

BLUE RIDGE

Bridge Longevity Upgrades to
Enhance Resiliency, Increase
Dependability, and Grow Equity



**PROTECT FFY 2022 and 2023
GRANT APPLICATION
AUGUST 2023**



Basic Project Information	
Project Name	Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity (BLUE RIDGE)
Project Sponsor	North Carolina Department of Transportation
PROTECT Grant Programs Applied For	Resilience Improvement Grant; Community Resilience and Evacuation Route Grants
Project Costs	
PROTECT Grant Request Amount	\$12,443,000
Estimated Other Federal Funding	\$0
Estimated Non-Federal Funding	\$3,110,750
Future Eligible Project Cost	\$15,553,750
Previously Incurred Costs	\$743,894
Total Project Cost (future eligible plus previously incurred)	\$16,297,644
Benefit Cost Ratio	6.97
Project Location	
State	North Carolina
Counties	Buncombe and Madison
Is the project located in or adjacent to Areas of Persistent Poverty?	Yes, Area IDs 37021002900, 37115010200, 37115010500, 37115010602, 37115010700
Is the project located in or adjacent to FEMA designated 100-year floodplains?	Yes

Supplemental Materials are available online at:

<https://connect.ncdot.gov/resources/PROTECT2023-Div13/Pages/default.aspx>

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Table of Contents

1	Basic Project Information.....	1
1.1	Transportation Challenges.....	3
1.2	Regional Transportation Infrastructure Investment.....	8
1.3	Project History.....	9
1.4	Project Location.....	9
1.5	Project Parties.....	12
2	Grant Funds, Sources, and Uses of All Project Funding.....	14
3	Merit Criteria.....	14
3.1	Vulnerability and Risk.....	14
3.1.1	Exposure.....	14
3.1.2	Sensitivity.....	15
3.1.3	Adaptive Capacity.....	16
3.2	Criticality to Community.....	17
3.2.1	Support Continued Operation or Rapid Recovery of the System.....	17
3.2.2	Provide Continued Access to Critical Assets and Facilities.....	17
3.2.3	Consequences If Improvements Are Not Made.....	18
3.3	Design Elements.....	18
3.3.1	Anticipated Service Life.....	18
3.3.2	Elements Specifically Addressing Current or Future Vulnerabilities.....	18
3.3.3	Consideration of Nature-based Solutions.....	18
3.3.4	Safety Improvements.....	20
3.3.5	Detailed Maintenance Plan.....	20
3.4	Public Engagement, Partnerships, Collaboration.....	21
3.5	Equity and Justice40.....	21
3.6	Climate Change and Sustainability.....	22
3.6.1	Reduces Greenhouse Gas Emissions.....	22
3.6.2	Addresses Disproportionate Impacts on Disadvantaged Communities.....	22
3.6.3	Avoids Adverse Environmental Impacts.....	22
3.7	Schedule.....	23

3.8	Innovation.....	23
3.8.1	Innovative Technologies and Techniques.....	23
3.8.2	Best practices in partnerships and cost sharing.....	25
3.9	Benefit Cost Analysis	25

List of Tables

Table 1:	<i>Detour Route Information</i>	4
Table 2:	<i>Current Bridge Conditions; Source: Routine Bridge Inspection Reports.....</i>	8
Table 3:	<i>Current Bridge Conditions; Source: Routine Bridge Inspection Reports.....</i>	9
Table 4:	<i>Project Parties.....</i>	13
Table 5:	<i>Cost Summary</i>	14
Table 6:	<i>Public Engagement Efforts.....</i>	21
Table 7:	<i>Proposed project schedule</i>	23
Table 8:	<i>Benefit Cost Results Summary</i>	25

List of Figures

Figure 1:	<i>General Project Location</i>	1
Figure 2:	<i>Bridge 100078 Detour Route</i>	5
Figure 3:	<i>Bridge 100154 Detour Route</i>	5
Figure 4:	<i>Bridge 100203 Detour Route</i>	6
Figure 5:	<i>Bridge 560149 Detour Route</i>	6
Figure 6:	<i>Bridge 560531 Detour Route</i>	7
Figure 7:	<i>Bridge 100078 and 100154 project vicinity.....</i>	10
Figure 8:	<i>Bridge 100203 project vicinity.....</i>	10
Figure 9:	<i>Bridge 560149 project vicinity.....</i>	11
Figure 10:	<i>Bridge 560531 project vicinity.....</i>	11
Figure 11:	<i>Areas of Persistent Poverty in project area.....</i>	12
Figure 12:	<i>100-Year Floodplain in project area</i>	15

Appendices

Appendix A: Benefit Cost Analysis

Appendix B: Letters of Support

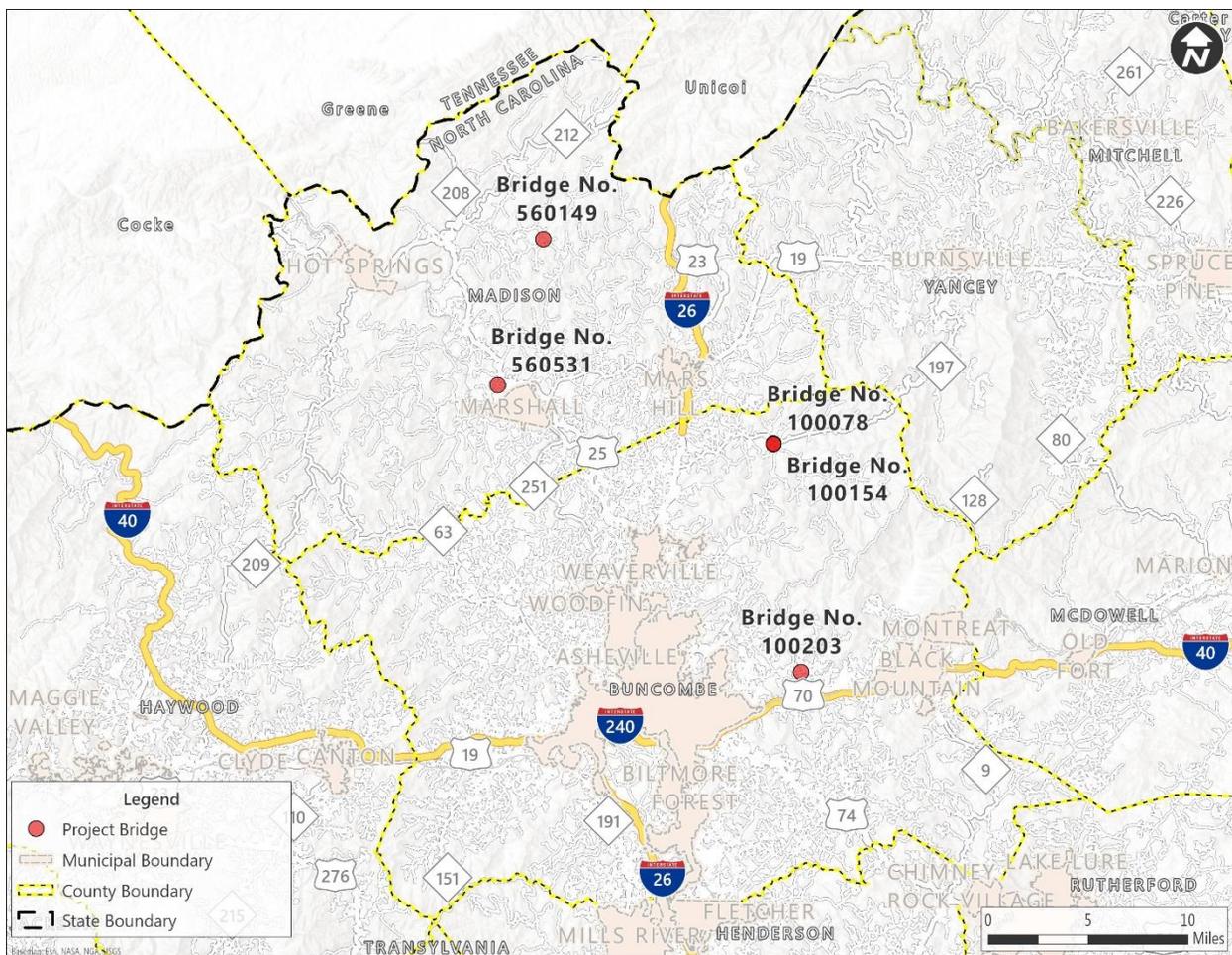
Appendix C: Funding Commitment Letter

1 Basic Project Information

The Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity (BLUE RIDGE) project located in Buncombe and Madison Counties, North Carolina, ranges from 9 to 30 miles outside of the Asheville Metropolitan area. The project includes four full bridge replacements and one structure rehabilitation. The implementation of BLUE RIDGE will improve regional resiliency in a rural and economically disadvantaged portion of North Carolina. It will also increase reliability in a region that has limited available detour routes due to mountainous terrain. **Figure 1** shows the general project location.

The Project proposes replacing Bridges 100078, 100154, 100203, and 560149 and rehabilitating Structure 560531. All five structures exhibit significant structural issues and deficiencies due to continued exposure to natural hazards. Because of the scale of the issues and the repeated repairs, continued remediation is not a feasible solution.

Figure 1: General Project Location



BLUE RIDGE

Buncombe and Madison Counties

All five structures have significant structural issues. They require continued maintenance to repair scour issues and remove debris. The constant damage is due to exposure to natural hazards such as flooding, major rain events, and other extreme weather conditions. The bridges are characterized by significant scour damage, failing substructures, and constant flooding. Additional details about the vulnerability of each structure are provided below:

Exhibit 1: Flooding and roadway failure near Bridge 560149 following April 2020 rain events



- Bridge 100078: Due to the hybrid design of the current bridge, the bridge experiences significant amounts of drift/debris and bed load collecting at the inlet and under the structure. The estimated annual cost to remove the collected material is approximately \$40,000.
- Bridge 100154: The current bridge has a narrow hydraulic opening, and experiences significant amounts of drift/debris caught at the center pier during high flow times. Major weather events increase the accumulation of sediment and debris on the structure as well as flood the roadway.
- Bridge 100203: The existing bridge had a narrow hydraulic opening and has repeated scour issues at end bent 2. Due to extensive scour at end bent 2, the bridge has been deemed structurally deficient.
- Bridge 560149: The spread footings of both end bents and pier of the existing bridge are inside the stream, creating a choke point during flood events. This leads to contraction scour at the structure and increased vulnerability during flood events. All concrete substructure elements are deteriorating, and a temporary timber bent has been constructed to support the superstructure. The bridge is a one lane bridge and is functionally obsolete. Both superstructure and substructure are structurally deficient.
- Structure 560531: The current structure consists of three ten-foot corrugated pipes under 40 feet of fill. In their current condition, the pipes are rated as structurally deficient and are at an increased risk of structural failure due to the loss of the invert. This allows the stream to erode the backfill, particularly during high flow/high stream velocity events.

These structures are in immediate need of replacement and rehabilitation to make them functional and safe for use. The proposed project will remove transportation barriers for the

BLUE RIDGE

Buncombe and Madison Counties

communities involved, improve safety for all relevant modes of travel, support the local economy, preserve the natural environment, and increase the resilience of necessary infrastructure that is vulnerable to the continued impacts of climate change. The project structures are regularly impacted by heavy precipitation events that are a result of climate change. These impacts can be seen in **Exhibits 1 and 2**.

1.1 Transportation Challenges

Each structure faces the continued challenge of exposure to flooding and other severe weather events. The 2020 North Carolina Climate Risk Assessment and Resilience Plan¹ found that climate change is likely to increase the incidence of severe weather events accompanied by heavy precipitation, thereby increasing the potential for flooding, and that heavy precipitation from more intense and frequent storms can cause significant damage to infrastructure assets in the state. Due to this fact, the structures will continue to face more weather challenges in the future.

Climate change is causing an increase in severe weather events which leads to the increase of flood events in the project area. According to the North Carolina Climate Science Report², the Asheville Region will experience and increase in the number of extreme precipitation events, which can lead to severe flooding, over the next century. By the end of the century, the annual number of days with precipitation of three inches or more in the Western Mountains of North Carolina is projected to increase by up to 250% compared to the 1996-2015 average. The increase in flood events will continue to decrease the reliability and safety of the project structures. Increased flooding in the project area will lead to more bridge closures and safety hazards. More bridge closures mean a decrease in accessibility to community resources and services as well as an increase in maintenance challenges.

For example, in 2021, Tropical Storm Fred caused about 14 inches of rain to fall in western North Carolina.³ Buncombe County was severely impacted by flooding and infrastructure damage. Not

Exhibit 2: Slope failure near Bridge 560531 following August 2021 rain events



¹ <https://www.deq.nc.gov/energy-climate/climate-change/nc-climate-change-interagency-council/climate-change-clean-energy-plans-and-progress/nc-climate-risk-assessment-and-resilience-plan>

² <https://ncics.org/programs/nccsr/>

³ <https://www.citizen-times.com/story/news/local/2022/09/21/tropical-storm-fred-2022-north-carolina-home-damage-nc-funding/69507269007/>

Exhibit 3: Major slide along SR 1395 in Buncombe County following major rain event in February 2020



only did the storm cause widespread damage to homes and other buildings, but it also led to multiple bridge and road closures throughout Buncombe County. During this event, there was a major slide along SR 1395 (see **Exhibit 3**) that led to a road closure for ten months. Due to this road closure, Bridge 560149 was along the only detour available throughout maintenance. Weather events such as Tropical Storm Fred highlight the importance of improving the resiliency and reliability of the project bridges to maintain transportation access.

The challenges brought to this region by flooding are particularly harmful to the populations that depend on the project bridges for transportation access to employers, schools, critical services, etc. When the bridges are closed following a flooding event due to inaccessibility or maintenance, people must use detours to get to their destinations. The available detours for the project bridges increase travel time for residents and emergency responders. They also reduce accessibility due to the limited width of roadway and lack of ability for trucks to travel along detour routes. Detour information can be found in **Table 1** and **Figures 2 through 6**.

Table 1: Detour Route Information

Structure ID	Detour Length (miles)	Additional Travel Time	Limitations/Concerns
100078	46.2	1 hour, 16 minutes	
100154	25.3	35 minutes	Not suitable for truck traffic
100203	5.9	10 minutes	Difficulty for large trucks
560149	11.8	29 minutes	
560531	1.8	4 minutes	Not suitable for truck traffic, not viable always due to Walnut Creek

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Buncombe and Madison Counties

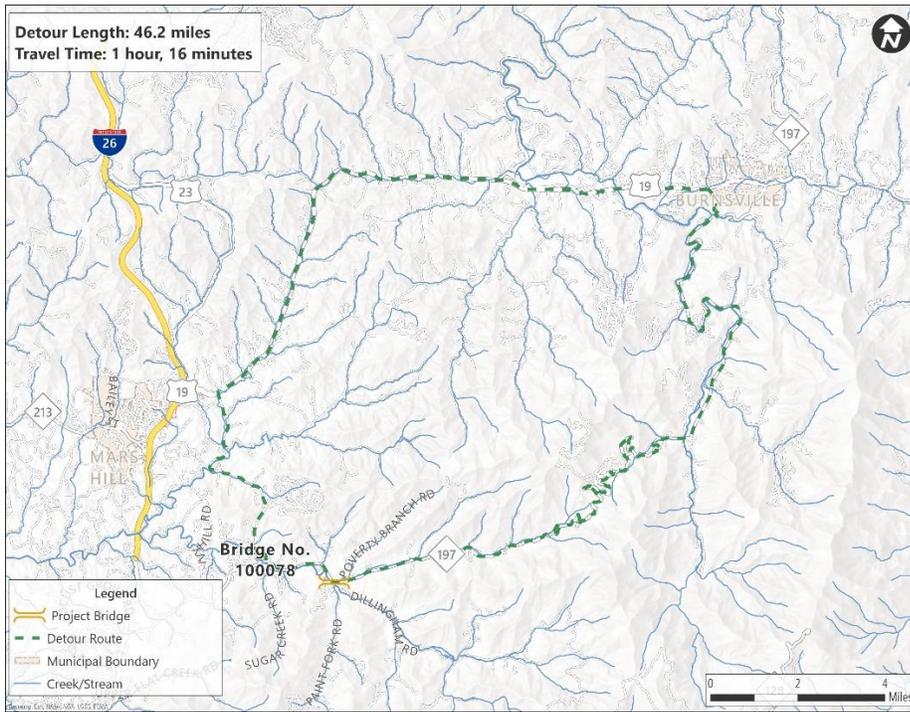


Figure 2: Bridge 100078
Detour Route

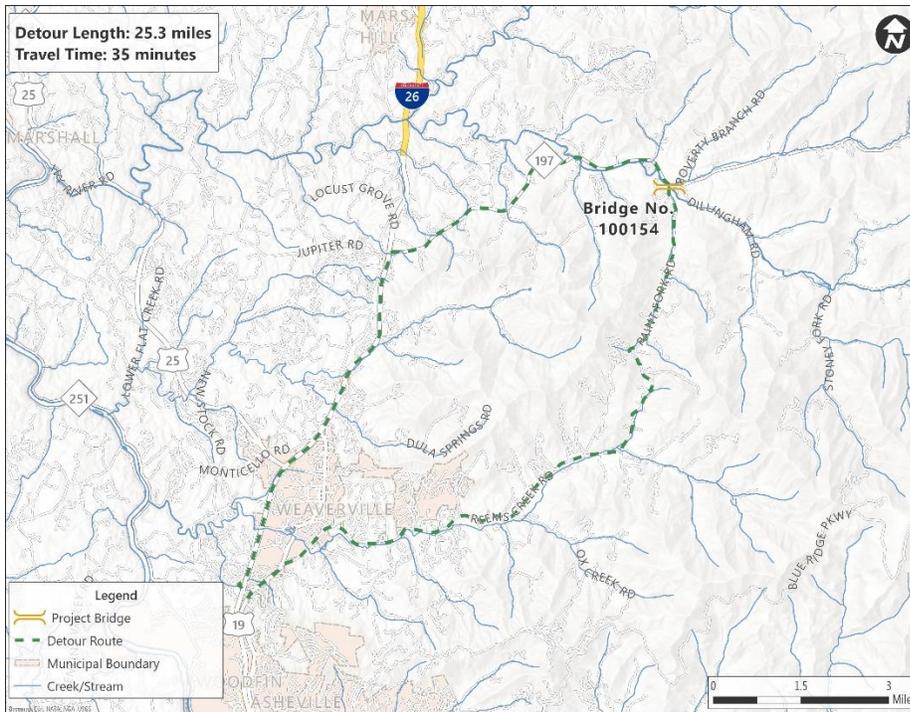


Figure 3: Bridge 100154
Detour Route

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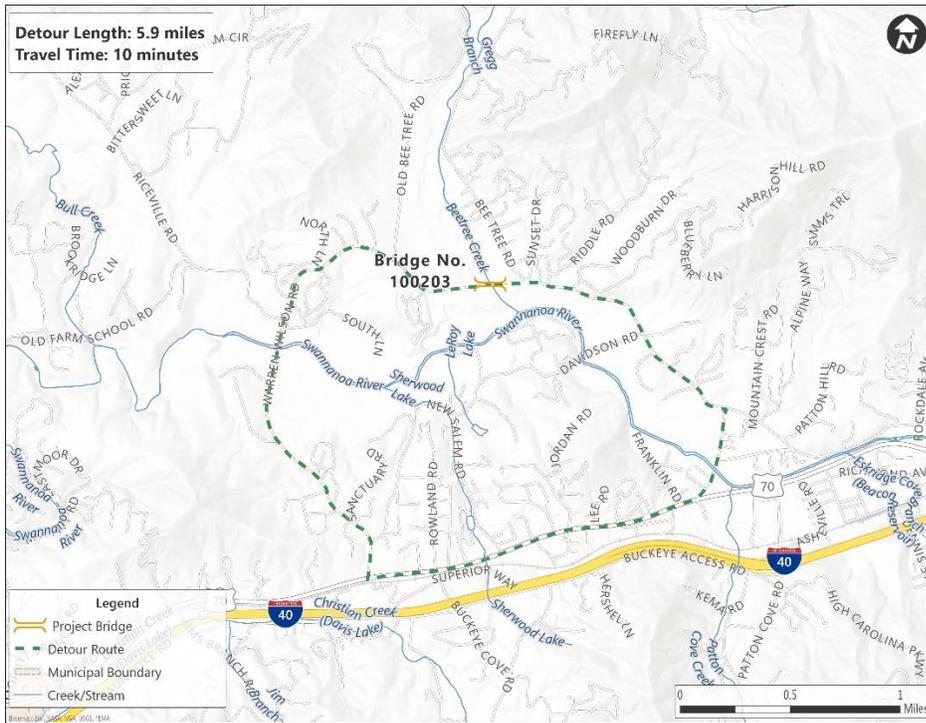


Figure 4: Bridge 100203
 Detour Route

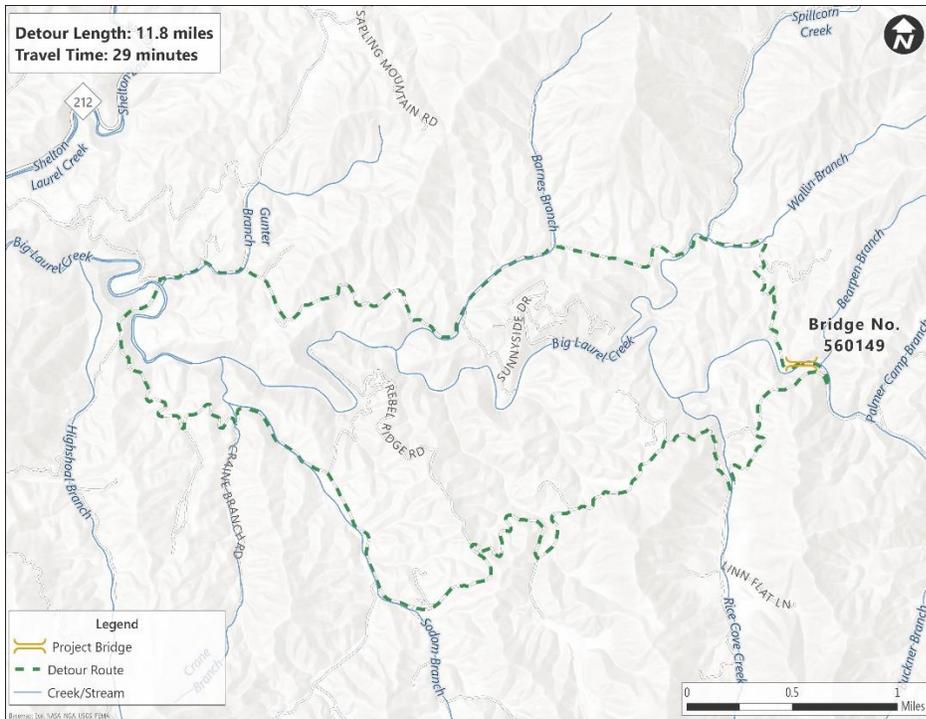


Figure 5: Bridge 560149
 Detour Route

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Buncombe and Madison Counties

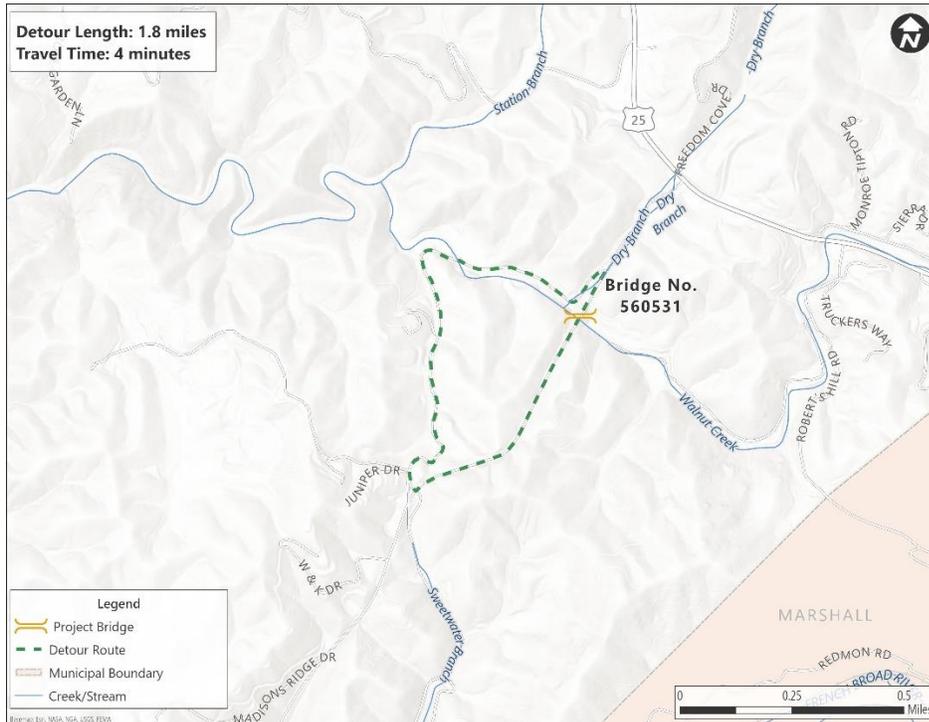


Figure 6: Bridge 560531
Detour Route

During flood events, the bridge structures are exposed to water for an increased amount of time. This ongoing exposure leads to corrosion and structural issues for each bridge. Prolonged exposure can lead to bridge failure and unsafe conditions. Additionally, multiple project bridges are prone to drift/debris collection. When the bridges flood, the inadequate bridge spans allow for substantial amounts of debris to collect along the structure. The debris adds increased stress to the bridge and accelerates the rate of scour. Debris collection may lead to bridge closure until the debris can be removed and NCDOT can verify the structural integrity of the bridge. This process further prolongs the impacts of flooding on the project bridges. The bridge replacements will be designed with these issues in mind. The new structures will be more resilient and less prone to debris collection. This will minimize both the number of bridge closures and the length of time bridges are closed during and following weather events.

Even during typical operating conditions, these structures pose multiple challenges to community safety, as the bridges do not meet current Federal and NCDOT design safety standards. All project bridges are currently identified as either functionally obsolete or structurally deficient due to their bridge sufficiency ratings. One of the project bridges is a single-lane facility, and the roadway crossing of the other three bridges and one structure are very narrow. The project seeks to mitigate such safety issues by redesigning BLUE RIDGE bridges to meet current design standards, widen single-lane bridges, and implement or widen shoulders to reduce the potential for crashes with fatalities and injuries, and promote safety and mobility

BLUE RIDGE

Buncombe and Madison Counties

for both motorized and non-motorized travel modes. The current conditions of the project structures can be found in **Table 2**.

Table 2: *Current Bridge Conditions; Source: Routine Bridge Inspection Reports*

Structure ID	Year Built	Existing Width (feet)	Load Restriction	Sufficiency Rating	Additional Features
100078	1950	24	No	56.05, functionally obsolete	on national network for trucks, school bus route
100154	1951	18.1	No	62.04, functionally obsolete	on national network for trucks, schools bus route
100203	1928	19.9	No	46.36, structurally deficient	on national network for trucks
560149	1951	17.3	No	44.92, structurally deficient	on national network for trucks
560531	1985	N/A	No	72.63, structurally deficient	on national network for trucks, bicycle route

Despite these existing challenges, the project bridges are still important access points for industries, residents, and essential services throughout western North Carolina’s rural communities. The project will increase safety, improve the local and regional economy, facilitate truck movement, create jobs, bolster resiliency in response to climate change impacts, protect and restore the surrounding natural environment, enhance residents’ quality of life, and form a more equitable transportation network.

1.2 Regional Transportation Infrastructure Investment

The State Transportation Improvement Program (STIP) lays out the North Carolina Department of Transportation’s (NCDOT) plan for transportation projects during the next 10 years. The STIP is updated approximately every two years. In the 2020-2029 STIP, over \$1.53 billion has been programmed for 177 transportation projects in Division 13, where the project is located.

Even given such massive investment in transportation allocated to the project region, North Carolina faces substantial challenges to funding infrastructure projects. While critical to ensuring safety, mobility, and the economic competitiveness of the impacted region, these bridges have failed to score well enough to receive the necessary funding through NCDOT’s prioritization process due to their low traffic volumes. The federal funds sought through this grant application will expedite improvements to these five structures to improve safety and accessibility in the region that relies heavily on these structures to meet daily needs.

1.3 Project History

The NCDOT has made significant maintenance investments in the project structures and surrounding infrastructure. NCDOT has had repair/maintenance crews on the project sites and surrounding areas following over 14 flood events over the last five years, with costs totaling approximately \$4.6 million. Some examples of previous maintenance include slide repair, culvert repair, drift removal, substructure concrete repair, cleaning and painting structure steel, scour repair, and bed load removal. Exhibit 4 shows an example of water diversion for scour repair on end bent 2 on Bridge 100203 in Buncombe County. Despite best efforts, the continued maintenance is not enough to keep the bridges functioning safely. More substantial improvements are necessary to keep the bridges functioning and serving their respective communities.

1.4 Project Location

The project bridges are located in Buncombe and Madison Counties, North Carolina, ranging from 9 to 30 miles outside of the Asheville Metropolitan area. These counties are part of the Appalachian Region of the Eastern U.S. Historically, Appalachian regions of the U.S. have had a higher percentage of working poor and a higher poverty rate than other areas of the country. Residents in these regions struggle with unemployment, low wages, lack of social services, educational disparities, and poorly developed infrastructure. The conditions of the Appalachian Region of the U.S. contribute to the creation of vulnerable populations and infrastructure in these areas. BLUE RIDGE aims to provide these vulnerable populations with more reliable transportation access and increase resiliency in their region.

General information on each project bridge can be found in Table 3 and key resources in the vicinity of each bridge are shown on **Figures 7 through 10**.

Table 3: *Current Bridge Conditions*

Structure ID	County	Facility	Water Body Crossed
100078	Buncombe	NC 197	North Fork Ivy Creek
100154	Buncombe	SR 1003	Dillingham Creek
100203	Buncombe	SR 2416	Beetree Creek
560149	Madison	SR 1318	Big Laurel Creek
560531	Madison	SR 1135	Walnut Creek

Source: *Routine Bridge Inspection Reports*

BLUE RIDGE

Buncombe and Madison Counties

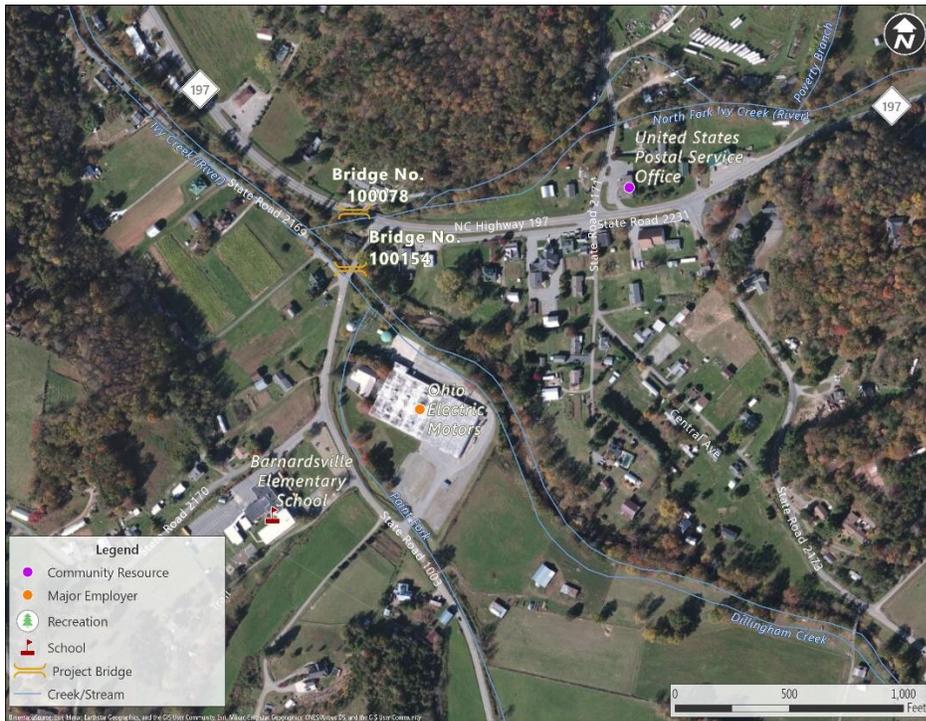


Figure 7: Bridge 100078 and 100154 project vicinity

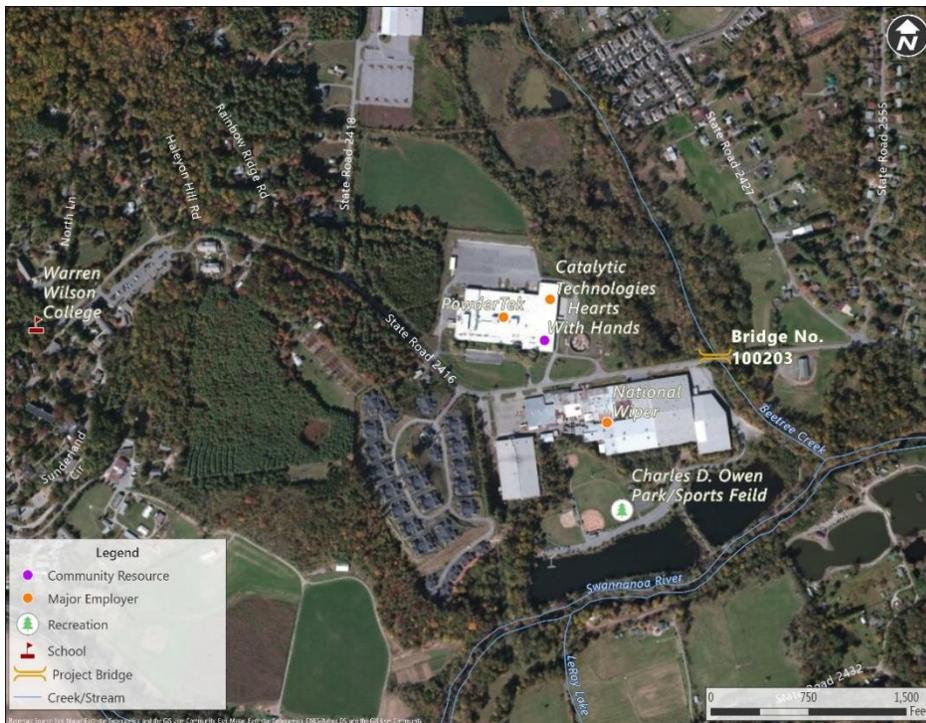


Figure 8: Bridge 100203 project vicinity

BLUE RIDGE

Buncombe and Madison Counties



Figure 9: Bridge 560149 project vicinity

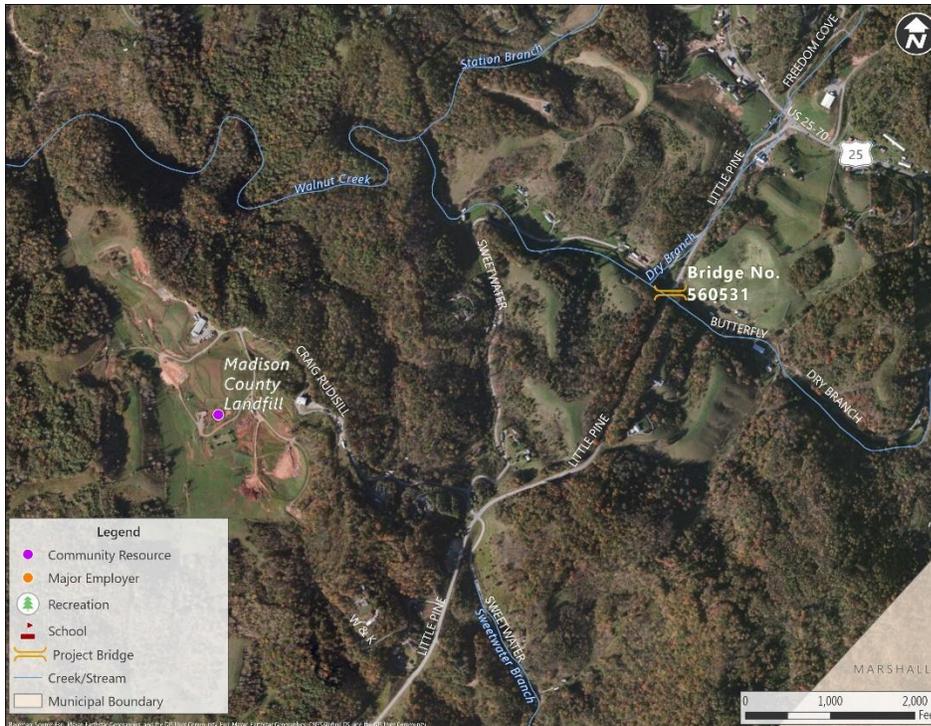


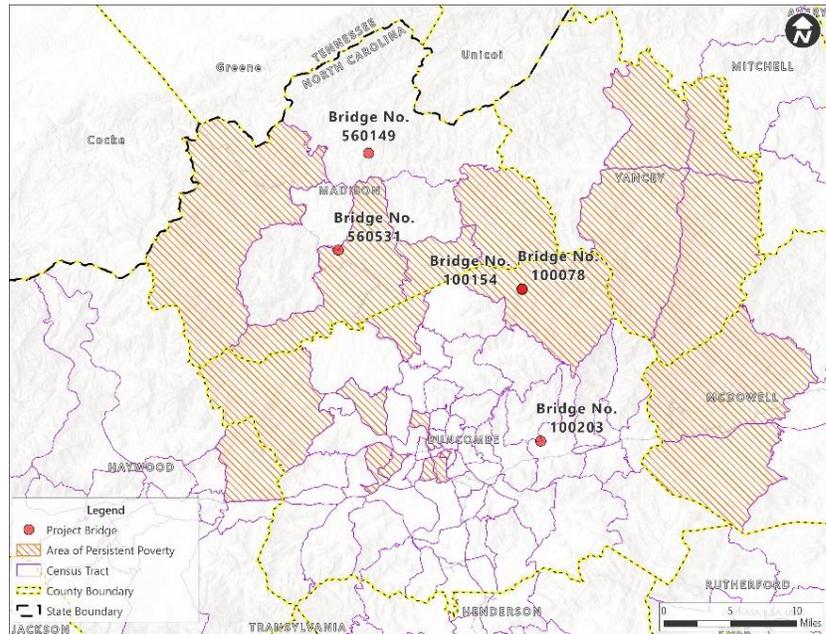
Figure 10: Bridge 560531 project vicinity

BLUE RIDGE

Buncombe and Madison Counties

Three of the project structures are located in or adjacent to Areas of Persistent Poverty (See **Figure 11**), and four are located in or adjacent to Areas of Historically Disadvantaged Communities. This project aligns with the Justice40 Initiative and Executive Order (EO) 13985 as 60% of the project bridges serve Areas of Persistent Poverty which exceeds the required 40%. These conditions have contributed to the creation of transportation disadvantaged populations in the project areas. Additional information about how the project will benefit disadvantaged populations is provided in Section 5.a.

Figure 11: Areas of Persistent Poverty in project area



Furthermore, as the impacts of climate change continue to worsen, these areas will become more vulnerable to increasingly frequent and severe weather events. Not only will essential services such as emergency response and transportation accessibility be negatively impacted, but these identified areas will face increasing challenges to their safety and quality of life, and Areas of Persistent Poverty will be even more detrimentally affected.

1.5 Project Parties

NCDOT will serve as the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) 2023 Applicant and Recipient. NCDOT is the owner of project right of way and will be responsible for administering the grant if selected for award and providing oversight of project delivery. NCDOT understands USDOT's reporting requirements and maintains the records and accounting systems to comply with the PROTECT program's reporting and administration requirements.

This project supports NCDOT's identified mission of:

Connecting people, products, and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina.

and is aligned with NCDOT’s vision:

It is NCDOT’s vision to be a global leader in providing innovative transportation solutions.

NCDOT has a rich experience of utilizing federal transportation funding and managing federal discretionary grants. As a direct recipient of USDOT funding and a strong model using State funds, NCDOT is responsible for managing the second-most amount of roadway miles in the United States. This requires a skilled understanding of federal requirements, project management, and fiscal responsibility. NCDOT has dedicated staff to help oversee grants management for its discretionary projects as well as seasoned project managers to oversee the implementation of awarded projects.

Since 2017, NCDOT has been awarded \$525 million in discretionary grant funding from USDOT’s Federal Highway Administration. These projects include INFRA grant awards from 2017 to improve US 70 and I-95 (\$147 million) and 2020 for upgrades on US 74 from Asheville, NC to Wilmington, NC (\$25 million). NCDOT has received other discretionary grant awards through BUILD and RAISE grant applications. These projects began construction on schedule and the Department is adhering to federal funding and reporting requirements through implementation.

NCDOT has also successfully partnered with various states, local governments, planning organizations, military organizations, and transit agencies for discretionary grant funding. In 2021, the Department partnered with High Point, NC to receive a \$19 million award from the Federal Highway Administration. NCDOT typically serves as the direct recipient of federal discretionary grant projects on behalf of local government awardees in order to utilize NCDOT’s staff and resources in managing federal grants. NCDOT takes pride in the strong working relationships with its many partners, which contribute to success in implementing complex projects.

Other project parties involved can be found in **Table 4**.

Table 4: *Project Parties*

Structure ID	Additional Parties Involved
100078	Buncombe County, French Broad River MPO, Land of Sky RPO
100154	Buncombe County, French Broad River MPO, Land of Sky RPO
100203	Buncombe County, French Broad River MPO, Land of Sky RPO
560149	Madison County, Land of Sky RPO
560531	Madison County, Land of Sky RPO

2 Grant Funds, Sources, and Uses of All Project Funding

BLUE RIDGE will likely not be completed without PROTECT grant funding. The project is estimated to cost \$15.5 million (year of expenditure [YOE] dollars), and this proposal requests \$12.4 million (YOE dollars) in PROTECT grant funding to implement the improvements. A non-Federal match of \$3.1 million (YOE dollars) is committed to the project and will be provided by NCDOT from the State Bridge Program (SBP). A letter of funding commitment from NCDOT is provided in **Appendix C**.

The capital costs, sources, and uses of funds for all five project structures are summarized in **Table 5** below. The estimated project costs include adequate contingency to account for risks related to supply chain and cost volatility and unanticipated cost increases. Previously incurred expenses total \$743,894 (YOE dollars) to perform drift and debris removal, scour repair, abutment repair, and slide repair.

Table 5: Cost Summary

Structure ID	Estimated Cost (PE, ROW, Construction)	Grant Funding Requested	Local Match (NCDOT SBP)
100078	\$5,226,750	\$4,181,400	\$1,045,350
100154	\$3,961,750	\$3,169,400	\$792,350
100203	\$2,926,750	\$2,341,400	\$585,350
560149	\$2,351,750	\$1,881,400	\$470,350
560531	\$1,086,750	\$869,400	\$217,350
TOTAL	\$15,553,750	\$12,443,000	\$3,110,750

3 Merit Criteria

3.1 Vulnerability and Risk

3.1.1 Exposure

Each bridge needs replacement or rehabilitation due to continued exposure to natural hazards. More specifically, constant flood events due to climate change continue to cause structural damage to each bridge. The project bridges are highly susceptible since most of them are located in or near a floodplain (**Figure 12**). Over the last five years, the project area has been

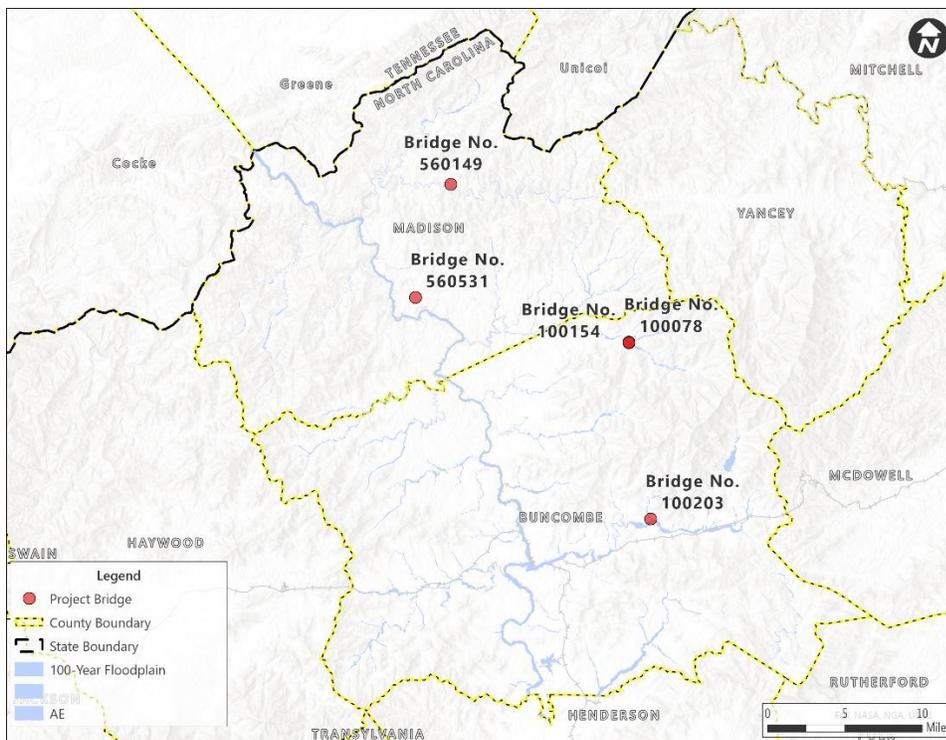
BLUE RIDGE

Buncombe and Madison Counties

impacted by over 14 flood events. These direct impacts include structural damage, debris pileup, and scouring, which all lead to bridge closures. Even if a project bridge was not directly impacted during an event, it may have served as a critical detour route during repairs to other bridges or roadway sections. According to the 2020 North Carolina Climate Risk Assessment and Resilience Plan, the number of flooding events is projected to increase. As regional flood events increase, this increases the surrounding communities' reliance on the project bridges as important detour routes for access to services.

To increase the resiliency of the structures and the community, exposure to natural hazards and flood events must be decreased. Decreasing the exposure of the project bridges to weather events will reduce the impacts and risk caused by the weather events.

Figure 12: 100-Year Floodplain in project area



3.1.2 Sensitivity

The project proposes to improve the resiliency of five structures against impacts from severe weather events worsened by climate change. Part of increasing the resiliency of the bridges is reducing the sensitivity of the bridges to climate related impacts. This will be done through the design elements of the bridge replacements and rehabilitation. More specifically, the design elements listed below:

- Bridge 100078: This bridge is a hybrid structure that combines a 4-barrel box culvert with a 2-span bridge. This hybrid design results in debris and bedload collecting at the inlet and

under the structure. Replacement with a more open bridge would allow this debris to wash out, and coordination of this bridge replacement with the replacement of adjacent Bridge 100154 would increase efficiency of design options and further enhance the stream restoration efforts on Ivy Creek (Dillingham Creek). Additional information on the stream restoration project is provided in Section III.3.c.

- Bridge 100154: The replacement of Bridge 100154 includes the realignment of the bridge to better accommodate the Buncombe County stream restoration work taking place along the creek (see Section III.3.c). The stream restoration includes restoration of the stream channel and streambanks which will provide protection against erosion, allow for efficient sediment transport, and provide resiliency to the surrounding properties during storm events. This realignment, along with the stream restoration will reduce the future buildup of sediment and debris along the bridge/roadway while also preserving the natural environment.
- Bridge 100203: Bridge 100203 is currently identified as structurally deficient due to extensive scouring of one of the end bents. The replacement of the bridge will remove the affected end bent out of the stream and align the skew angle better with the stream. These design elements of the new bridge will prevent future scouring along the end bents and increase the resiliency of the structure.
- Bridge 560149: The replacement of Bridge 560149 includes removing the end bents from the stream as well as widening the hydraulic opening. These elements will increase the capacity of the hydraulic opening, making it better able to handle major weather events, leading to less scouring and the preservation of the natural environment. In addition, widening of the roadway section over the bridge to two lanes will allow for improved traffic flow and safety.
- Structure 560561: The improvements to Bridge 560561 include re-lining of the existing pipes to decrease the vulnerability of the structure. The new lining will decrease the erosion of the pipes from the stream.

3.1.3 Adaptive Capacity

The project bridge improvements will increase the resiliency of the structures while reducing the sensitivity to climate related impacts. Specific improvements include the widening of structures to accommodate increased stream flow during heavy precipitation events and the relocation of end bents out of the streams to prevent scouring and prevent debris from catching under the structure. Additionally, two of the project bridge replacements are in conjunction with a stream restoration project that will incorporate nature-based solutions to improve stream flow, reduce erosion, and improve overall resiliency. Increased structure resiliency will allow for the project bridges to stay open during and following heavy precipitation events, reducing the need for lengthy and inaccessible detours. These improvements will allow for the project bridges to better withstand impacts from severe weather events through modernized designs, increased strength of structures and materials, and decreased exposure to natural hazards.

3.2 Criticality to Community

3.2.1 Support Continued Operation or Rapid Recovery of the System

The project bridges serve as primary access points for residents to necessary resources and services. They are along key collector routes to employers, schools, community resources, and medical services. The closure of the project bridges impacts the ability of residents and emergency responders to access critical destinations.

Not only are the project bridges necessary as access points for their surrounding rural communities, but they are also often needed for more widespread use. During regional flooding events, project bridges are necessary for detour routes and accessibility. They are often relied on for detours when weather events inhibit the use of nearby roads and structures. For example, following a flood event in February 2020, a nearby road (SR 1395) was closed for 10 months. Bridge 560149 was part of the detour route during the roadway repairs.

Additionally, some of the project bridges are along the most efficient routes accessible to truck traffic. Multiple detour options include roadways that do not accommodate truck traffic due to width restrictions. This demonstrates the critical importance of the project bridges to truck traffic and freight movement.

3.2.2 Provide Continued Access to Critical Assets and Facilities

The project bridges serve as primary access routes for residents and emergency responders to critical resources and services. For residents, this includes access to schools, medical facilities, employers, grocery stores, and community services. For emergency responders, this includes access to residents in need as well as medical services. Specific assets in proximity to each bridge are listed below and shown in **Figures 7 through 10** above:

- Bridge 100078: Barnardsville Elementary School, Ohio Electric Motors (largest employer in the community), United States Postal Service office; located adjacent to Bridge 100154
- Bridge 100154: Barnardsville Elementary School, Ohio Electric Motors (largest employer in the community), United States Postal Service office; located adjacent to Bridge 100078
- Bridge 100203: Warren Wilson College, Charles D. Owen Park/Sports field, PowderTek (major employer), National Wiper Alliance (major employer), Catalytic Technologies (major employer), Hearts with Hands (community disaster relief resource)
- Bridge 560149: US 25/70 on the west end to I-26 on the east end and runs the border of Pisgah National Forest near Shelton Laurel Backcountry Area
- Structure 560531: Madison County Landfill

3.2.3 Consequences If Improvements Are Not Made

NCDOT identified the project bridges based on the most urgent needs of the residents in their region. If the project were to not be implemented, the surrounding communities would suffer greatly. Were the project bridges to fail, access to critical resources as well as safety would greatly decrease across the region. Travel times would increase due to the use of lengthy detour options and freight movements would be heavily debilitated. Given the existing condition of the project bridges, the project must be completed in the near term to avoid further negative community impacts as the available detour routes are not viable long-term options.

3.3 Design Elements

3.3.1 Anticipated Service Life

The anticipated service life of the project bridges was determined based on the latest bridge inspection reports from NCDOT. Assuming a total service life of approximately 75 years, one project bridge has already reached the end of its useful service life and three project bridges will reach the end of their useful service lives in the next three years.

3.3.2 Elements Specifically Addressing Current or Future Vulnerabilities

The bridge improvements include design elements that address current vulnerabilities and assumptions of future weather events. The current vulnerabilities include issues with flooding due to exposure to water and debris capture. Specific design elements of replacement bridges will address debris capture and decrease scour by widening the bridges and realigning bridge structures to move piers and end bents out of streams. Deterioration of existing pipes at Structure 560531 will be addressed by re-lining the pipes to extend their useful life and better withstand increased flow during storm events.

3.3.3 Consideration of Nature-based Solutions

NCDOT is partnering with Buncombe County to implement nature-based solutions in the bridge designs for Buncombe County. They plan to align the bridge replacement design of Bridges 100154 and 100078 with a stream restoration project (**Figure 13**). The existing bridges prove problematic as they have central supports that serve to capture debris and sediment which block the flow of the creek below. During major weather events this blockage causes flooding that endangers the traffic flow across the bridge. Additionally, the frequent flooding impacts the primary business district of Barnardsville, which severely impacts education, economic development, and resident well-being. In order to address these longstanding issues, Buncombe County has worked with residents, elected officials, and subject matter experts to develop a resolution plan.

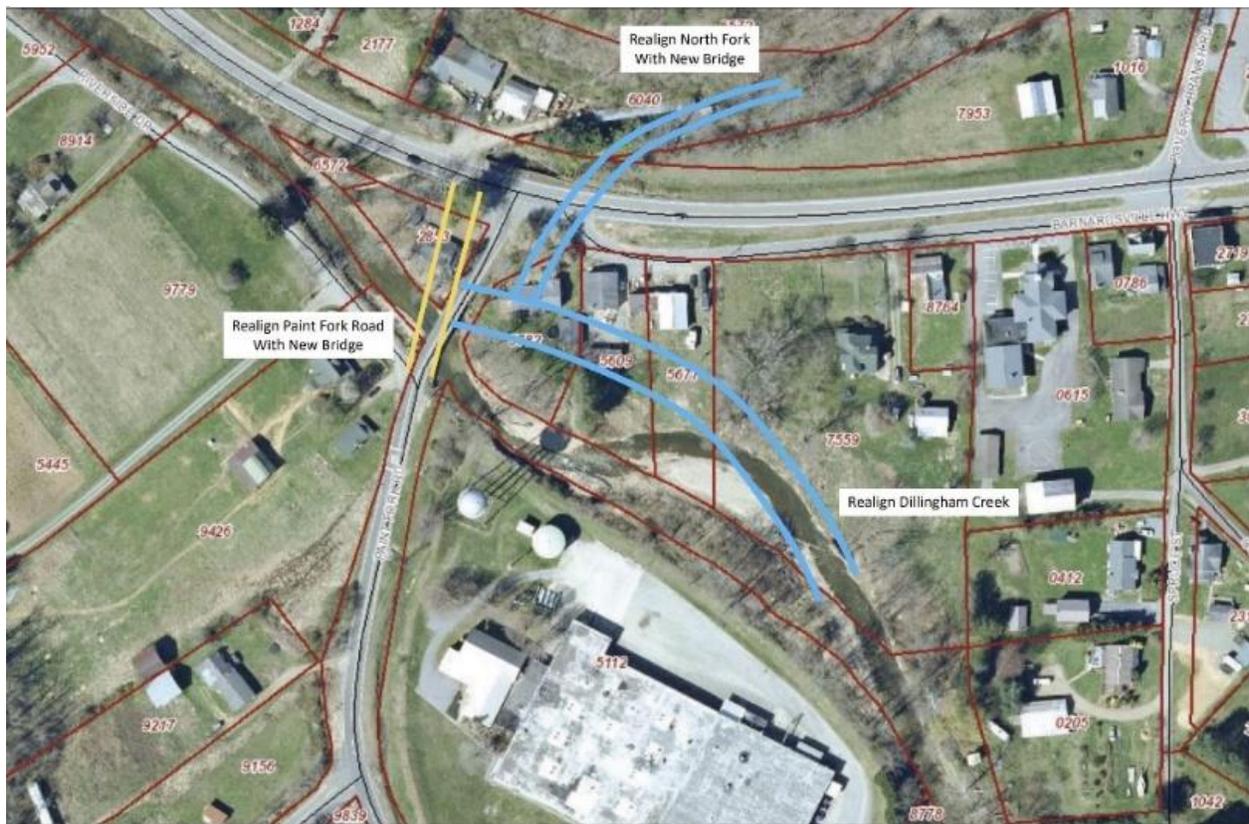
To address these issues, Buncombe County has developed a three-part solution:

BLUE RIDGE

Buncombe and Madison Counties

- 1) The first portion of the solution is the restoration of Dillingham Creek. The stream restoration project will realign the creek as well as restore the stream channel and streambanks to provide protection against erosion, allow for efficient sediment transport, and provide resiliency to the surrounding properties during storm events.
- 2) The second part of the solution is to purchase the six flood prone properties adjacent to the creek to allow for the realignment and stream restoration as well as provide the necessary for flood mitigation during weather events.
- 3) Lastly, the project bridges need to be replaced to reduce blockage and align better with the creek.

Figure 13: Bridge 100154 and 100078 realignment plan with stream restoration project



The combination of the three solution parts laid out by Buncombe County will decrease the impact of weather events on the structures, the stream channel and streambanks, and the surrounding properties, while increasing resiliency against future weather events. Additional information and documentation on the Barnardsville Flood Mitigation Project is provided in the Supplemental Materials (<https://connect.ncdot.gov/resources/PROTECT2023-Div13/Pages/default.aspx>).

3.3.4 Safety Improvements

The existing project bridges exhibit safety deficiencies for all traffic modes. All project bridges are currently identified as either functionally obsolete or structurally deficient due to their bridge sufficiency ratings. They also do not meet current state design and safety standards. The project bridges are very narrow and additionally, one is a one-lane bridge serving a two-lane road requiring traffic to “take turns” to cross the bridge. The bridges also lack shoulders for the safe accommodation of bicycle and pedestrian traffic. These factors contribute to systemic safety issues on the BLUE RIDGE bridges.

To address the safety concerns, the bridge improvements will include wider lanes and shoulders to bring the bridges up to current design and safety standards. Wider lanes will provide increased safety for all modes of transportation. BLUE RIDGE supports a critical component of the National Roadway Safety Strategy⁴ by improving mobility for vulnerable populations in Areas of Persistent Poverty and rural Appalachian areas (see section 2). With PROTECT funding, the project bridges can be promptly replaced/rehabilitated to increase access and safety for the surrounding communities. Additionally, the project aligns with NC’s Vision Zero⁵ goals, aiming at designing infrastructure to protect users and decrease crashes, and contributes to the “Safer Roads” objective in the National Roadway Safety Strategy.

The project also focuses on safety strategies other than specific bridge designs. BLUE RIDGE will reduce the likelihood of crashes by reducing vehicle miles traveled associated with detours as described previously. The project will also increase regional safety by improving access to healthcare and emergency services. Lastly, the project will improve access for emergency responders to vulnerable populations. More specifics on the impact of the project’s safety improvements can be found in the BCA Technical Memorandum.

3.3.5 Detailed Maintenance Plan

To ensure the longest possible usage life and safer transportation routes, NCDOT developed a Transportation Asset Management Plan in 2019. The Transportation Asset Management Plan (TAMP)⁶ is a strategic framework that positions agencies to consider the full life-cycle cost when evaluating, managing, and investing in transportation assets and infrastructure. It establishes a business-like approach within an agency that looks to limit long-term costs, while extending the overall life cycle and boosting the system-wide performance of the transportation network. The purpose of the TAMP is to document the transportation assets that fully encompass NCDOT’s transportation network in order to maintain and preserve that network. The maintenance of the

⁴ <https://www.transportation.gov/NRSS>

⁵ <https://ncvisionzero.org/>

⁶ <https://connect.ncdot.gov/resources/Asset-Management/TAMP/Final%20TAMP%20-%20June%202021.pdf>

BLUE RIDGE

Buncombe and Madison Counties

project bridges will fall under the scope of the TAMP. They will be assessed and maintained according to state-wide guidelines set forth in the TAMP to ensure the preservation and connectivity of NCDOT's transportation network.

3.4 Public Engagement, Partnerships, Collaboration

NCDOT is collaborating with the French Broad River MPO (FBRMPO), The Land-Of-Sky RPO (LOSRPO), Buncombe County, and Madison County to ensure equity considerations are meaningfully incorporated into the planning and project development through regular engagement and to ensure that the components of the project are included in long-range transportation plans.

Public engagement was incorporated into the FBRMPO and Rural Areas of Buncombe and Haywood Counties Comprehensive Transportation Plan (CTP) and the Madison County CTP, within project counties. **Table 6** summarizes the efforts involved.

Table 6: Public Engagement Efforts

County	Plan	Engagement Effort
Buncombe	2008 FBRMPO CTP	3 work sessions, 3 public drop-in sessions, 3 public hearings
Madison	2012 CTP	3 public drop-in sessions and 4 public hearings

Additionally, NCDOT is partnering with Buncombe County on the replacement of Bridge 100154. The replacement of the bridge will include design elements to align with Buncombe County's stream restoration plan occurring at the site of the bridge. See more information about the stream restoration plan in Section 3.c.

Support letters can be found in **Appendix B**. Additional support letters will be uploaded to the Supplemental Materials site.

3.5 Equity and Justice⁴⁰

When the project bridges are closed, detours increase the cost of transportation and decrease transportation access for disadvantaged communities. According to the USDOT Equitable Transportation Community Explorer⁷, all census tracts containing project bridges fall into the disadvantaged category in terms of transportation insecurity. Transportation insecurity is split

⁷ <https://experience.arcgis.com/experience/0920984aa80a4362b8778d779b090723/page/ETC-Explorer---State-Results/>

BLUE RIDGE

Buncombe and Madison Counties

into three sections: Transportation Access, Transportation Cost Burden, and Traffic Safety. The closure of project bridges enhances the issues of all three sections of transportation insecurity. The length of the proposed detours decreases transportation access, increases transportation cost burden, and decreases traffic safety for already disadvantaged communities when it comes to transportation insecurity. The project improves access for disadvantaged communities by providing reliable routes that are more resilient during severe weather events. It also decreases transportation cost burden by increasing the resiliency of the bridges and reducing the amount of bridge closures.

As shown in Section III.2.b, the project bridges function as connectors to critical services, good-paying jobs, and facilities that improve quality of life in the project communities. These services and resources include major employers, medical services, community resources, educational facilities, and recreational facilities. The increased resiliency to weather events and reliability of the project bridges as a result of BLUE RIDGE ensures continued access to services even during storm events.

3.6 Climate Change and Sustainability

3.6.1 Reduces Greenhouse Gas Emissions

The proposed project will reduce greenhouse gas (GHG) emissions in multiple ways. If the bridges were to be out of commission, GHG emissions would be increased due to the long detour routes available. The project will produce reliable and more resilient structures with the goal of reducing the need for detours during major weather events. The proposed improvements also include the widening of some of the project bridges for bicycle use. This improvement allows for safer bicycle traffic along the roadway. An increase in bicycle traffic is an increase in energy-efficient travel modes which will reduce GHG emissions in the project area.

Additionally, the project reduces lifecycle GHG emissions. Since the project proposes more resilient structures, the project bridges will have a longer use life and require less maintenance than the existing bridges. Less maintenance and longer use life will reduce lifecycle GHG emissions than if the bridges were to continue their current maintenance cycle.

3.6.2 Addresses Disproportionate Impacts on Disadvantaged Communities

The BLUE RIDGE project will address disproportionate negative environmental impacts on disadvantaged communities by improving the resilience of the transportation system in and adjacent to Areas of Persistent Poverty.

3.6.3 Avoids Adverse Environmental Impacts.

By removing impediments to stream flow and areas of debris collection, the proposed project will reduce scour and erosion of stream banks, as well as reduce flooding of adjacent properties.

BLUE RIDGE

Buncombe and Madison Counties

In addition, all design and construction activities will adhere to NCDOT’s Erosion and Sediment Control Design and Construction Manual⁸, including best management practices.

In addition, the collaboration of the replacement of Bridges 100078 and 100154 with Buncombe County’s Barnardsville Flood Mitigation Project will provide environmental benefits by realigning the creek to its natural condition and restoring the stream channel and streambanks to protect against erosion, allow for efficient sediment transport, and provide resiliency to the surrounding properties during storm events.

3.7 Schedule

The proposed project schedule is shown below. All funds would be obligated by September 30, 2026.

Table 7: Proposed project schedule (Note: schedule is shown in calendar years)

	2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Development												
Preliminary Engineering												
Environmental Document												
Final Design & Construction												
Final Design												
Right of Way												
Utility Relocation												
Construction												

3.8 Innovation

3.8.1 Innovative Technologies and Techniques.

Several innovative techniques will be incorporated into the design of the project bridges:

- The project bridges will be designed to accommodate the 25-year flood elevation, reducing the risk of overtopping and making them much more resilient and reliable during storm events. Additional innovations to accommodate increased rainfall and climate change will be evaluated during project design to meet current standards and also mitigate flood impacts to adjacent properties, in accordance with NCDOT’s Resilience Policy⁹ adopted in September 2021 and NCDOT’s 2022 Resilience Strategy Report¹⁰.

⁸https://connect.ncdot.gov/resources/roadside/SoilWaterDocuments/Erosion%20and%20Sediment%20Control%20Design%20and%20Construction%20Manual_Rev20220519.pdf

⁹<https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-policy.pdf>

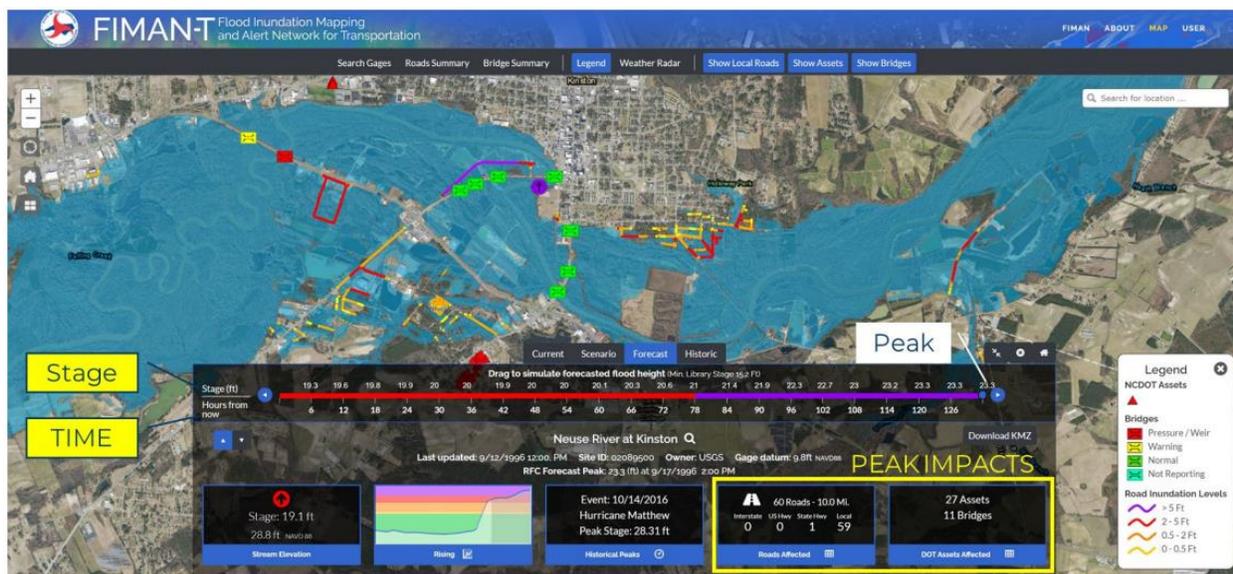
¹⁰<https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-report.pdf>

BLUE RIDGE

Buncombe and Madison Counties

- The replacement structures will be constructed with concrete decks and modern superstructures to improve accessibility and reduce maintenance requirements.
- Barrier rails will be installed to meet current standards, providing improved safety for motorists and pedestrians/bicyclists.
- The five project structures will include flood gages that provide flood warning and water-level monitoring. This information will support the application of the Flood Inundation Mapping and Alert Network Tool (FINMAN)¹¹ and BridgeWatch¹², two modeling programs that allow NCDOT to use the information from the flood gages to run simulations and forecasts as storm events unfold to predict future inundation by location as well as stresses on bridges (see **Exhibit 5**). This information is vital when planning a storm response or screening investments to improve the resilience of the network, especially for isolated households in the region with limited or no other means of ingress or egress.
- For Structure 560531, spincasting will be used to re-line the inside of the existing triple 10-foot pipes. This method creates new structurally independent pipes with 3-inch thickness that have a lifespan of at least 50 years. The original pipes can completely rot/disintegrate without affecting the new pipes. This method is much more cost-effective than replacing the existing pipes and eliminates the need to close the roadway during construction.

Exhibit 5: Example of FINMAN Forecast Tool to show predicted flood levels during storm events



¹¹ <https://fiman.nc.gov/>

¹² BridgeWatch is a real-time bridge flooding warning system that relies on stream gages and weather radar to indicate which bridges and culverts are near flooding, actively flooding, or have weather conditions favorable for flooding.

3.8.2 Best practices in partnerships and cost sharing.

As discussed in Section III.3.C, two of the project bridges in Buncombe County are part of a larger stream restoration/flood mitigation effort by Buncombe County and Town of Barnardsville. Buncombe County has already secured funding for the stream restoration portion of the project and is working to secure additional funding for the property buy-outs. The addition of PROTECT grant funds along with additional state funding to complete the associated bridge replacement projects with the County funding is a great demonstration of best practices in partnership and cost sharing.

3.9 Benefit Cost Analysis

BLUE RIDGE will provide comprehensive benefits for residents by improving transportation access and reliability throughout the region. As shown in **Table 8**, over the 20-year benefits period (2025-2044), the benefits and residual savings provide approximately \$97.8 million of net benefits. Based on the USDOT's Benefit Cost Analysis (BCA) guidance, the project's cumulative Benefit-Cost Ratio (BCR) is calculated to be 6.97. More details and a full summary of the inputs and outputs for the analysis can be found in the BCA Technical Memorandum (**Appendix A**).

Table 8: *Benefit Cost Results Summary*

Life-Cycle Costs	\$16,375,366
Life Cycle Benefits	\$114,176,952
Net Present Value	\$97,801,586
Benefit Cost Ratio	6.97

**PROTECT FFY 2022 and 2023
GRANT APPLICATION
AUGUST 2023**

BLUE RIDGE

**Bridge Longevity Upgrades to
Enhance Resiliency, Increase
Dependability, and Grow Equity**



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Appendix A

Benefit Cost Analysis

BLUE RIDGE

Bridge Longevity Upgrades to
Enhance Resiliency, Increase
Dependability, and Grow Equity



**Benefit Cost Analysis
Technical Memorandum
AUGUST 2023**



**BLUE RIDGE – PROTECT Grant:
BENEFIT COST ANALYSIS TECHNICAL MEMORANDUM**

Table of Contents

Introduction.....	1
Merit Criteria	2
Program Alignment.....	2
Schedule and Budget.....	3
Public Engagement, Partnerships, and Collaboration.....	3
Innovation	3
Vulnerability and Risk	3
Criticality to Community	4
Design Elements	5
Equity and Justice 40	5
Climate Change and Sustainability.....	6
BCA Assumptions, Methodology, and Results	7
General Project Assumptions.....	7
5.1 Safety	8
Safety Benefits	8
5.2 Travel Time Savings.....	9
Average Annual Daily Traffic (AADT) Demand Forecast	9
Travel Time Savings (TTS)	10
Vehicle Travel Time Savings.....	10
Automobile and Freight Travel Time Savings.....	11
Reliability.....	11
5.3 Operating Cost Savings.....	11
5.4 Emissions Reduction Benefits	12
5.5 Facility and Vehicle Amenity Benefits.....	12
Pedestrian and Bicycle Facilities	12
5.6 Health Benefits.....	13
5.7 Other Benefits	13
Agglomeration Economies.....	14

BLUE RIDGE
 Buncombe and Madison Counties

Emergency Services.....	14
Stormwater Runoff.....	14
Wildlife Impacts.....	14
5.8 Other Issues in Benefits Estimation.....	15
Benefits to Existing and Additional Users.....	15
Modal Diversion	15
Work Zone Impacts.....	15
State of Good Repair.....	15
Geographic Extent	15
Property Value Increases	15
6.1 Capital Costs	15
6.2 Operations and Maintenance Costs.....	16
6.3 Residual Value Analysis	16
BENEFIT-COST RATIO	17

List of Tables

Table 1: Benefit Cost Results Summary (2021\$)	1
Table 2: BCA General Assumptions	8
Table 3: Project Study Area Crashes and Severity (January 2018- December 2022) (Excel tab 5.1)	9
Table 4: Proposed CMFs to be Applied to the Project (Excel tab 5.1)	9
Table 5: Anticipated Crash Cost Savings (Excel tab 5.1)	9
Table 6: Travel Time Savings Assumptions (Base Year Traffic Volumes)	10
Table 7: Estimated Annual Volume (Excel tab 5.2a and 5.2b)	10
Table 8: VTTS Over the 20-year Horizon (Excel tab 5.2a and 5.2b)	11
Table 9: Anticipated Operating Costs Per Hour (Excel tab 5.3)	11
Table 10: Total Operational Cost Savings (Excel tab 5.3)	12
Table 11: Value and Amount of Emissions Reductions (Excel tab 5.4)	12
Table 12: Anticipated Bicycle and Pedestrian Benefit (Excel tab 5.5)	13
Table 13: Anticipated Health Benefit (Excel tab 5.6)	13
Table 14: Capital Cost (Excel tab 6.1)	15
Table 15: Maintenance Costs (Excel tab 6.2)	16
Table 16: Residual Year Value (Excel tab 6.3)	16
Table 17. The BLUE RIDGE Benefit Cost Analysis (in 2021\$) (Excel tab Benefits + Costs Summary)	17

List of Figures

Figure 1: BLUE RIDGE Project Location..... 2

BLUE RIDGE – PROTECT Grant
BENEFIT COST ANALYSIS TECHNICAL MEMORANDUM

Introduction

The North Carolina Department of Transportation (NCDOT) is pursuing a PROTECT grant for four full bridge replacements and one structure rehabilitation in Buncombe and Madison Counties. The project aims to improve regional resiliency in a rural and economically disadvantaged portion of North Carolina. It will also increase reliability and maintain accessibility in a region that has limited available detour routes due to mountainous terrain.

The Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity (BLUE RIDGE) project will implement NCDOT design standards to increase safety and traffic mobility in the project areas. These designs include increased shoulder widths, additional lanes where applicable, and increased lane widths.

This document outlines the methodologies, assumptions, and values identified within the Benefit Cost Analysis (BCA) and is a supporting technical memorandum (Tech Memo) for the grant narrative. The BCA has been included with the grant submittal as an Excel workbook, and as applicable, has utilized the methodologies and values identified within the USDOT 2023 Benefit-Cost Analysis Guidance for Discretionary Grant Programs (BCA Guidance). To further correlate the analysis with the BCA Guidance, the chapter headers and supporting Excel worksheets have been labeled in accordance with the naming criteria of the BCA Guidance. For example, section 5.1 correlates to Safety Benefits, 5.2 correlates to Travel Time Savings, etc.

The BCA results are summarized in **Table 14**, and the supporting methodologies are summarized in the subsequent sections.

Table 14: Benefit Cost Results Summary (2021\$)

Life-Cycle Costs	\$16,375,366
Life Cycle Benefits	\$114,176,952
Net Present Value	\$97,801,586
Benefit Cost Ratio	6.97

The location of the BLUE RIDGE project is depicted in **Figure 1**.

BLUE RIDGE

Buncombe and Madison Counties

the shoulders and travel more safely along the project structures. Additionally, the increased use of alternative transportation modes will decrease emissions.

Schedule and Budget

The total cost of the bridge replacement project is \$15,553,750 (updated in August 2023). NCDOT is requesting \$12,443,000 from the PROTECT Discretionary grant program, comprising 80% of the future eligible costs.

The project schedule (shown below in calendar years) will meet the requirements of obligation to begin construction by September 30, 2026.

	2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Development												
Preliminary Engineering												
Environmental Document												
Final Design & Construction												
Final Design												
Right of Way												
Utility Relocation												
Construction												

Public Engagement, Partnerships, and Collaboration

NCDOT is collaborating with the French Broad River MPO (FBRMPO), The Land-Of-Sky RPO (LOSRPO), Buncombe County, and Madison County to ensure equity considerations are meaningfully incorporated into the planning and project development through regular engagement and to ensure that the components of the project are included in long-range transportation plans.

Public engagement was also incorporated into the FBRMPO and Rural Areas of Buncombe and Haywood Counties Comprehensive Transportation Plan (CTP) and the Madison County CTP, within project counties.

Additionally, NCDOT is partnering with Buncombe County on the replacement of Bridge 100154. The replacement of the bridge will include design elements to align with Buncombe County's stream restoration plan occurring at the site of the bridge. Additional information about the stream restoration project can be found in the Grant Narrative.

Innovation

Several innovative techniques will be incorporated into the design of the project bridges:

- The project bridges will be designed to accommodate the 25-year flood elevation, reducing the risk of overtopping and making them much more resilient and reliable during storm events. Additional innovations to accommodate increased rainfall and climate change will be evaluated during project design to meet current standards and also mitigate flood impacts to

BLUE RIDGE

Buncombe and Madison Counties

adjacent properties, in accordance with NCDOT's Resilience Policy¹ adopted in September 2021 and NCDOT's 2022 Resilience Strategy Report².

- The replacement structures will be constructed with concrete decks and modern superstructures to improve accessibility and reduce maintenance requirements.
- Barrier rails will be installed to meet current standards, providing improved safety for motorists and pedestrians/bicyclists.
- The five project structures will include flood gages that provide flood warning and water-level monitoring. This information will support the application of the Flood Inundation Mapping and Alert Network Tool (FINMAN)³ and BridgeWatch⁴, two modeling programs that allow NCDOT to use the information from the flood gages to run simulations and forecasts as storm events unfold to predict future inundation by location as well as stresses on bridges. This information is vital when planning a storm response or screening investments to improve the resilience of the network, especially for isolated households in the region with limited or no other means of ingress or egress.
- For Structure 560531, spincasting will be used to re-line the inside of the existing triple 10-foot pipes. This method creates new structurally independent pipes with 3-inch thickness that have a lifespan of at least 50 years. The original pipes can completely rot/disintegrate without affecting the new pipes. This method is much more cost-effective than replacing the existing pipes and eliminates the need to close the roadway during construction.

Vulnerability and Risk

The project will address the project structures and surrounding community's vulnerability to a range of risks, including flooding and climate change impacts. Vulnerability will be addressed and accounted for in the project designs through decreasing the structures exposure to natural hazards, reducing the sensitivity of the project structures to climate related impacts, and increasing the resiliency of the region. This will be done through specific design elements and realignments of project structures.

Criticality to Community

The project structures serve as primary access points for residents to necessary resources and services. They are along key collector routes to employers, schools, community resources, and

¹ <https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-policy.pdf>

² <https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-report.pdf>

³ <https://fiman.nc.gov/>

⁴ BridgeWatch is a real-time bridge flooding warning system that relies on stream gages and weather radar to indicate which bridges and culverts are near flooding, actively flooding, or have weather conditions favorable for flooding.

BLUE RIDGE

Buncombe and Madison Counties

medical services. The closure of the project bridges impacts the ability of residents and emergency responders to access critical destinations.

Not only are the project bridges necessary as access points for their surrounding rural communities, but they are also often needed for more widespread use. During regional flooding events, project bridges are necessary for detour routes and accessibility. They are often relied on for detours when weather events inhibit the use of nearby roads and structures. For example, following a flood event in February 2020, a nearby road (SR 1395) was closed for 10 months. Bridge 560149 was part of the detour route during the roadway repairs.

Additionally, some of the project bridges are along the most efficient routes accessible to truck traffic. Multiple detour options include roadways that do not accommodate truck traffic due to width restrictions. This demonstrates the critical importance of the project bridges to truck traffic and freight movement.

Moreover, the transportation infrastructure improvements will directly help businesses by decreasing their shipping costs, expanding their access to markets, and improving access to a larger pool of employees available for jobs. These improvements also benefit workers, who enjoy increased employment opportunities as travel times and costs are reduced.

Design Elements

The bridge improvements include design elements that address current vulnerabilities and assumptions of future weather events. The current vulnerabilities include issues with flooding due to exposure to water and debris capture. Specific design elements of replacement bridges will address debris capture and decrease scour by widening the bridges and realigning bridge structures to move piers and end bents out of streams. Deterioration of existing pipes at Structure 560531 will be addressed by re-lining the pipes to extend their useful life and better withstand increased flow during storm events.

More specific design elements are listed below:

- Bridge 100078: This bridge is a hybrid structure that combines a 4-barrel box culvert with a 2-span bridge. This hybrid design results in debris and bedload collecting at the inlet and under the structure. Replacement with a more open bridge would allow this debris to wash out, and coordination of this bridge replacement with the replacement of adjacent Bridge 100154 would increase efficiency of design options and further enhance the stream restoration efforts on Ivy Creek (Dillingham Creek).
- Bridge 100154: The replacement of Bridge 100154 includes the realignment of the bridge to better accommodate the Buncombe County stream restoration work taking place along the creek. The stream restoration includes restoration of the stream channel and streambanks which will provide protection against erosion, allow for efficient sediment transport, and provide resiliency to the surrounding properties during storm events. This realignment, along

BLUE RIDGE

Buncombe and Madison Counties

with the stream restoration will reduce the future buildup of sediment and debris along the bridge/roadway while also preserving the natural environment.

- Bridge 100203: Bridge 100203 is currently identified as structurally deficient due to extensive scouring of one of the end bents. The replacement of the bridge will remove the affected end bent out of the stream and align the skew angle better with the stream. These design elements of the new bridge will prevent future scouring along the end bents and increase the resiliency of the structure.
- Bridge 560149: The replacement of Bridge 560149 includes removing the end bents from the stream as well as widening the hydraulic opening. These elements will increase the capacity of the hydraulic opening, making it better able to handle major weather events, leading to less scouring and the preservation of the natural environment. In addition, widening of the roadway section over the bridge to two lanes will allow for improved traffic flow and safety.
- Structure 560561: The improvements to Bridge 560561 include re-lining of the existing pipes to decrease the vulnerability of the structure. The new lining will decrease the erosion of the pipes from the stream.

Equity and Justice 40

Three of the project structures are located in or adjacent to Areas of Persistent Poverty and four are located in or adjacent to Areas of Historically Disadvantaged Communities. This project aligns with the Justice40 Initiative and EO 13985 as 60% of the project bridges serve Areas of Persistent Poverty which exceeds the required 40%. These conditions have contributed to the creation of transportation disadvantaged populations in the project areas.

When the project bridges are closed, detours increase the cost of transportation and decrease transportation access for disadvantaged communities. According to the USDOT Equitable Transportation Community Explorer⁵, all census tracts containing project bridges fall into the disadvantaged category in terms of transportation insecurity. Transportation insecurity is split into three sections: Transportation Access, Transportation Cost Burden, and Traffic Safety. The closure of project bridges enhances the issues of all three sections of transportation insecurity. The length of the proposed detours decreases transportation access, increases transportation cost burden, and decreases traffic safety for already disadvantaged communities when it comes to transportation insecurity. The project improves access for disadvantaged communities by providing reliable routes that are more resilient during severe weather events. It also decreases transportation cost burden by increasing the resiliency of the bridges and reducing the amount of bridge closures.

⁵ <https://experience.arcgis.com/experience/0920984aa80a4362b8778d779b090723/page/ETC-Explorer---State-Results/>

BLUE RIDGE

Buncombe and Madison Counties

The project bridges function as connectors to critical services, good-paying jobs, and facilities that improve quality of life in the project vicinities. These services and resources include major employers, medical services, community resources, educational facilities, and recreational facilities. The increased resiliency to weather events and reliability of the project bridges as a result of BLUE RIDGE ensures continued access to services even during storm events.

Climate Change and Sustainability

BLUE RIDGE will address climate change through specific design elements. The new structures will be designed to minimize impacts from weather events caused by climate change. More information can be found in the Design Elements section.

Additionally, the proposed project will reduce GHG emissions in multiple ways. If the bridges were to be out of commission, GHG emissions would be increased due to the long detour routes available. The project will produce reliable and more resilient structures with the goal that the use of detours would be greatly reduced during major weather events. The proposed improvements also include the widening of some of the project bridges. The widening of these structures includes the widening of the shoulders for the use of bicycle traffic. This improvement allows for safer bicycle traffic along the roadway. An increase in bicycle traffic is an increase in energy-efficient travel modes which will reduce GHG emissions in the project area.

The project also reduces lifecycle GHG emissions. Since the project proposes more resilient structures, the project bridges will have a longer use life and require less maintenance than the existing bridges. Less maintenance and longer use life will reduce lifecycle GHG emissions more than if the bridges were to continue their current maintenance cycle.

In addition, the collaboration of the replacement of Bridges 100078 and 100154 with Buncombe County's Barnardsville Flood Mitigation Project will provide environmental benefits by realigning the creek to its natural condition and restoring the stream channel and streambanks to protect against erosion, allow for efficient sediment transport, and provide resiliency to the surrounding properties during storm events.

BCA Assumptions, Methodology, and Results

General Project Assumptions

The development of the BCA relies on a series of assumptions and methodologies to quantify the overall benefit of the proposed BLUE RIDGE project. To the extent feasible, assumptions and methodologies have been developed to correlate directly with the information provided within the BCA Guidance as updated for 2023. This Tech Memo describes the methodologies and references to the accompanying BCA Excel workbook.

Table2 outlines a series of general assumptions that have been utilized in this analysis.

Table 2: BCA General Assumptions

BCA General Assumptions	
Trucks/Buses allowed on roadway?	Yes
\$ Value Year:	2021\$
Data Base Year:	2021
Analysis Base Year:	2025
Analysis Forecast Year:	2044
Years to Construction:	2
Peak Hours / year:	12%
Non-peak Hours / year:	88%
Annual Traffic Growth Rate:	0.9%
Truck Percentage:	7%
Discount Rate:	7%
Discount Rate CO₂:	3%

5.1 Safety

A safety analysis was conducted for two different corridors. The structures were grouped into corridors for the purpose of the BCA based on historical traffic volumes. Structures with smaller traffic volumes were placed in the “rural” corridor and structures with larger traffic volumes were placed in the “urban” corridor. The rural corridor includes three structures (100154, 560149, 560531) and the urban corridor includes two structures (100078, 100203). The rural corridor includes 1.50 miles in which vehicle crashes located along the project structures were identified. The urban corridor includes 1.00 miles in which vehicle crashes located along the project structures were identified. This crash data was identified between January 2018 and December 2022, representing a five-year period of analysis.

The BLUE RIDGE corridor improvements are anticipated to reduce the overall number of crashes through the implementation of wider lanes, additional lanes when applicable, and wider shoulders. The corridor currently does not have bicycle and pedestrian infrastructure, and the addition of the wider shoulders will encourage the safer use of the corridor for the most vulnerable users.

Safety Benefits

Over the five-year period, six vehicular crashes were recorded along the rural corridor and ten vehicular crashes were recorded along the urban corridor. There were no recorded fatal crashes on this corridor between 2018 and 2022.

BLUE RIDGE
Buncombe and Madison Counties

Table 33 shows the number of crashes and their severity using the KABCO scale.

Table 3: Project Study Area Crashes and Severity (January 2018- December 2022) (Excel tab 5.1)

Crash Severity	Project Corridor
(A) Suspected Serious Injury	1
(B) Suspected Minor/Visible Injury	4
(C) Possible Injury / Complaint	0
(K) Fatal Injury	0
(O) No Injury	11
Total Crashes	16

Source: NCDOT Planning Level Safety Scoring Data

The planned corridor improvements are anticipated to reduce the number of crashes along the corridor. To quantify the benefit from this reduction, a series of Federal Highway Administration (FHWA) crash mitigation factors (CMFs) have been applied to the recorded crash data.

Table 4 indicates the applied CMFs and the anticipated reduction in the number of crashes.

Table 4: Proposed CMFs to be Applied to the Project (Excel tab 5.1)

CMF(s)	Crash Reduction Factor
4821	17.3%
4823	42.7%

Source: FHWA CMF Clearinghouse

The crash savings anticipated through the inclusion of the CMF(s) described above are depicted in **Table 5**.

Table 5: Anticipated Crash Cost Savings (Excel tab 5.1)

	Crash Cost Savings (2021\$)
Rural	\$554,498
Urban	\$924,945

Source: RS&H Analysis

5.2 Travel Time Savings

Average Annual Daily Traffic (AADT) Demand Forecast

To estimate future AADT, historical traffic volumes from NCDOT were utilized to determine the rural corridor’s annual traffic growth rate of 0.86% and the urban corridor’s annual traffic growth rate of 2.03% between 2018 and 2022. Count Stations from NCDOT were also utilized to understand historical traffic volumes along the roadway.

BLUE RIDGE

Buncombe and Madison Counties

Travel Time Savings (TTS)

Travel time savings were developed based on the known volumes, travel times, and detour travel times. It was predicted that toward the end of the usage life of the project structures, certain percentages of traffic would have to use the nearest detour to divert the structures. The following tables outline the assumptions related to TTS beginning with **Table 6** which highlights the monetary values associated with vehicle types and the overall volumes along the corridor.

Table 6 through **Table 8** depict the values and assumptions utilized to develop the TTS analysis.

Table 6: Travel Time Savings Assumptions (Base Year Traffic Volumes)

Vehicle Travel Time Savings Peak and Non-Peak Hour Assumptions (Base Year No-Build)		
	Rural (100154, 560149, 560531)	Urban (100078, 100203)
Data Base Year	2021	
Analysis Base Year	2025	
Years to Construction	2	
Analysis Forecast Year	2044	
Peak Hour Vehicle Average Volume (Year)	89,410	332,753
Non-Peak Hour Vehicle Average Volume (Year)	663,694	2,470,048
Peak Hour Vehicle Occupancy	1.48	
Non-Peak Hour Vehicle Occupancy	1.67	
Hourly Value of Travel - Personal Vehicles	\$18.80	
Hourly Value of Travel - Commercial Trucks	\$32.40	

Source: NCDOT, BCA Guidance

Vehicle Travel Time Savings

Travel time savings in this analysis were divided into peak hour (12% of the year) and non-peak (88% of the year) to more realistically estimate the time and operations savings within this analysis. During the peak time periods, vehicle occupancy was estimated at 1.48 person per vehicle, while during non-peak periods it was assumed that vehicles contained 1.58 person per the BCA Guidance. Truck traffic was identified as a percentage of total volumes (as identified by NCDOT) and trucks were assumed to have only one occupant. The anticipated vehicular volumes are depicted in **Table 7**.

Table 7: Estimated Annual Volumes (Excel tab 5.2a and 5.2b)

Segment Description	Year	Average Volume (total vehicles/year)	AUTOS: Average Volume (Autos / year)	TRUCKS: Average Volume (Trucks / year)
Rural	1	753,104	704,152	48,952
	20	885,789	828,213	57,576
Urban	1	2,802,801	2,620,619	182,182
	20	3,296,611	3,082,331	214,280

Source: NCDOT and RS&H Analysis

Automobile and Freight Travel Time Savings

Building upon the volumes identified above, the value of travel time savings (VTTS) for automobiles and trucks was developed. The values have been discounted by 7% to 2021 dollars and are depicted in **Table 8**.

Table 8: VTTS Over the 20-year Horizon (Excel tab 5.2a and 5.2b)

VTTS by Segment (2021\$)			
	Autos	Trucks	Total
Rural	\$9,221,938	\$711,401	\$9,933,339
Urban	\$76,045,716	\$5,810,081	\$81,855,797

Source: RS&H Analysis

Reliability

Reliability is another metric that was considered within this analysis but was not quantified. It is anticipated that the reduction in crashes, improved travel times, and general roadway improvements being implemented as part of this project will promote consistent and reliable travel times along the corridor.

5.3 Operating Cost Savings

Vehicle operating costs were estimated using the assumed travel time savings and anticipated costs per hour. This analysis varies from the BCA guidance, which specifically utilizes vehicle miles traveled (VMT); however, the same sources provided in the BCA Guidance also indicate operating cost estimates by vehicle hours traveled. To coincide with the assumed benefits associated with this project, the per hour costs have been utilized as identified within **Table 9**, while the total values over the 20-year period are depicted within **Table 10**.

Table 9: Anticipated Operating Costs Per Hour (Excel tab 5.3)

2022 BCA Guidance	Hourly Value of Travel Time Savings
In-Vehicle Personal	\$18.80
Commercial Vehicle Truck Drivers	\$32.40

Source: AAA Driving Costs (2022); ATRI An Analysis of Operational Costs of Trucking: 2023 Update

Table 10: Total Operational Cost Savings (Excel tab 5.3)

Operational Cost Savings by Segment (2021\$)			
	Autos	Trucks	Total
Rural	\$465,479	\$1,178,648	\$1,644,127
Urban	\$3,839,123	\$9,721,138	\$13,560,261

Source: RS&H Analysis

5.4 Emissions Reduction Benefits

The anticipated emissions reductions benefits have been developed based on the projected reduction in travel times related to the development of the project. This reduction in travel time (calculated as a reduction in vehicle idle time) is anticipated to directly reduce the NO_x, CO₂ and PM_{2.5} emissions within the study area. The anticipated emissions reductions have been discounted to the 2021 base year using a 7% discount rate, with the exception of the CO₂ values which have been discounted by 3%, per the BCA Guidance. The quantified emissions over the 20-year period are depicted within **Table 11**.

Table 11: Value and Amount of Emissions Reductions (Excel tab 5.4)

Carbon Dioxide (CO ₂) Avoided*	Value of CO ₂ Avoided (2021\$)	NO _x Avoided*	Value of NO _x Avoided (2021\$)	PM _{2.5} Avoided*	Value of PM _{2.5} Avoided (2021\$)	Total Value (2021\$)
88,294.79	\$1,508,666	150.74	\$578,225	4.21	\$805,423	\$2,892,315

*Values are in Short Ton; Source: RS&H Analysis

5.5 Facility and Vehicle Amenity Benefits

Pedestrian and Bicycle Facilities

The project will add shoulders that can be used by cyclists in areas where they are not currently provided. It is anticipated that these facilities will improve the safety of the corridor, while also encouraging more active transportation through the area. The bicycle and pedestrian infrastructure benefit for this analysis has been quantified using the methodologies within the BCA Guidance and identified below:

- The shoulder intended for bicycle use will be 8 feet wide.
- The total bicycle distance is the anticipated improvement distance at 0.02 miles.

To estimate bicycle and pedestrian movement within the area, the Replica Model was used to estimate these movements for a typical day in Spring 2021 and Fall 2021. Due to the corridor's

lack of existing bicycle and pedestrian infrastructure, based on research⁶, it is conservatively anticipated that these user groups would increase by 20% over the planning horizon. The identified non-motorized user growth was then discounted by the rule of 1/2 for the future considerations per the BCA Guidance.

Table 12 depicts the anticipated benefit from the development of bicycle and pedestrian facilities along the corridor.

Table 12: Anticipated Bicycle and Pedestrian Benefit (Excel tab 5.5)

Bicycle and Pedestrian Benefit (2021\$)
\$1,691

Source: RS&H Analysis

5.6 Health Benefits

The bicycle and pedestrian facility additions to the corridor are anticipated to have positive health benefits to the surrounding community. Using the United States Census Bureau’s American Community Survey (ACS) 2021 5-year estimate, a review of the population that would receive health benefits was quantified. Per the BCA Guidance, the following age groups will experience benefits:

- Walking Population between the ages of 20-74
- Cycling Population between the ages of 20-64

To quantify these values, a review of the adjacent Census Tracts was conducted, and the populations within these age ranges were identified. This analysis then related the age ranges to the anticipated walking and cycling populations for the development of a quantified benefit as outlined within the BCA Guidance. **Table 13** depicts the anticipated health benefits associated with the development of improved non-motorized infrastructure.

Table 13: Anticipated Health Benefit (Excel tab 5.6)

Health Benefit (2021\$)
\$747,218

Source: RS&H Analysis

⁶ <https://www.peopleforbikes.org/statistics/economic-benefits>

BLUE RIDGE

Buncombe and Madison Counties

5.7 Other Benefits

Agglomeration Economies

The proposed improvements are intended to increase the safety and efficiency of travel within the region. As such, it is likely that business clustering and increased development along the corridor is possible. However, the value of this clustering has not been quantified in this analysis.

Emergency Services

The project corridors provide critical connections throughout the region. The FEMA Resilience Analysis and Planning Tool (RAPT)⁷ was utilized to determine the location of emergency and health services in the area that are likely to benefit from the improvement of the project corridors. The following were identified within five miles of the project locations:

- Bridge 100203
 - o Six fire stations
 - o One medical center
- Bridge 100154
 - o One fire station
- Bridge 100078
 - o One fire station
- Structure 560531
 - o Two fire stations
 - o Two police stations
- Bridge 560149
 - o One fire station

The proposed travel time improvements and additional travel lanes along the corridor are anticipated to improve response times for local emergency vehicles and increase the safety of the region.

Stormwater Runoff

The project will be completed in accordance with all necessary stormwater containment and management processes. It is anticipated that the roadway improvements will enhance the existing stormwater management and reduce the potential for flooding or roadway pooling which can lead to safety concerns.

Wildlife Impacts

The project activities will adhere to all required construction management practices to minimize any possible impacts to wildlife.

⁷ <https://www.fema.gov/about/reports-and-data/resilience-analysis-planning-tool>

5.8 Other Issues in Benefits Estimation

Benefits to Existing and Additional Users

The improved roadway is anticipated to benefit current and future travelers within the region through both safety and travel time enhancements. The project corridors provide critical connections in the region, and they are expected to experience continued use and need from users. This BCA has been conducted without the quantification of induced traffic, and as such, the growth of users out to the 20-year horizon is based on current and past trends.

Modal Diversion

The project is providing increased access to bicycle infrastructure and is anticipated to increase modal diversion in the area. However, the population and business densities within the project areas are not conducive to full modal split.

Work Zone Impacts

Work zone impacts resulting from this corridor improvement will be temporary and have not been analyzed within this 20-year analysis period.

State of Good Repair

This project will contribute to a state of good repair by upgrading the existing roadway infrastructure, including wider shoulders, additional lanes, and wider lanes. BLUE RIDGE is intended to correct existing issues with the current structures and alignments.

Geographic Extent

This project will have regional travel benefits that will extend beyond the project limits. The importance of the BLUE RIDGE project is evident due to the structures' roles as regional and local connectors. The project will maintain accessibility to critical resources and increase the reliability of the structures which will benefit the local businesses and residents as well as the overall regional transportation network.

Property Value Increases

It is anticipated that the improvement of these corridors could improve property values. However, these values have not been quantified or used in this analysis.

6.1 Capital Costs

Table 14 depicts the anticipated costs both spent and to be spent on development of these corridors.

Table 14: Capital Cost (Excel tab 6.1)

Capital Cost (2021\$)
\$16,297,644

Source: RS&H Analysis

6.2 Operations and Maintenance Costs

The development of this project is anticipated to reduce upcoming maintenance costs along the corridor due to the increased lifespan of the proposed bridge improvements. However, the maintenance of the corridor has been assumed to be in line with state averages and has been included as a disbenefit. **Table 15** depicts the anticipated operations and maintenance costs of the roadway over the 20-year horizon period.

Table 15: Maintenance Costs (Excel tab 6.2)

Total Maintenance Costs (2021\$)	
	\$77,722

Source: RS&H Analysis

6.3 Residual Value Analysis

This BCA anticipates that the roadway improvements will have a 50-year lifespan, which will surpass the scope of this 20-year analysis period. A residual analysis value has been applied to the BCA to identify the anticipated value of the roadway beyond the listed 20-year period. The residual value formula is listed below, and the anticipated residual value is depicted within **Table 16**.

Residual Value Formula:

$$RV = \left(\frac{U - Y}{U} \right) \times Project\ Cost$$

Where: RV = Residual Value

U = Useful Service Life of Project

Y = Years of Analysis Period Project Operation

Source: Benefit Cost Analysis Guidance for Discretionary Grant Programs, 2023

Table 16: Residual Year Value (Excel tab 6.3)

Residual Year Value Calculation (50-Year Service Life)	
Constant Dollar Value	\$11,951,606
Discounted Dollar Value (2021\$)	\$2,521,154

BLUE RIDGE
Buncombe and Madison Counties

BENEFIT-COST RATIO

The BLUE RIDGE benefit-cost ratio has been developed using the materials described within this Tech Memo and shown within the accompanying Excel workbook. This analysis has determined that the BLUE RIDGE improvements will yield a positive benefit-cost ratio as described within **Table 17**. This analysis has quantified a series of benefits to the region; however, it is anticipated that other benefits which have been qualitatively discussed will yield further benefit to the area.

The BLUE RIDGE benefit-cost ratio was developed with the following formula:

$$\text{Benefit Cost} = \text{Total Benefit} / \text{Total Cost}$$

Table 17. The BLUE RIDGE Benefit Cost Analysis (in 2021\$) (Excel tab Benefits + Costs Summary)

2023 PROTECT Grant: BLUE RIDGE	
20 Year Benefits Period (2025-2044)	
Values in 2021\$	
Discounted at 7% (3% for CO2)	
Costs (2021\$)	
<i>Total Costs</i>	\$16,375,366
Benefits (2021\$)	
Fatalities and Crashes	\$1,479,442
Residual Value	\$2,062,762
Travel Time Savings (Peak)	\$10,336,058
Travel Time Savings (Non-Peak)	\$81,453,078
Vehicle Operating Savings	\$15,204,387
Emissions Savings	\$2,892,315
Facility and Vehicle Amenity Benefits	\$1,691
Health Benefits	\$747,218
Single Year Land Value Increase	\$0
Life-Cycle Costs	\$16,375,366
Life Cycle Benefits	\$114,176,952
BC Ratio	6.97
Net Present Value	\$97,801,586

Appendix B

Letters of Support



Buncombe County Emergency Services

Office of Emergency Management

164 Erwin Hills Rd Asheville, NC 28806

(828) 250-2316

08/13/2023

The Honorable Peter Buttigieg
U.S. Secretary of Transportation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Secretary Buttigieg,

I would like to express my strong support for the North Carolina Department of Transportation's (NCDOT's) Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Grant application titled BLUE RIDGE (Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity) for the rehabilitation or replacement of five structures in Buncombe and Madison Counties.

These structures serve as critical connections for rural communities and residents to vital services such as employment hubs, educational institutions, and medical centers. Each structure is in critical need of rehabilitation or replacement due to reoccurring natural hazards such as flooding caused by climate change. Major structure improvements are necessary to increase the resiliency of the region, restore the natural environment, and ensure necessary accessibility to vital community services.

Should any bridge need to be closed due to its structural deficiencies or impacts from flood events, there are very few viable detour options to ensure continued access. The detours for these bridges are not all suitable for truck traffic, contain functionally obsolete bridges, and increase travel distance by an average 17 miles. This would significantly impact the nearby communities due to increased travel times and decreased access to vital services.

Please allow me to elaborate on how each bridge within our area affects our residents and their wellbeing. Bridge #100203 in Swannanoa allows access to Warren Wilson College which is one of three colleges within our County, however it is one of the most outlying areas. It also allows access to Owen Park which is a very popular area for our east side residents; ballfields, fishing ponds, walking trails and much more. This bridge also allows access to several of our industries in the east side of our County who are important contributors in our economy. This bridge project would allow our residents to continue to love their way of living but also provide a safer and more resilient environment.

Bridges #100154 and #100078 allows access to the same area of secluded, yet beautiful Barnardsville. This bridge allows access to many of our rural citizens in the north sector of our County. It allows access to Barnardsville Elementary, which is the only school in that immediate area for students. It allows access for Ohio Electric Company which is another important business within our community. Our rural citizens in



Buncombe County Emergency Services

Office of Emergency Management

164 Erwin Hills Rd Asheville, NC 28806

(828) 250-2316

Buncombe County count on these roadways to ensure they are able to travel to town for their jobs. They are already a very resilient community because of their area, however this would only shore them up further and illuminate the issues that might occur with the current infrastructure. Secretary, I hope that you see the importance of each of the listed projects and how they will better serve our great Buncombe County taxpayers. We appreciate any support you would give our County.

As a statewide transportation priority, the improvements to the five structures will provide reliable connectivity and increase the resiliency of the surrounding communities and the region, while repairing the surrounding natural environments. Thank you for your favorable consideration of this important project.

Sincerely,

Brittany Robinson

Emergency Management Division Manager



Buncombe County Government

Avril M. Pinder, CPA, ICMA-CM
County Manager

8/7/2023

The Honorable Peter Buttigieg
U.S. Secretary of Transportation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Secretary Buttigieg,

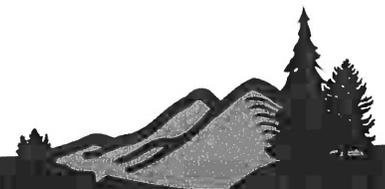
I would like to express my strong support for the North Carolina Department of Transportation's (NCDOT's) Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Grant application titled BLUE RIDGE (Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity) for the rehabilitation or replacement of five structures in Buncombe and Madison Counties.

These structures serve as critical connections for rural communities and residents to vital services such as employment hubs, educational institutions, and medical centers. Each structure is in critical need of rehabilitation or replacement due to reoccurring natural hazards such as flooding caused by climate change. Major structure improvements are necessary to increase the resiliency of the region, restore the natural environment, and ensure necessary accessibility to vital community services.

Should any bridge need to be closed due to its structural deficiencies or impacts from flood events, there are very few viable detour options to ensure continued access. The detours for these bridges are not all suitable for truck traffic, contain functionally obsolete bridges, and increase travel distance by an average 17 miles. This would significantly impact the nearby communities due to increased travel times and decreased access to vital services.

This project is extremely important to Buncombe County as the impacted region, Barnardsville, has long been subject to flooding events and was severely impacted by Tropical Storm Fred in 2021. The area includes the U.S. Post Office, Barnardsville Elementary School (100+ students), and Ohio Electric Motors, Inc. (60+ employees). The aging infrastructure in this region results in frequent disruptions to education, economic development and resident well-being.

As a statewide transportation priority, the improvements to the five structures will provide reliable connectivity and increase the resiliency of the surrounding communities and the region,



while repairing the surrounding natural environments. Thank you for your favorable consideration of this important project.

Sincerely,

A handwritten signature in black ink, appearing to read 'Avril Pinder', written in a cursive style.

Avril Pinder
County Manager



August 11, 2023

The Honorable Peter Buttigieg
U.S. Secretary of Transportation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Secretary Buttigieg,

As District Director for Madison County Soil & Water Conservation District, I would like to express my strong support for the North Carolina Department of Transportation's (NCDOT's) Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Grant application titled BLUE RIDGE (Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity) for the rehabilitation or replacement of five structures in Buncombe and Madison Counties.

These structures serve as critical connections for rural communities and residents. Should #560149 on Big Laurel Creek Rd need to be closed due to its structural deficiencies or impacts from flood events, the only viable detour option to ensure continued access is not at all suitable for truck traffic and would increase travel distance by 30 minutes. I spoke with Maurice McAlister and Emerson Franklin who work for the Laurel Volunteer Fire Department (VFD) about the bridge. They have responded to several 911 calls where U-Hauls and semi-trailers have gotten stuck on the bridge, due to the bridge being too narrow, the most recent one was just last week on August 9th. They also report that the placement between two sharp curves has caused car wrecks, and first responders must almost come to a stop before and after the bridge when responding to emergencies in fire trucks because of the poorly aligned single-lane bridge. They believe the unfortunate design is because when the bridge was built several decades ago the vital connector was merely a gravel road.

I was also able to speak with Chastity Jenkins, who lives right below structure #560531 on Little Pine Rd. She confirmed that the culvert pipes there are severely rusted, and that the area regularly receives a huge amount of water during storm events. Madison County has experienced large culvert failures twice on Highway 213 in recent years, indicating a limited lifespan for similar-aged metal culverts.

Major structure improvements are necessary to increase the resiliency of the region, restore the natural environment, and ensure necessary accessibility to vital community services.

Thank you for your favorable consideration of this important project.

Sincerely,

Jessica Hocz

Jessica Hocz

LAND OF SKY



Land of Sky Rural Planning Organization

339 New Leicester Highway

Suite 140

Asheville, North Carolina 28806

Phone: (828) 251-6622 • Fax: (828) 251-6353

Website: www.landofskyrpo.org • E-mail:

vicki.eastland@landofsky.org

The Honorable Pete Buttigieg
Secretary
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Dear Secretary Buttigieg:

Land of Sky RPO would like to express our strong support for the North Carolina Department of Transportation's (NCDOT's) Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Grant application titled BLUE RIDGE (Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity) for the rehabilitation or replacement of five structures in Buncombe and Madison Counties.

These structures serve as critical connections for rural communities and residents to vital services such as employment hubs, educational institutions, and medical centers. Each structure is in critical need of rehabilitation or replacement due to reoccurring natural hazards such as flooding caused by climate change. Major structure improvements are necessary to increase the resiliency of the region, restore the natural environment, and ensure necessary accessibility to vital community services.

Should any bridge need to be closed due to its structural deficiencies or impacts from flood events, there are very few viable detour options to ensure continued access. The detours for these bridges are not all suitable for truck traffic, contain functionally obsolete bridges, and increase travel distance by an average 17 miles. This would significantly impact the nearby communities due to increased travel times and decreased access to vital services.

The mountainous terrain in Western North Carolina and the Land of Sky RPO present many challenges and limitations. The Appalachian Mountains and numerous rivers and streams that make Western North Carolina a unique and desirable location, also constrain the transportation network and limit system redundancy and connectivity. Throughout the region several communities rely on single or limited access points. Due to the increase of extreme weather events impacting our region, communities are at an elevated risk of being isolated due to potential transportation network failures in extreme weather events. Providing more resilient infrastructure is key to adapting our region to increasing natural challenges.

As a statewide transportation priority, the improvements to the five structures will provide reliable connectivity and increase the resiliency of the surrounding communities and the region, while repairing the surrounding natural environments. Thank you for your favorable consideration of this important project.

Sincerely,

A handwritten signature in black ink, appearing to read "Mathew Wechtel". The signature is written in a cursive style with a long, sweeping underline.

**Mathew Wechtel, Commissioner Madison County, NC,
Chair, Land of Sky Rural Planning Organization**

Appendix C

Funding Commitment Letter



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

08/16/2023

Secretary Pete Buttigieg
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC, 20590

Subject: Certification of Financial Contribution 2023 PROTECT Application:
Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability,
and Grow Equity Project (“BLUE RIDGE Project”)

Dear Secretary Buttigieg,

The North Carolina Department of Transportation (NCDOT) respectfully seeks your favorable consideration and review of the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Grant application titled BLUE RIDGE (Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity) for the rehabilitation or replacement of five structures in Buncombe and Madison Counties.

The project includes the replacement of four bridges and the rehabilitation of one existing culvert. These structures exhibit significant structural issues and deficiencies due to continued exposure to natural hazards such as flooding. The project will increase the resiliency of the region, restore the natural environment, and ensure necessary accessibility to vital community services.

Each structure serves as a primary access point to essential services for the surrounding communities. They are vital structures to connect rural communities with employment centers, educational facilities, and health services. Should any bridge need to be closed due to its structural deficiencies or impacts from flood events, there are very limited viable detour options to ensure continued access.

NCDOT is seeking \$12,443,000 in PROTECT funding, which represents 80% of the total project cost. NCDOT will fund the remaining balance with state funds. Previous expenditures (over the past five years) include \$743,894 for drift and debris removal, scour repair, abutment repair, and slide repair.

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FINANCIAL MANAGEMENT DIVISION
1514 MAIL SERVICE CENTER
RALEIGH, NC 27699

Telephone: (919) 707-4200
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Customer Service: 1-877-368-4968

Website: www.ncdot.gov

Location:
1 SOUTH WILMINGTON STREET
RALEIGH, NC 27601

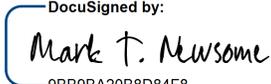
Secretary Pete Buttigieg - Bridge Longevity Upgrades to Enhance Resiliency, Increase Dependability, and Grow Equity (BLUE RIDGE) Project

Page 2 of 2
08/16/2023

Award of the PROTECT funding will allow NCDOT to advance this important resiliency and accessibility project. The improvements will ensure the safety of the traveling public, allow for efficient access for rural populations, increase regional resiliency, and restore the natural environment. Thank you for your favorable consideration of this major project.

If NCDOT can be of any further assistance, please do not hesitate to contact me at (919)707-4320 or via e-mail at mnewsome@ncdot.gov.

Sincerely,

DocuSigned by:

9BB9BA20B8D84F8...
Mark T. Newsome
Chief Financial Officer