loop onto Route 223 Piscataway Road and Old Ford Road.

1. **Bridge No. P-0579, Derrick Place** **over Butler Branch.** **ADT = 270 vpd. ADTT = 2%. Detour length = 1 mi.**

Derrick Place connects Hellen Lee Drive on the north to Armor Drive on the south. Derrick Place provides a second point of access to a closed loop residential neighborhood located approximately 0.5 mile west of Brandywine Road.

1. **Bridge No. P-0596, Leeland Road** over Collington Branch. **ADT = 3,568 vpd. ADTT = 10%. Detour length = 3 mi.**

Leeland Road connects US Route 301 on the east to Oak Grove Road and Route 202 on the west. Leeland road provides connectivity to St. Barnabas Episcopal Anglican church, Imagine Foundations at Leeland Public Charter School, and numerous

residential and business area.

For this analysis the loss of service is quantified by the Detour Delay Time incurred when trucks traverse the additional detour length to circumvent or bypass a load-posted bridge. The delay time is equal to the detour length divided by the posted speed (40 mph). In the case of passenger vehicles, it is assumed that the bridge will remain open during the analysis period and therefore will not contribute to the travel delay cost.

The load posting of the bridges is assumed to occur beginning in the year 2025, three years into the analysis period and continuing constant each year thereafter.

*Travel Delay Cost = Detour Delay Time X $/hr value of trucks travel x Number of Trucks*

The value of truck travel is assumed as follows:[[8]](#footnote-9)

Trucks = $32.00/hr. Occupancy rate = 1.00.

The number of users is obtained by directly multiplying the number of trucks (occupancy factor is equal to 1.0). A growth rate of 2% on the ADT was assumed for the forecasting of travel volume beyond the ADT year from the SI&A.

Example: For Bridge P-0177, the detour length from the SI&A is 2 mi, the ADT is 9,620 vpd with 5% tucks.

Detour delay time = 2 mi / 40 mph = 0.05 hr or 3 minutes.

Travel delay cost = 0.05 hr X $32/hr X 9620 vpd X 0.05 = $769.60/day. If the detour is implemented 365 days in a year, then the annual cost = $769.60/day X 365 days = $280,900/year

For subsequent years after 2022, the ADT value will increase 2% annually.

**Alternative 2 – Bridge Preservation**

**COSTS:**

**Alternative 2 – Operating and Maintenance (O&M)**

Operating and maintenance expenditures incurred in the period of 2025 through 2040 are forecasted using the expenditure trend from the Alternative -1 Baseline O&M analysis applied to the remainder of the bridges in the asset inventory with elements in fair or poor condition.

After the Bridge Project is completed, the Prince George’s County DPW&T Operating Budget will be utilized to maintain 46 bridge structures with elements still in condition 5 or less in addition to any other asset which would have fallen into condition five or less from 2022 through 2025.

**Alternative 2 – Professional Services for Preliminary Design**

The BCA estimates the return on the total investment related to the Bridge Project, hence all expenditures incurred from the inception of project must be accounted for.

Professional services cost incurred for the development of the Preliminary Design of the project during 2018-2022 was $ 122,684. Refer to Exhibit 21 for supporting data related to professional services for preliminary design. An inflation factor of 3% was used to discount the cost to the year 2020.

**Alternative 2 – Professional Services for Final Design and Construction Services**

The total estimated cost for professional services required to develop the project design to construction documents during the period of 2023 through 2025 is $525,000. Based on the project schedule, 90% of the cost will be spent in 2023 prior to project advertisement and the remainder 10% cost will be spent in 2024 prior to or at the beginning of the bridge construction. Professional services for final design are forecasted using past experiences with similar projects and the total cost for professional services was assumed evenly spent among all bridges in the Bridge Project.

Construction Services include the review of bid documents, responding to inquiries from bidding contractors, preparing bid price justifications, submittal reviews, and technical consultations during the project construction. The professional services for construction are forecasted using past experiences with similar projects. Refer to Exhibit 21 – BCA Supporting Data and Exhibit 22 – Detailed Cost Estimate for detailed cost for professional services.

**Alternative 2 – Construction cost**

The estimated total construction cost for the Bridge Project is $12,264,613 including $87,000 for legal fees and administrative expenses, $870,000 for project inspection and management, and 30% contingency. The construction cost is evenly distributed among all structures deriving a cost per bridge of $721,448. The project construction cost is distributed 6% during 2023, 41% during 2024, and 53% during 2025. The contingency of 30% accounts for unforeseen and/or unknown changes on the scope or site conditions.

Refer to the Bridge Project budget narrative for details and estimation related to the project construction.

**Alternative 2 – Construction Zone Cost:**

Construction zone user cost is defined as the additional costs borne by motorists and the community at-large as a result of work zone activity, such as the user delay costs, vehicle operating costs (VOC), crash costs and emission costs. Additionally, other off-site components such as noise, business and local community impacts may also be a consequence related to the implementation of construction zones. These off-site impacts are hard to monetize since the factors that influence their computation are often site-specific. Based on FHWA research no generalized method or tool is yet available to determine these off-site impacts ([[9]](#footnote-10)).

For the purpose of this BCA analysis, the construction zone cost includes the cost incurred by users travelling on the roadway due to the additional time necessary to traverse the work zone at the lower posted speed. The construction zone cost correlates the upstream and work zone speed differential and length of the work zone under both unrestricted and restricted traffic flow. The Work Zone Travel Delay calculated using the following formulas10:

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of personal travel X Number of passenger cars on personal travel*

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of business travel X Number of passenger cars on business travel*

*Work Zone Travel Delay Cost = Work Zone Delay Time X $/hr value of trucks travel x Number of Trucks*

The value of personal travel, business travel, and truck travel are assumed as follows[[10]](#footnote-11):

Personal Travel = $16.20/hr. Vehicle occupancy all travels = 1.67.

Business Travel = $29.40/hr. The distribution of personal / business travel is 88.2% personal, 11.8% business.

Trucks = $32.00/hr.

Assumed Work Zone Delay Time = distance traveled /speed reduction.

Speed reduction = 10 mph (assumed reduction from 40 mph to 30 mph).

Distance traveled (mile) = Work zone length = Bridge length + Buffer length + Taper Length

Bridge Length and ADT values were obtained from the bridge SI&A data sheet. Buffer length and Taper Length are based on MDOT SHA Standard Details for Maintenance of Traffic Details No. 104.02-02, 104.02-04, 104.02-08, and 104.02-10 for shoulder work, lane shift, and flagging operations on a 2-lane 2-way roadway with prevailing speed less than 40 mph. A conservative value of 1000 Feet has been assumed for Buffer length + Taper Length at all bridge sites.

The number of users is obtained by multiplying the number of vehicles by the number of occupants, distributed by personal travel or business travel respectively. For trucks, the number of users is directly obtained from the number of truck (occupancy factor is equal to 1.0). A growth rate of 2% on the ADT was assumed for the forecasting of travel volume beyond the year 2022.

Example: For Bridge P-0177, the work zone length is equal to 0.2732 mi, the ADT is 9,620 vpd with 5% tucks.

Work Zone Delay Time = 0.2732 mi / 10 mph = 0.0273 hr or 1.64 minutes.

Work Zone Travel Delay Cost = 0.0273 hr X $16.20/hr X 9620 vpd X 1.67 X 88.2% = $6266.70/day for personal trips.

Work Zone Travel Delay Cost = 0.0273 hr X $29.40/hr X 9620 vpd X 1.67 X 11.8% = $1521.50/day for business trips.

Work Zone Travel Delay Cost = 0.0273 hr X $32.00/hr X 9620 vpd X 0.05 X 1.0 = $420.00/day for trucks trips.

If the construction zone is implemented for a maximum of 1.5 months (42 days) in a year, then the annual cost is: $6,266.70/day X 42 days = $263,201/year for personal trips,

$1,521.50/day X 42 days = $63,900/year for business trips, and

$420.00/day X 42 days = $17,640/year for trucks.

**BENEFITS:**

**Alternative 2 – Avert bubble expenditure for bridge repair:[[11]](#footnote-12)**

Based on the year-built of the bridge structures and as mentioned previously in this analysis, four out of the 17 bridges (24%) were built between 1960 and 1969; five bridges (29%) were built between 1970 and 1979; seven bridges (41%) were built between 1980 and 1989; one bridge (6%) was built after 1990[[12]](#footnote-13). This means that 53% of the bridges are already exceeding their service life (older than 40 years) and that in the next ten to fifteen years the remaining 47% of the bridges will be approaching the end of their service life.

The FHWA Bridge Preservation Guide has defined bridge preservation as those actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good or fair condition; and extend their service life[[13]](#footnote-14).

The Prince George’s County (DPW&T) 2022 operating budget is $43,351,205, of which 1% is allocated to roadway and bridge maintenance with 1/3 ($144,504/year) dedicated to the maintenance of NBIS bridges with elements in fair or poor condition rating. Operating cost also includes employee salaries, technology, fuel, etc. The SAM inventory currently has 63 NBI bridges with sub-elements in condition 5 or less in Prince George’s County.

Similarly, the Prince George’s County 2022 Capital Improvement Projects budget is $5,700,000 allocated for several county-wide improvement projects including two bridge design projects and one major bridge replacement project. Based on data from the past 10 years, the cost for a major bridge rehabilitation or replacement project in Prince George’s County is $2,000,000.

If alternative No. 1 “No-Built” is selected, within the next ten to fifteen years, 53% of the bridges will fall into poor condition necessitating major rehabilitation or replacement, while the remaining 47% of the bridges will deteriorate to fair condition. The aggregated expenditure to rehabilitate or replace bridges with poor condition due to exhausted service life and maintaining bridges currently in fair condition within the constraint of the operating and CIP budgets constitute a tremendous challenge for the Prince George’s County DPW&T. This compound effect or bubble expenditure is averted by initiating bridge preservation repairs such as those included in this Bridge Project Grant and spreading the cost of the bridge preservation dollars through the next ten to fifteen years with the purpose of reducing the cost of future maintenance and delaying the need for major rehabilitation or replacement of those structures currently having sub-elements in fair or poor condition.

This benefit of averting the bubble expenditure is quantified by amortizing the cost of a bridge replacement from the end of the construction year (2025) through the remaining service life of the bridge within the analysis period and discounting this value at 7% and 3% to the year 2022.

Average cost of major bridge rehabilitation/ replacement = $4,400,000 (2022 value).

Number of service years remaining = The youngest bridge is 25 years old, so the remaining number of service years, assuming it was built for a 40-year service life, is 40 – 25 = 15 years.

Amortized value = $4,400,000 / 15 years = $293,333/year from 2026 through 2040.

Discounting is computed as follows:[[14]](#footnote-15)

*Present value = Future value / (1 + i)t*

*Where: i is the discount rate, t = years in the future for payment (based year is t = 0).*

Example:

For the year 2026 the discounted value at 7% is = $293,333 / (1.07)4 = $223,782.00/year

The discounted value at 3% is = $293,333 / (1.03)4 = $260,622.00/ year

**Alternative 2 – Avert Increased Bridge Inspection Cost (qualitative benefit)**

A consequence of loss of capacity on the primary structural members and load posting is the increased frequency of the bridge inspection activities to a period less than the standard routine inspection period. The 2022 NBIS states that a routine bridge inspection must be performed at an interval not to exceed 24 months to properly assess the bridge components and evaluate maintenance needs. The MDOT State Highway Administration Guidelines and Procedures Memorandum SI-12-06(4) supports this requirement for routine bridge inspections and SI-12-05(4) stablishes a procedure to increase the inspection frequency based on the load rating factor, load posting, condition rating value, and ADT volumes. For bridges with operating rating factors for any legal vehicle < 1.0, increasing the frequency of the inspection is required. For bridges with inventory rating factors for any legal vehicle < 1.0, the determination of reducing the inspection frequency will depend on the condition rating and the ADT values.

The reduced inspection frequency can vary from 12 to 6 months depending on the severity and extent of the condition. Bridges on the increased inspection cycle will require additional cost expenditure in addition to the routine inspections. By preserving the bridges in good state of repair the loss of capacity can be delayed, thus delaying or preventing altogether additional costs related to frequent inspections.

**Alternative 2 – Resiliency of Construction (qualitative benefit)**

A good maintenance program will help to reduce the potential for deterioration that leads to a bridge failure.[[15]](#footnote-16) Cleaning and painting of steel bridges and repair of concrete deterioration can reduce deterioration and extend the service life of the structure. The maintenance of drainage features such as scuppers, basins, downspouts and troughs can substantially help preserve other main components for the structure in goods state of repair. Deck joint repairs can help prevent the deterioration of steel elements such as bearings, beams, diaphragms, connections, and other superstructure and substructure elements by preventing water-induced corrosion. Effective deck joints can also prevent chloride contamination on the concrete elements of the substructure by warding off moisture and salty runoff.

**Alternative 2 – Bundled Project (qualitative benefit)**

The Prince George’s County will realize savings by bundling the development of the design, procurement, and construction of the group of bridge structures. These savings are mainly caused by the efficiency of designing and constructing similar work activities, spreading administrative costs, and overall requiring fewer man-hour to complete the same project.

**BCA RESULTS:**

The BCA comparison for the baseline Alternative 1 No-Build and Alternative 2 Bridge Preservation is shown on Table 21a below. The Benefit to Cost Ratio for the nominal cost of the Bridge Project varies from 3.13 to 44.51. The Benefit to Cost Ratio for the Discounted Cost at 7% varies from 2.10 to 22.98. The Benefit to Cost Ratio for the Discounted Cost at 3% varies from 2.59 to 32.91.

The results of the BCA are summarized in the BCA narrative and are reproduced in the table below.

| Table 21a. Comparison Summary No-Build (Baseline) vs. Bridge Preservation | | | |
| --- | --- | --- | --- |
| Bridge No. | Undiscounted Cost  BCR | Cost Discounted at 7%  BCR | Cost Discounted at 3%  BCR |
| 1. Bridge No. P-0117, Cherrywood Ln. over I-95/I-495 | 3.13 | 2.10 | 2.59 |
| 2. Bridge No. P-0169, Contee Road over CSX Railroad | 44.03 | 22.76 | 32.57 |
| 3. Bridge No. P-0185, Metzerott Road over Paint Branch | 6.96 | 4.06 | 5.41 |
| 4. Bridge No. P-0190, Sellman Road over Little Paint Branch | 4.22 | 2.56 | 3.33 |
| 5. Bridge No. P-0198031, Cherry Lane (Eastbound) over CSX Railroad | 42.44 | 21.81 | 31.32 |
| 6. Bridge No. P-0198041, Cherry Lane (Westbound) over CSX Railroad | 42.43 | 21.81 | 31.31 |
| 7. Bridge No. P-0204, Ritchie Road over the Southwest Branch | 44.51 | 22.98 | 32.91 |
| 8. Bridge No. P-0205, Walker Mill Road over the Southwest Branch | 40.28 | 20.94 | 29.84 |
| 9. Bridge No. P-0220, Riverdale Road over Tributary to Northeast Branch | -0.45\* | 0.17\* | -0.10\* |
| 10. Bridge No. P-0273, Carter Ave. over Amtrak Railroad | 18.10 | 9.64 | 13.55 |
| 11. Bridge No. P-0283, Lottsford Road over Western Branch | 23.43 | 12.35 | 17.47 |
| 12. Bridge No. P-0294, Decatur Street over Northeast Branch | 11.64 | 6.33 | 8.79 |
| 13. Bridge No. P-0396, Tucker Road over Henson Creek | 0.87\* | 0.88\* | 0.89\* |
| 14. Bridge No. P-0484, McKendree Road over Timothy Branch | 9.53 | 5.20 | 7.21 |
| 15. Bridge No. P-0490, Gallahan Road over Tinkers Creek | 6.62 | 3.73 | 5.07 |
| 16. Bridge No. P-0579, Derrick Place over Butler Branch | -4.29\* | -1.78\* | -2.93\* |
| 17. Bridge No. P-0596, Leeland Road over Collington Branch | 3.43 | 2.13 | 2.74 |
| Maximum BCR Value = | 44.51 | 22.98 | 32.91 |
| Minimum BCR Value = | 3.13 | 2.10 | 2.59 |

\* Bridge structures receiving the most benefit from the bundled Bridge Project.

**References:**

1. Work Zone Road User Costs. FHWA Office of Operations.
2. USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs. March 2022.
3. FHWA Bride Preservation Guide. 2018.
4. USDOT Framework for Improving Resilience of Bridge Design. Publication No. FHWA-IF-11-016. January 2011.
5. Prince George’s County DPW&T Operating Budget Report for FY 2022, FY 2021, FY 2020, and FY 2019. https://www.princegeorgescountymd.gov/565/Operating-Budgets.
6. MDOT SHA Structure Asset Management (SAM) System. Accessed in August 2022.
7. I-35W Bridge collapse 15 years later: How much safer are Minnesota’s bridges? By Caroline Cummings. Article published on CBS News, Minnesota on July 31, 2022. https://www.cbsnews.com/minnesota/news/i-35w-bridge-collapse-15-years-later-how-much-safer-are-minnesotas-bridges/

1. FHWA Bridge Preservation Guide. 2018. [↑](#footnote-ref-2)
2. Refer to MDOT SHA Structure Asset Management (SAM) query for bridge elements rated 5 or less. August 2022. [↑](#footnote-ref-3)
3. FHWA Definition of Service Life: The service life is the period for which a component, element, or bridge provides the desired function and remains in service with appropriate preservation activities. Service life of bridge components or elements is the period during which the item actually performs. The service life of a bridge and components in good to fair condition can be extended with cyclical and/or condition-based PM activities. Bride Preservation Guide. 2018. [↑](#footnote-ref-4)
4. USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs. March 2022. [↑](#footnote-ref-5)
5. Work Zone Road User Costs. FHWA Office of Operations. [↑](#footnote-ref-6)
6. USDOT benefit-Cost Analysis Guidance for Discretionary Grant Programs. [↑](#footnote-ref-7)
7. ADT, ADTT, detour length, and load posting data was obtained from the bridge SI&A. [↑](#footnote-ref-8)
8. USDOT benefit-Cost Analysis Guidance for Discretionary Grant Programs. [↑](#footnote-ref-9)
9. Work Zone Road User Costs. FHWA Office of Operations. [↑](#footnote-ref-10)
10. USDOT benefit-Cost Analysis Guidance for Discretionary Grant Programs. [↑](#footnote-ref-11)
11. I-35W Bridge collapse 15 years later: How much safer are Minnesota’s bridges? By Caroline Cummings. Article published on CBS News, Minnesota on July 31, 2022. https://www.cbsnews.com/minnesota/news/i-35w-bridge-collapse-15-years-later-how-much-safer-are-minnesotas-bridges/ [↑](#footnote-ref-12)
12. MDOT SHA Structure Asset Management (SAM) query for bridge elements rated 5 or less, Refer to Exhibit 21. [↑](#footnote-ref-13)
13. FHWA, USDOT 2018 Bridge Preservation Guide. [↑](#footnote-ref-14)
14. Based on the USDOT benefit-Cost Analysis Guidance for Discretionary Grant Programs [↑](#footnote-ref-15)
15. USDOT Framework for Improving Resilience of Bridge Design. Publication No. FHWA-IF-11-016. January 2011. [↑](#footnote-ref-16)