

GRAHAM

Greater Rural Access and Highways to Accelerate Mobility



BICYCLE & PEDESTRIAN



CLIMBING LANES



UPGRADES



ITS COMPONENTS



SAFETY

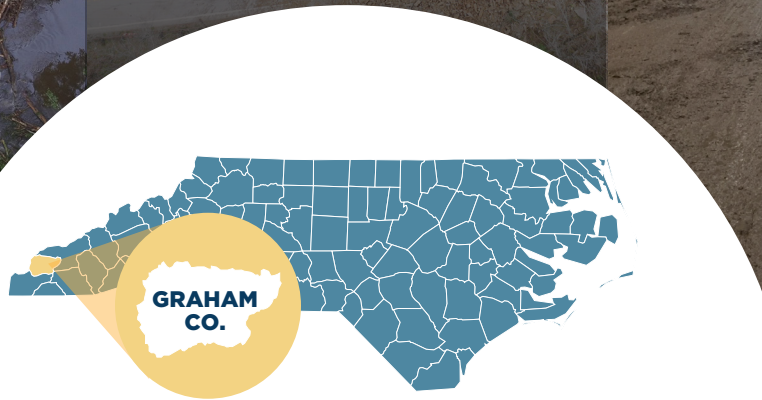
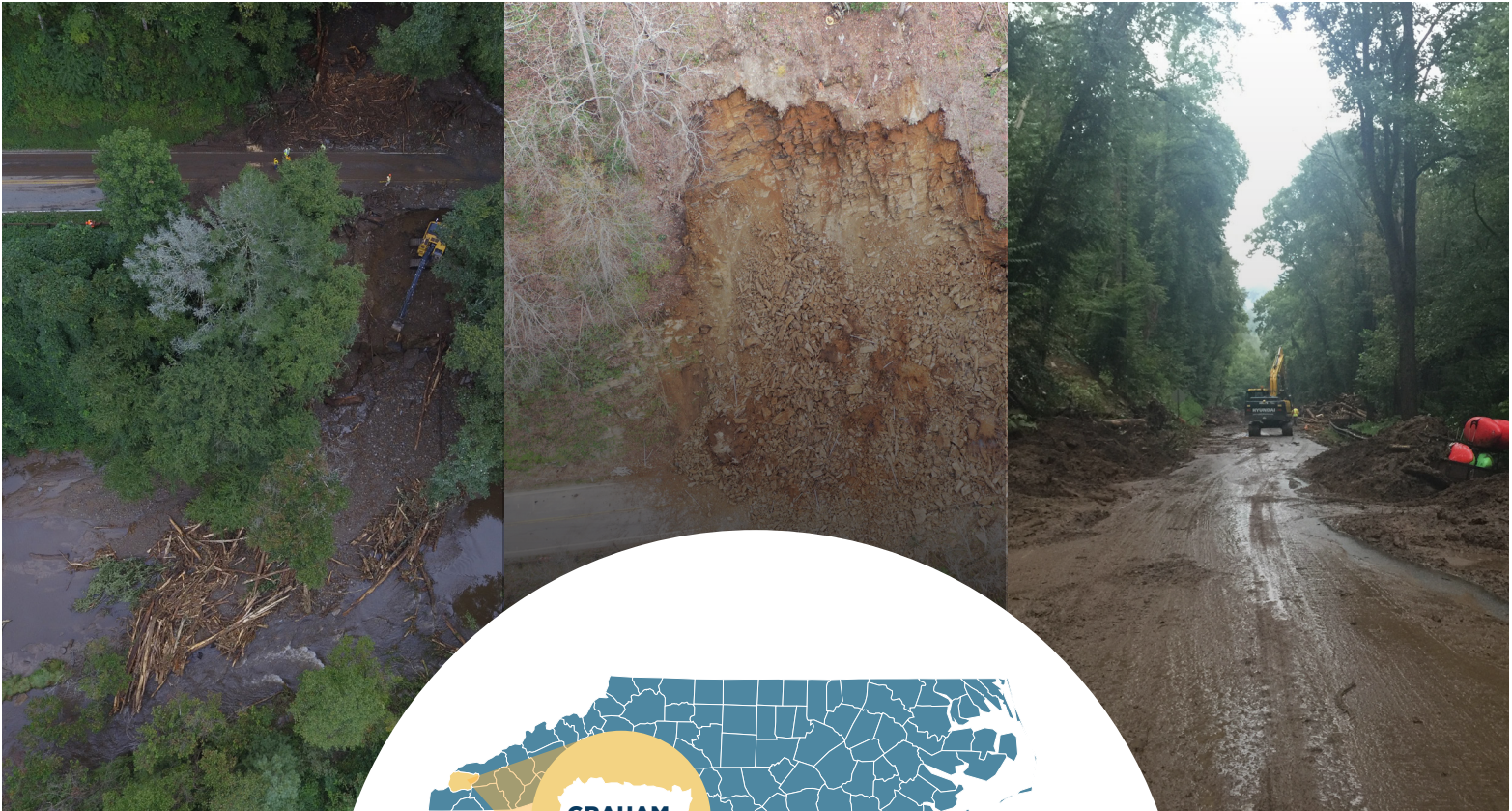


STATE OF GOOD REPAIR



WILDLIFE CROSSING

Outcome Criteria Narrative



**MPDG FFY 2023 and 2024
GRANT APPLICATION
AUGUST 2023**



Safety

Page: 1



The Project will reduce roadway fatalities and crashes and improve response times for emergency vehicles by introducing climbing, passing lanes, and widening shoulders. In Robbinsville, where there is a disproportionate number of zero-vehicle households, new sidewalks will improve safety for non-motorized travelers.

State of Good Repair

Page: 4



The Project will restore and modernize the corridor while creating new multimodal infrastructure in a remote community. The Project will also mitigate system vulnerabilities by improving the reliability of this critical infrastructure asset in an underserved area.

Economic Impacts, Freight Movement and Job Creation

Page: 5



The Project will improve travel time reliability and freight mobility by modernizing the roadway and introducing signal coordination and other ITS components. The new land bridge and expanded parking at Stecoah Gap will draw more visitors to the Appalachian National Scenic Trail (ANST), increasing revenue for local businesses reliant on tourism and fostering the region's long-term economic growth.

Climate Change, Resiliency, and the Environment

Page: 8



The Project will replace retaining walls and improve embankments to make the corridor more resilient to natural disasters and extreme weather events. The Project will also improve the region's resiliency by modernizing the corridor, allowing it to serve as a reliable alternative to US 19/74 during flooding, landslides, and other emergency events. The Project will reduce travel time throughout the corridor, which will lead to reduced greenhouse gas (GHG) emissions. New bicycle and pedestrian facilities will promote a modal shift to active transportation. The Corridor K project won the National Association of Environmental Professionals Environmental Excellence Award in Environmental Management, Stewardship, Conservation, and Protection in 2021.

Equity, Multimodal Options, and Quality of Life

Page: 10



The Project expands active transportation in Graham County, thereby improving public health outcomes and increasing access to healthcare, education, employment, and other essential services. Additionally, the Project's travel time savings and congestion reductions will decrease vehicle fuel and maintenance costs, lessening transportation cost burdens on residents.

Improves Mobility and Community Connectivity

Page: 13



The Project's multimodal components increase accessibility for non-motorized travelers in Historically Disadvantaged Communities. Moreover, realignments to the ANST, including a new land bridge, will improve mobility for residents and visitors to the region.

Innovation Areas: Technology, Project Delivery and Financing

Page: 14



During planning and design for the Project, several innovative technologies have been used such as Quantm 3D, an alignment optimization program; Ground Penetrating Radar to avoid areas of potential archaeological and ecological importance; and innovative methods to determine travel time reliability using a 365-day simulation model.



Safety

The Project applies U.S. DOT's "Safe System Approach" to roadway safety.

The Project will deliver three layers of reinforcing protection to reduce the likelihood that crashes will occur and minimize the harm caused by those that do. This integrated approach will make the residents and visitors in Graham County safer. North Carolina has been identified by USDOT (NOFO, page 55, footnote 18) as a state with above average rural roadway departure fatalities, based on a five-year rolling average of rural roadway departure fatalities per 100 million VMT.¹

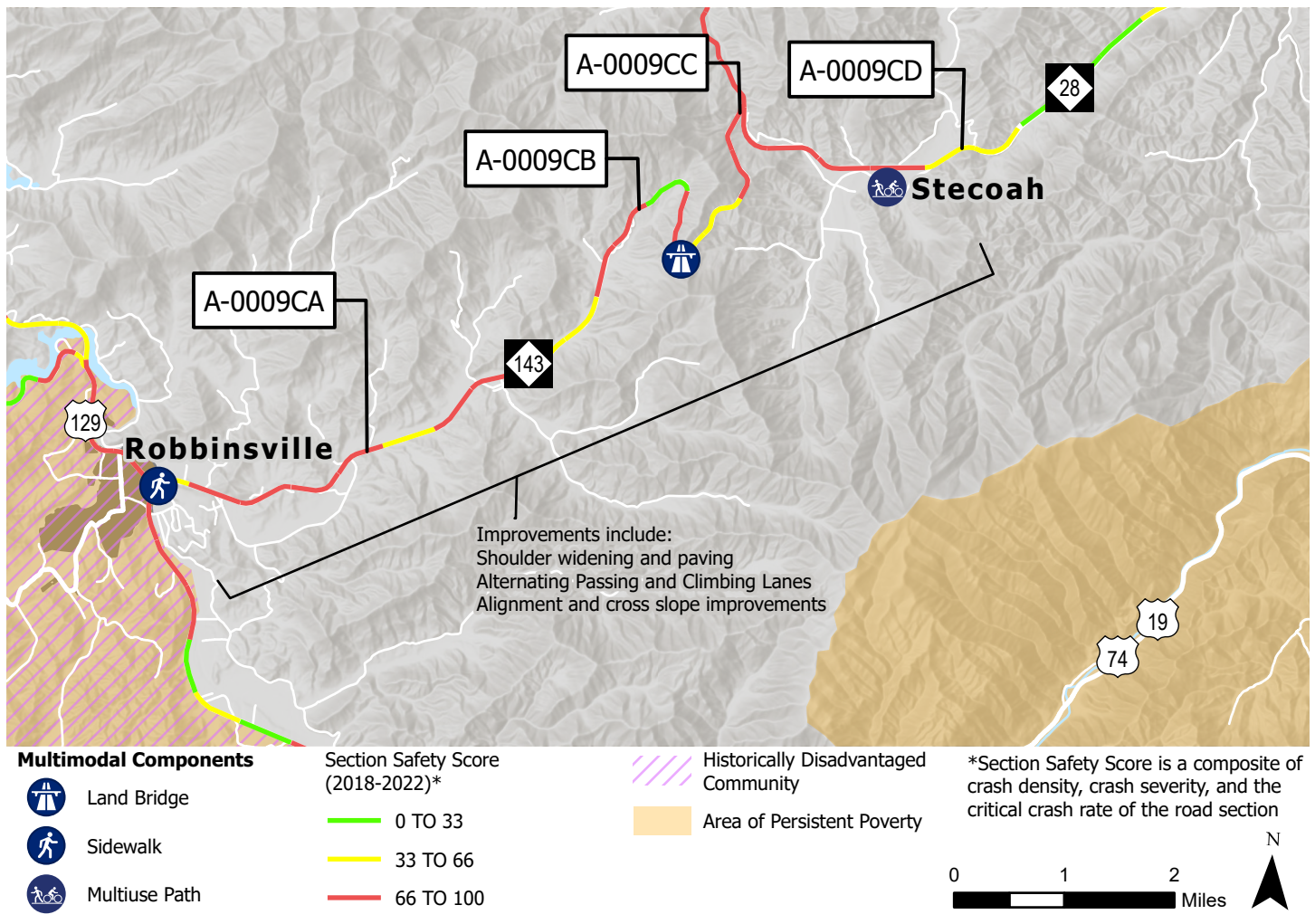
Improving safety for both motorized and non-motorized travelers along this mountainous route is a primary purpose of GRAHAM. By constructing new multimodal facilities, implementing roadway improvements, and improving travel time

reliability, the Project will protect motorists and vulnerable pedestrians and cyclists from safety risk. GRAHAM's improvements support the Safer Roads objective of the USDOT's National Roadway Safety Strategy Plan (NRSSP) by incorporating design elements to prevent crashes from occurring. GRAHAM also supports the NRSSP Post-Crash Care objective of improving emergency medical services (EMS) delivery by decreasing EMS responder travel time.

Design Improvements

Corridor K is situated along an approximately 12-mile stretch mountainous of terrain. The route contains sharp curves that limit sight distance and grades as high as 8 percent, which increase the risk of vehicles losing control or running off the road. Inadequate and/or non-existent shoulders and the narrowness of existing lanes further exacerbate safety risks to both motorized

Figure 1 Elevated Safety Scores Along the Project Corridor



and non-motorized travelers. Between 2018 and 2023 there were 265 crashes on Project roads, including 4 that were fatal and 13 that resulted in serious injury. The elevated safety scores² of Project roads, calculated based on crash density, crash injury severity and critical crash rate, reflect this poorer highway safety performance. Figure 1 illustrates this scoring along the corridor.

GRAHAM will address these safety concerns in several ways. By constructing paved shoulders where inadequate or no shoulders currently exist, GRAHAM will provide a safe area for motorists to pull over and help drivers safely recover from lane departures. The installation of additional, alternating climbing and passing lanes (2+1 design) will reduce the potential for lane departure-related crashes associated with drivers passing in areas of limited sight distance. These improvements are projected to prevent 19 crashes annually (inclusive of fatal, serious, other injury, and property damage only). The value of avoiding these fatalities, injuries and property damage totals \$34.3 million over 20 years when discounted at 7 percent.

Emergency Response

The Project's intent to address EMS deficiencies in this rural NC area also aligns with the goals of the USDOT's Rural Opportunities to Use Transportation for Economic Success (ROUTES) initiative. The Project's 2+1 design, road shoulder improvements, and Robbinsville signal coordination improvements will save an estimated seven minutes per vehicle in response time for EMS trips in Graham and Swain Counties. As there are comparatively few highways in this rural region, EMS responders currently utilize the Project corridor when making most emergency responses.

Local EMS agencies include the Graham County Fire Department, Graham County Sherriff, and Stecoah Fire Department. The Graham County Fire Department is located at 70 West Fort Hill Road, and serves the six-mile district around Robbinsville that includes the Towns of Robbinsville and Lake Santeetlah. The Stecoah Fire Department is located at 30 Lloyd and Lydia Drive in Robbinsville and provides rescue of all levels, including EMS

transport and EMS training. The Graham County Sheriff's office is located at 300 Rodney Orr Bypass in Robbinsville.

The Community Impact Assessment for STIP A-0009C in Graham (April 2020, page 19) quotes the Graham County Emergency Services Director as reporting that US 129, NC 143, and NC 28 are the primary routes used when transporting individuals to surrounding hospitals. These hospitals are all located outside of Graham County, and include Swain Community Hospital, Harris Regional Hospital, Asheville Memorial Hospital, and Cherokee Indian Hospital.

Previous communication with local officials has indicated that EMS response times are frequently affected by a lack of mobility and poor reliability on regional the road network. Rockslides and winter weather events have caused road closures that resulted in loss of life events because EMS crews were unable to bypass them in a timely way. This Project will thus benefit EMS response times by providing responders the ability to pass slower moving vehicles on the roadway, and avoid accidents and other obstructions such as fallen rocks/landslides.

Even when EMS responders can get through, health outcomes worsen when emergency responses are delayed. GRAHAM's roadway design improvements will enhance EMS delivery by decreasing travel time. Safety benefits from increased emergency access are valued at \$11.1 million, over 20 years discounted at 7 percent.

Non-motorized Travelers

Given the large population of zero-vehicle households in Graham County, GRAHAM is also being designed to improve corridor safety for non-motorized travelers and road users. Residents within the Project's study area are in particular need of such improvements due to their higher reliance on multimodal and pedestrian travel options. In Robbinsville, for instance, 18.9 percent of homes do not have a vehicle, compared with an average of 5.6 percent of households in North Carolina overall. The Project will, thus, install new sidewalks in Robbinsville, a land bridge at the Stecoah Gap,

² <https://www.arcgis.com/home/item.html?id=7415a4df4df1468585225bc74a77369b>



and a multi-use path in Stecoah, all of which will separate non-motorized road users from vehicular travelers, allowing cyclists and pedestrians to travel along and across the corridor without risk of collision with motorists. By adding sidewalks along US 129 and NC 143, GRAHAM will also close gaps in the existing pedestrian network, improving residents' access to Robbinsville High School and other important destinations in downtown Robbinsville.

Lastly, the new land bridge at the Appalachian National Scenic Trail (ANST) crossing of NC 143 will provide a safer, grade separated passage for wildlife, tourists and hikers to use to safely cross NC

143. The land bridge and new wildlife fencing will decrease wildlife-involved crashes by providing a grade-separated means of safe passage for native species. According to [FHWA HRT-08-034](#)³, vehicle collisions with deer and other large animals occur most frequently on high-speed, rural, two-lane roads like NC 143 and NC 28. Other species of wildlife found in Graham County, such as black bear and wild boar, have migratory patterns that follow the ANST corridor. GRAHAM's land bridge will result in estimated at \$0.2 million in wildlife savings, discounted at 7percent.



State of Good Repair

Corridor K is one of the remaining 8.9% of outstanding sections along the Appalachian Development Highway System (ADHS), and one of only two small sections in North Carolina. Although GRAHAM is only 12.9 miles of this 3,090-mile system, the Project includes some of the most challenging mountainous terrain in rural Appalachia.⁴ This helps explain why it is one of the last to be addressed in the system.

Outdated infrastructure such as that found along this corridor creates serious maintenance challenges and safety issues, decreases travel time reliability, increases travel-related costs, decreases mobility, and leads to less area resiliency. The outdated infrastructure along Corridor K impair regional mobility, reduce travel time reliability, and decrease the overall resiliency of the corridor. GRAHAM will modernize and restore the corridor's roads and mitigate system vulnerabilities by correcting deficient drainage systems and deteriorating pavement, improving cross slopes, stabilizing steep slopes, widening travel lanes, addressing geotechnical hazards, and widening/adding shoulders. These improvements will prolong the useful life of the corridor's roadway and reduce future maintenance costs.

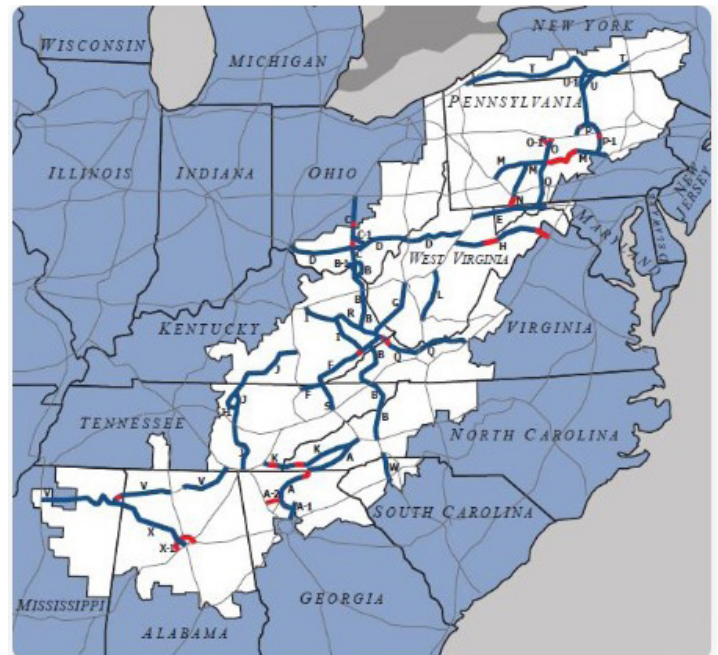


Figure 2 As of Fiscal Year 2022, 2,814.8 miles, or 91.1 percent, of the ADHS is under construction or open to traffic.

Construction for the Project will also reduce future asset renewal costs by avoiding or delaying major rehabilitation and replacement of pavement, guardrails, drainage pipes and headwalls; as well as the replacement of one bridge. Without the Project, these improvements will be required as early as 2025. Operations and maintenance (O&M) costs avoided by construction of the Project total \$8.8 million, discounted at 7 percent. After construction is completed, Project roads will then have 25 useful years remaining past the end of the analysis period. The value of the remaining useful

3 <https://www.fhwa.dot.gov/publications/research/safety/08034/02.cfm>

4 <https://www.arc.gov/appalachian-development-highway-system/>

life for the Project is \$23.8 million, discounted at 7 percent.

By reducing maintenance and rehabilitation needs, GRAHAM will also mitigate ongoing system vulnerabilities by reducing delays. In a region vulnerable to route closures from flooding and landslides, such delays frequently hinder regional travel and freight movement. On NC 143 alone, for instance, there have been an average of 13 annual closures with detours due to maintenance, each lasting an average of 3.54 hours. Over five thousand motorists per day on average will benefit from Project improvements that prevent such delays. US 129, NC 143, and NC 28 together form the only detour for emergency closures on US 19/74; by modernizing and improving the state of good repair of the Project roads, GRAHAM will bolster NCDOT's ability to maintain this critical corridor in a state of good repair into the future.



GRAHAM will create new multimodal infrastructure in these remote communities that will be at the very beginning of its useful life and can more easily be maintained in a state of good repair. As noted previously, new sidewalks in Robbinsville and a new multimodal path in Stecoah will close gaps in the existing pedestrian network and expand travel options for non-motorized travelers, improving conditions for the outsized percentage of transportation-disadvantaged and vulnerable road users served by the Project. These new ADA-compliant bicycle and pedestrian facilities can be more easily kept in good condition as they will be built to modern standards of use and resiliency, and will thus allow for many years of facilitating vulnerable road users' navigation of their communities, and access to employment, educational opportunities, and essential services.



Economic Impacts, Freight Movement and Job Creation

Graham County faces ongoing economic challenges. Stanley Furniture, the area's last resident manufacturer, announced it was closing its Robbinsville's plant and laying off 400 workers in 2014. Since then, only one small manufacturing startup has opened; employment there stands at about 30 workers. As a result, the County's labor force relies on commuting for jobs in neighboring counties. Approximately 67% of employed Graham County residents commute to jobs outside of the county. Tourism tied to the area's nature

and recreational amenities has also become an economic anchor. Approximately 1,000 jobs in Graham County employ residents from other counties, with most commuting from Cherokee County. Residents have expressed concerns over the lack of job opportunities within the county.

The Southwestern Commission's Region A Toolbox⁵ projects low population growth for Graham County (8.8 percent) through 2030. The Bureau of Labor Statistics reports that the jobless rate is 6.3 percent in May of 2023. Within Robbinsville, 43.8 percent of residents live in poverty, far exceeding the statewide average of 13.4 percent.

GRAHAM will promote economic competitiveness and opportunity in this economically-distressed region by improving travel time reliability and reducing delays. The Project will improve freight mobility, facilitate tourism opportunities, and

⁵ <https://regiona.org/wp-content/uploads/ToolBox-New.pdf>

promote long-term economic growth. Additionally, the Project has adopted inclusive economic development by utilizing Minority- and Women-owned Disadvantaged Business Enterprises (DBEs).

Travel Time Reliability

As noted previously, travel times on Project roads can be unpredictable, located as they are in mountainous terrain, with grades between three and eight percent, and sharp curves that reduce sight distance. Speed limits on Project roads range from 25 mph in tight curve sections to 55 mph in straighter sections. Lane widths are narrow and there are limited passing opportunities over substantial distances due to sharp curves and steep grades.

By implementing a 2+1 design in specific locations, the Project will improve mobility and travel time reliability by allowing vehicles to pass trucks and slow machinery safely and efficiently, while maintaining the direction of travel and minimizing crossings into the opposing lane of traffic. Travel time reliability will be further improved with the introduction of ITS components, including closed-circuit television (CCTV) and signal coordination in Robbinsville, which will reduce congestion and delays during detour events.

GRAHAM will improve travel time reliability in each direction and during the peak period (see traffic studies on the [Supplemental Materials website](#)). Additionally, GRAHAM will result in travel

time savings of seven minutes per vehicle, and cumulatively result in travel time savings of \$53.0 million, discounted at 7 percent. The Project's travel time savings and reliability improvements will also result in \$3.5 million in operating cost savings for freight vehicles and trucks, while the ITS components will quickly alert travelers on US 19/74 of road closures, delays and detour routes ahead of decision points, saving VMT and VHT and resulting in a detour cost savings of \$68.2 million, discounted at 7 percent.

Tourism

Graham County's economy is strongly tied to recreational tourism; [Graham County's Outdoor Recreation Economic-Building Strategy & Report](#)⁶ found that visitor expenditures reached \$29.4 million in 2018. A [2015 report](#)⁷ by the American Hiking Society found that this revenue generates economic activity twenty times its original value. Western NC's \$206 million [craft-based economy](#)⁸ is also highly dependent on tourism, as visitors drive 62 percent of art gallery sales in the region.

The Project includes several improvements that will draw tourists to the county's preeminent attractions. An additional two parking spaces at the ANST trailhead along the NC 143 gap will allow more tourists and hikers to access this nationally-significant attraction. An increase in ANST through-hikers would also boost the county's economy; a [2019 report](#)⁹ by the NC Department of Commerce found that overnight visitors spend



Figure 3 Stecoah's Annual Harvest Festival

6 https://regiona.org/wp-content/uploads/Outdoor-Recreation-Economy-Building-strategy-report_-final.pdf

7 https://americanhiking.org/wp-content/uploads/2015/05/AHS_RPT_fnl_LOW.pdf

8 <https://www.blueridgeheritage.com/wp-content/uploads/images/PDFs/Research/CraftEconomicImpactBrochure.pdf>

9 https://regiona.org/wp-content/uploads/Outdoor-Recreation-Economy-Building-strategy-report_-final.pdf

10 <https://www.arc.gov/wp-content/uploads/2021/02/ARC-Tourism-report-final-Dec-2020-1.pdf>

three times as much as single- day trip visitors in western NC. As an accessible means of observing wildlife and a unique landscape feature, the Project's new ANST land bridge will likely become an attraction in its own right, a precedent¹⁰ set by other transportation infrastructure in Appalachia like the New River Gorge Bridge in West Virginia and the Lynn Cove Viaduct in North Carolina.

Similarly, the planned multi-use path in Stecoah will bring residents and visitors closer to one of Graham County's cultural hubs, the Stecoah Valley Cultural Arts Center¹¹. The Graham County Strategic Tourism Plan¹² has identified this artistic venue, though widely viewed among local stakeholders as one of the county's strongest draws, as an untapped asset. The Project's installation of a new multi-use path will improve non-motorized access to this important destination, connecting it with local roads and a nearby walking path.

The Project's travel time savings and reliability savings will also aid the tourism sector. Tourism development stakeholders have maintained the importance of improving regional highways to facilitate the health and growth of the industry. ARC reports¹³ that a third of these stakeholders consider "better roads" to be "extremely important."

Freight Mobility

Trucks utilize National Highway System routes US 129, NC 143, and NC 28 for freight and delivery services into and out of Graham County. Because these roads are the only arterials in the county, industrial traffic must utilize these roads to travel through Graham County. According to the NCDOT North Carolina Truck Network, NC 143 is a designated route for approved Surface Transportation Assistance Act (STAA) Vehicles. US 129, NC 143 and NC 28 all have impaired mobility and constrained freight movement for heavy vehicles due to their combination of steep grades and tight curves.

Businesses along Robbinsville's Main Street and US 129 include independent and fast-food restaurants, auto parts stores, gas stations, markets, hotels; and several government-owned facilities, including the Graham County Sheriff's office, the Graham County Travel and Tourism information center, the Graham County Courthouse, and the Graham County Department of Public Health.

Agriculture is also a significant economic driver in western NC. USDA's annual statistical bulletin for North Carolina¹⁴ shows that Graham County's 123 farms generated over \$3 million in sales in 2021; there are over 1,000 farms in the region (see BCA Technical Memo). A reliable transportation network is necessary for growers to bring produce from farm to market and for consumers to reach them. The Project's roadway improvements will increase freight mobility for farmers and the local agricultural industry, reducing delays, shipping costs, and ultimately final costs for agricultural products. Travel time savings will cut transportation-associated expenses and provide access benefits for farmers in Graham and neighboring counties at a value of \$28.4 million.

Minority-and Women-owned Business Participation

The Project will include participation from minority owned and women owned businesses. NCDOT has robust DBE outreach¹⁵ and certification¹⁶ programs to promote the participation of disadvantaged businesses in NC transportation projects. All three let sections of the Project utilize DBEs for construction: DBE participation is anticipated to reach six percent for A-0009CA and four percent for A-0009CB and A-0009CC. NCDOT will continue to strive to include robust participation from DBEs in A-0009CD upon receipt of the additional funding needed to complete this last section of the Project.

11 <https://www.stecoahvalleycenter.com/>

12 <https://www.grahamcounty.net/great/Graham%20County%20Strategic%20Tourism%20Plan.pdf>

13 <https://www.arc.gov/wp-content/uploads/2021/02/ARC-Tourism-report-final-Dec-2020-1.pdf>

14 https://www.nass.usda.gov/Statistics_by_State/North_Carolina/Publications/Annual_Statistical_Bulletin/AgStat/Section06.pdf

15 <https://www.ncdot.gov/divisions/highways/Pages/highways-dbe-outreach.aspx>

16 <https://www.ncdot.gov/about-us/board-offices/offices/civil-rights/Pages/disadvantaged-business-enterprise.aspx>





Climate Change, Resiliency, and the Environment

Environmental sustainability is one of the primary purposes of the Project and addressing climate change and environmental justice are essential components. GRAHAM will address these issues by improving the resiliency of at-risk infrastructure to the region's geotechnical hazards. Drainage and culvert improvements will offer flood protection, while also facilitating aquatic species passage.

As noted previously, the Project will add climbing and passing lanes as well as ITS components (including Dynamic Message Signs (DMS), Dynamic Trailblazers, and signal coordination in Robbinsville) that will reduce travel time delays during emergency closures of US 19/74. Lessening these delays will reduce greenhouse gas (GHG) emissions associated with vehicle congestion and idling. In addition, Project components like sidewalks, the land bridge connecting the ANST, and the Stecoah multi-use path will encourage residents and visitors to undertake modal shifts to active transportation, likely reducing vehicle usage in this pristine natural region.

GHG Reductions

According to North Carolina Department of Environmental Quality's (NCDEQ's) 2022 GHG Inventory¹⁷, the transportation sector creates the largest share of GHG emissions in North Carolina, accounting for 36 percent of emissions in the State between 2005 and 2018. GHG emissions not only drive global climate change processes, but they negatively impact local conditions through poor air quality, hotter temperatures, and natural hazards like increased flood events. North Carolina Executive Order (EO) 246¹⁸ outlines state goals to reduce GHG emissions to at least 50 percent below 2005 levels by 2030 and to achieve net-zero emissions as soon as possible, but no later than, 2050.

GRAHAM aligns with these statewide decarbonization plans and will decrease transportation-related GHG emissions within communities. The Project's 2+1 design and ITS components (see Project Description for discussion of travel time reliability) will reduce travel times and minimize the delays and idling that lead to congestion.

These design and ITS improvements will save an estimated average of seven minutes per trip in the corridor, while signal coordination and signal timing plans for various high-volume traffic scenarios in Robbinsville will save an estimated 24 seconds per trip. These travel time reductions will reduce GHG emissions associated with congestion, idling, and detours, by over 30,000 metric tons of carbon dioxide equivalent (MTCO_{2e}) over twenty years. They will also result in a \$1.3 million emissions savings benefit, discounted at 3 percent.

Moreover, the addition of DMS and Dynamic Trailblazers to alert travelers of potential delays along US 19/74, will allow for more efficient traffic direction to and along detour routes. These improvements will avoid delays and idling, and reduce related VMTs and GHG emissions. These reductions are estimated to have an additional emissions savings benefit of \$0.7 million, discounted at 7 percent.



17 <https://deq.nc.gov/media/27070/download?attachment>

18 <https://governor.nc.gov/media/2907/open>

Regional Resiliency

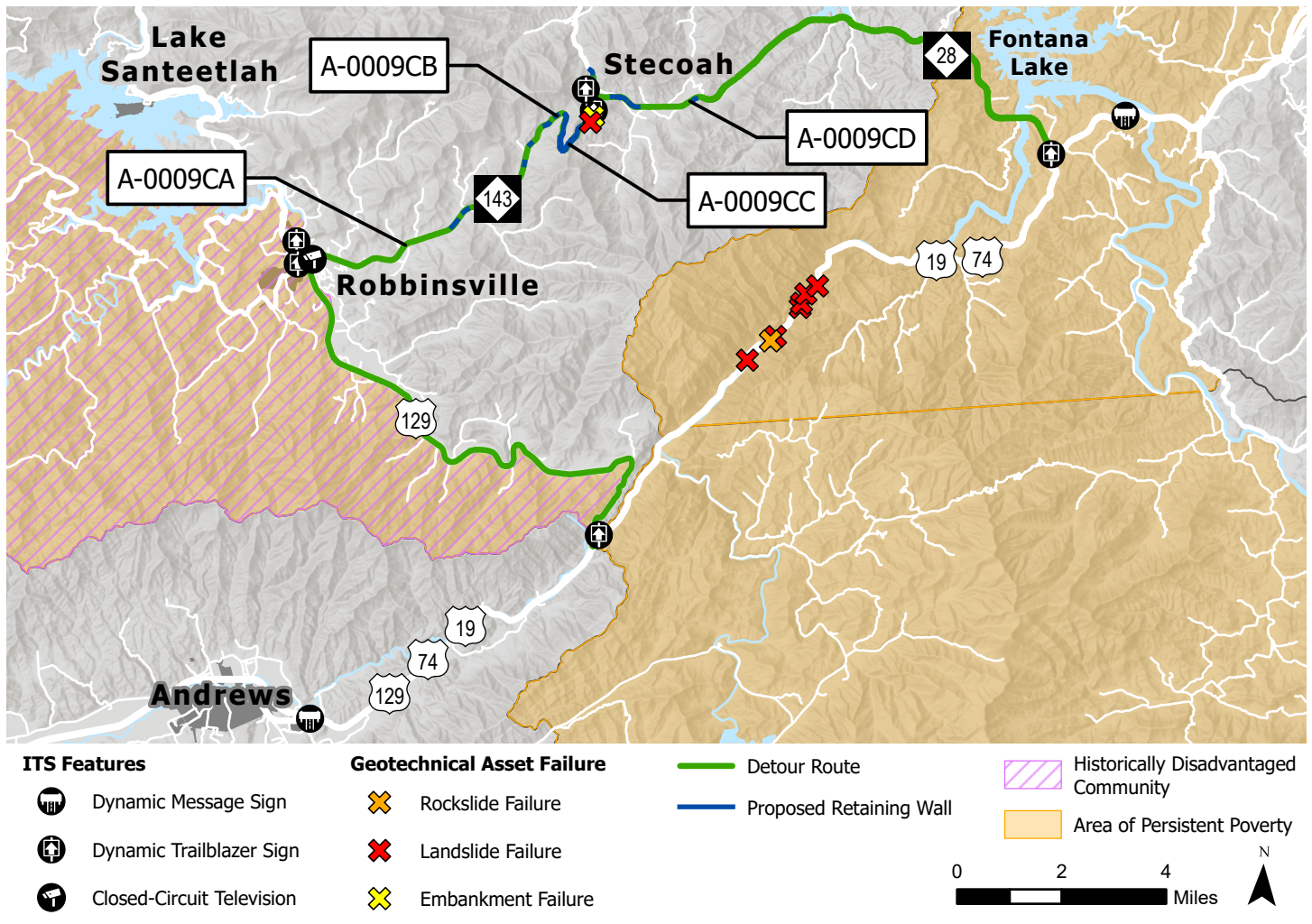
As explained previously, the Project corridor is particularly important during emergency events as it serves as the only travel alternative and detour during closures of US 19/74, which experiences frequent landslides and flooding. Since 2019, the roadway has been closed on five separate occasions. As storms and other hazards continue to occur more frequently and with greater intensity due to climate change, it is critical that residents have a reliable and safe way to travel during a variety of weather events.

In alignment with the [NCDOT 2021 Resilience Policy](#)¹⁹ and the [2020 North Carolina Climate Risk Assessment and Resilience Plan](#)²⁰, GRAHAM will improve the resilience to the impacts of climate change of critical at-risk infrastructure, by bringing Project roadways into a state of good repair and

improving the corridor with design and structural elements (such as new embankments, retaining walls, shoulders, drainage pipes, and culverts).

According to the [NCDOT Geotechnical Asset Management \(GAM\)](#)²¹ mapping tool, the segment of NC 143 that passes through the Stecoah Gap has previously experienced an embankment failure and landslide. Shored-mechanically stabilized-earth-(SMSE)-filled walls will be constructed to address large slope failures and improve resilience to geotechnical failures related to colluvium deposits found in the area. The Project will stabilize and reduce slopes along roadways and add a multi-bench rock cut with a concrete barrier, vegetated embankments, and more catchment between the slope and travel lanes. When constructing steeper fill slopes, rock embankments and rock plating will be utilized to minimize impacts to streams, wetlands, and archaeological sites.

Figure 4 Elevated Safety Scores Along the Project Corridor



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

20 <https://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>

21 <https://www.arcgis.com/home/item.html?id=6908e4d9497d462c90c0101b50308bd1>

The Project corridor also has several areas that the NCDOT and North Carolina Emergency Management (NCEM) Roadway Inundation Tool (RIT)²² has shown to be susceptible to ground inundation. To ensure the corridor can withstand a 50-year storm event, 13 major and 75 minor stream-crossing structures were evaluated for improvement. New drainage pipes and two dry detention stormwater basins will more effectively manage stormwater flow and prevent flooding, ensuring that Project roads remain safe and viable routes during storms. New culverts and stream-crossing improvements such as sills and baffles will also be installed to manage stormwater. These improvements also support the passage of aquatic species by maintaining normal stream depth-of-

flow and velocity, and preserving channel widths. Grass-lined ditches will also be added as an additional stormwater control measure that can also improve the water quality of local streams.

Active Transportation

The Project will support a modal shift to active transportation by constructing a new multi-use path in Stecoah, new sidewalks in Robbinsville, and a land bridge to provide a grade-separated crossing of NC 143 along the ANST. The new sidewalks will fill a gap in the existing pedestrian network to improve pedestrian access to destinations within Robbinsville, notably Robbinsville High School.



Equity, Multimodal Options, and Quality of Life

Improving the quality of life for Graham County residents is one of the primary purposes of the Project. GRAHAM will improve quality of life by reducing the financial burden of transportation through travel time savings from better road conditions; improving reliable and safe access to daily destinations such as employment, essential services, and recreational amenities; and promoting public health by adding new active transportation facilities such as sidewalks, a multi-use path, and a land bridge to connect the ANST. The Project also proactively addresses equity by improving transportation facilities for vulnerable road users and transportation disadvantaged populations in its economically distressed area. The Project will allow these populations to access opportunities more reliably and safely, and increase transportation options for the region's disproportionately high number of zero-vehicle households.

Reduced Transportation Costs

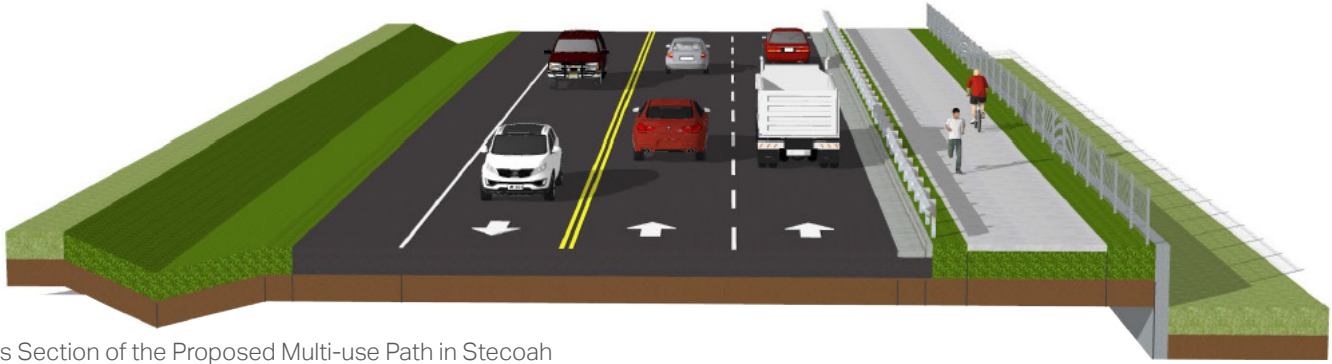
The Bureau of Transportation Statistics' Household Spending on Transportation²³ data shows that transportation accounts for the second largest household expenditure category after housing. Rural households devote 20 percent of their total household spendings on transportation, which is more than urban households. Graham County residents are especially vulnerable to rising transportation costs, as they must travel between 1 and 1.5 hours to access the closest hospitals and health care resources in Sylva, NC, Knoxville, TN, and Chattanooga, TN. The cost burden of owning and operating a vehicle is further exacerbated by the fuel price volatility, supply chain issues, and inflation the nation is currently experiencing.

GRAHAM will reduce transportation costs for travelers along its corridor through travel time savings and improved roadway conditions. By adding climbing and passing lanes, widening and adding shoulders, and using ITS components to reduce delays during closures, the Project will reduce congestion and decrease the waste of costly vehicle fuel borne by travelers from idling. Bringing local roadways into a state of good repair will also minimize damage to vehicles from traveling over rough/uneven stretches of road and decrease vehicle maintenance costs.

22 <https://www.ncdot-raft.info/login.php>

23 <https://data.bts.gov/stories/s/ida7-k95k>





Cross Section of the Proposed Multi-use Path in Stecoah

Improved Access

The Project will improve access to employment and essential goods and services (such as healthcare, education, grocery stores, and recreation) by modernizing a critical roadway. According to the US Census Bureau’s 2016-2020 ACS 5-year estimates, 25 percent of residents in Graham County work outside of the county (see Demographic Snapshot Tool on [Supplemental Materials website](#)), and Project roads are one of the primary travel routes for regional travel. In addition, Graham County residents rely on Project roads to reach educational institutions and healthcare facilities both within and outside of the county. Furthermore, the Graham County EMS Director estimates that the Project corridor is used to serve around 2,000 emergency trips a year.

The design and condition of Project roads, including the lack of safe passing opportunities and inadequate and nonexistent shoulders, can lead to congestion, and delays; while the corridor’s aging infrastructure is vulnerable to geotechnical hazards like slope failures and landslides, which can result in road closures. The Project will add climbing lanes, widen shoulders, and construct design improvements to reduce emergency response times and create a safe, reliable, and efficient route for residents to access opportunities and life-saving medical care.

Improved Public Health

According to the CDC’s [National Center for Chronic Disease Prevention and Health Promotion](#)²⁴, rural communities often have fewer opportunities to be physically active compared with their urban counterparts, which can lead to disproportionately

negative health outcomes for rural populations. GRAHAM will improve this rural area’s public health by promoting active transportation through the addition of sidewalks in Robbinsville, a multi-use path in the Stecoah Valley, bikeable shoulders, and a land bridge to provide a grade-separated crossing of NC-143 along the ANST.

Through the Project’s public outreach efforts, the community identified a portion of the Stecoah Valley as a popular walking route and noted that residents and tourists currently walk and bicycle along that roadway, which has dangerously narrow shoulders alongside vehicular lanes in which vehicles may travel up to 55 miles per hour (mph). The Project will add a multi-use path along the NC 28 portion of this walking loop to support safe walking and bicycling.

The Project will also add sidewalks to improve pedestrian access to destinations such as Robbinsville High School and the Ingles grocery store in downtown Robbinsville. The Project will add a land bridge to facilitate a safe crossing across NC 143 for hikers and tourists on the ANST. The Project will also construct eight-foot paved bikeable shoulders from Robbinsville through Stecoah Valley. These multi-modal facilities will promote active transportation and physical activity for improved public health outcomes. The benefit of walking for health and recreation totals \$0.2 million, discounted at 7 percent.

24 <https://www.cdc.gov/chronicdisease/resources/publications/factsheets/rural-health.htm>

Proactively Address Equity

The Project will proactively address equity by improving motorized and non-motorized travel for transportation-disadvantaged residents in rural Graham County. The Project's construction will improve access to opportunities both locally and across the region. GRAHAM will complete one of the last sections of the Appalachian Development Highway System (ADHS), which was established to improve roadways for populations in Appalachia that often experience higher rates of poverty and other socioeconomic disparities as a result of the region's unique challenges such as its physical isolation and rugged topography. Access in Appalachia Primer²⁵ report highlights the connection between transportation access and social and economic opportunities for residents in places such as Graham County.

The Project's components are located across a Historically Disadvantaged Community²⁶ (Census Tract 37075920300), two Areas of Persistent Poverty (Census Tracts 37075920300 and 37173960301), as well as tracts identified by the Justice40 Initiative²⁷ as disadvantaged (Census Tracts 37075920300 and 37075920100). A

portion of the Project passes through Eastern Band of Cherokee Indian territory and certain routes are included in the National Tribal Transportation Facility Inventory (NTTFI).

In Robbinsville, 45 percent of the population lives below the poverty line compared to 14 percent in North Carolina (See Demographic Snapshot on the Supplemental Materials website). In addition, 10 percent of residents in Robbinsville commute to work by bicycling or by walking compared to two percent in the State, highlighting the importance of multi-modal infrastructure to support these populations. The Project will proactively address equity through roadway improvements and new multi-modal facilities that will close gaps in the existing non-vehicular travel network and better connect disadvantaged residents with employment, education, healthcare, recreation, and other essential services.

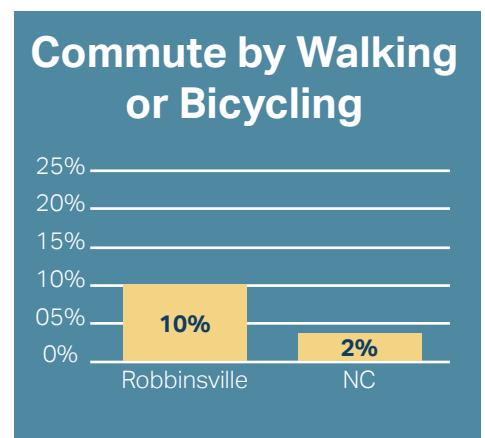
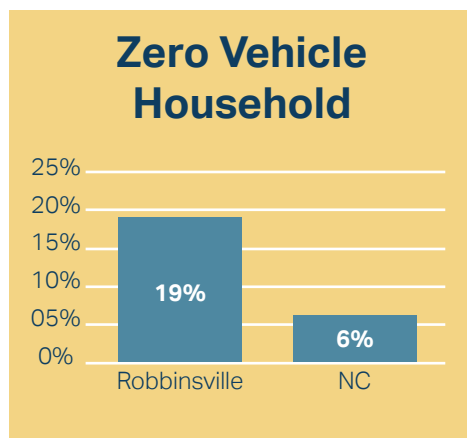
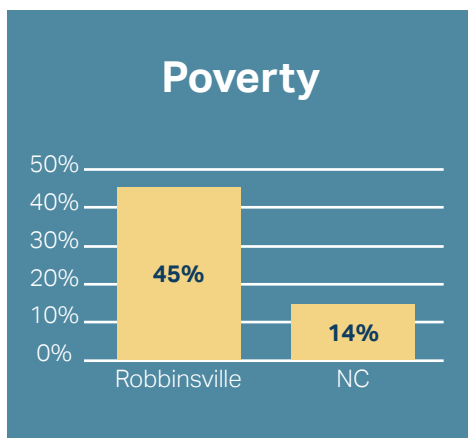
The Project components are located across:

One Historically Disadvantaged Community (HDC)

Two Areas of Persistent Poverty (APPs)

Two census tracts identified as disadvantaged by the Justice40 Initiative

1500 Acres of Tribal Lands belonging to the Eastern Band of Cherokee Indians



25 <https://www.arc.gov/wp-content/uploads/2020/12/ARC-Access-Primer-20201110.pdf>

26 <https://maps.dot.gov/BTS/GrantProjectLocationVerification/>

27 <https://www.arcgis.com/apps/mapviewer/index.html?webmap=bdac3e391cd04d2396983fc67c23bf1c>



Improves Mobility and Community Connectivity

Improving mobility and community connectivity are also primary purposes of the Project. GRAHAM will accomplish these goals by modernizing the Project corridor to serve as a safe and reliable route for Graham County Transit's demand-response services. The Project will also improve mobility for non-motorized travelers in underserved communities through new multi-modal facilities which close gaps in the non-motorized travel network and increase community connectivity.

Improved Transit Connectivity

The Project will improve system-wide connectivity and access to transit by modernizing a roadway that serves as a critical route for Graham County public transportation. Approximately 19 percent of households in Robbinsville, and 7 percent of Graham County households, do not have access to a personal vehicle. Graham County's transit service is thus crucial to supporting these residents (See Demographic Snapshot Tool on [Supplemental Materials website](#)). Graham County Transit operates both demand-response and subscription services for residents to reach medical appointments, continuing education programs, shopping, nutrition, and other key services and goods located in and out of the county.

According to the Graham County Transit Director, the service operates 24 days a month and provides transportation to an average of 1,505 riders during this time. Nearly all of these trips use the Project corridor, but congestion and delays resulting from current roadway conditions can create service delays and challenges. GRAHAM will improve transit access by increasing the corridor's capacity and efficiency through a 2+1 design as well as by adding and widening paved shoulders. The Project will also strengthen the corridor's resilience to climate change by repairing

and improving drainage features, slopes, retaining walls and embankments to ensure this route is safe and reliable for Graham County's transit services. The value of time saved for transit users from such modal diversion is \$300,000, discounted at 7 percent.

Increased Accessibility and Mobility

GRAHAM will increase accessibility for local non-motorized travel through the addition of sidewalks, paved shoulders and the previously described multi-use path. The Project will also support regional non-motorized travel on the ANST by adding a grade-separated land bridge for hikers to safely cross NC 143. These multi-modal Project features will comply with Americans with Disability Act (ADA) requirements and will support residents in Historically Disadvantaged Communities by improving their reliable access to economic, social and recreational opportunities.

The Project's multi-modal components were developed with robust community participation that helped to identify gaps in the existing pedestrian and bicycle network (See Partnership and Collaboration). The multi-use path addresses a community-identified need to support existing pedestrian and bicyclist activity in the Stecoah Valley, while the new sidewalk in Robbinsville addresses a gap in the pedestrian network, thereby improving access to educational opportunities, essential services, and other important destinations in downtown Robbinsville. The paved shoulders will not only provide a vital transportation alternative to cyclists and walkers within Robbinsville, but also an alternate way to access recreational facilities including the Great Smoky Mountain National Park, Cherokee and Nantahala National Forest, and Joyce Kilmer National Park.



Graham County Transit staff



Innovation Areas: Technology, Project Delivery and Financing

There are several innovative features of GRAHAM, from technologies incorporated during planning and design to project delivery methods.

Innovative Technologies

Travel time reliability measures the consistency or dependability of travel times from day-to-day or across different times of day. NCDOT used a 365-day simulation model of the study area for both the build and no-build scenarios to determine the travel time reliability of the Project. This model determined the travel time for every vehicle over a one-year period based on actual variations in demand collected from aggregated location-based data for 2019. By using the 95th percentile travel times, this approach was able to robustly estimate and quantify delay reductions on specific routes during the heaviest traffic days. By increasing travel time reliability, the Project can reduce barriers to opportunity faced by transportation-disadvantaged populations and vulnerable road users.

Another advanced technology used during project development is ground penetrating radar (GPR). GPR is traditionally used to identify septic systems, however NCDOT leveraged this technology to identify potential areas that may be archeologically significant to the ECBI tribe, as well as ecological anomalies to avoid during construction. Both the 365-day simulation and the use of GPR created significant cost-savings during Project planning and have reduced potential impacts to the environment and community.

The plan for the ANST land bridge is a physical representation of how the Project is using innovative design and planning to mitigate barriers to opportunity and emphasize the importance of public involvement. The land bridge was initially proposed by the public and environmental advocacy groups, and developed by the Project

with public feedback. The land bridge will facilitate wildlife and pedestrians traversing the ANST across NC-143. The FONSI provides several avoidance, minimization, and mitigation measures for potential adverse impacts to the ANST users and USFS lands.

Finally, NCDOT used the Quantm software tool to best evaluate design options for optimal roadway alignments. Quantm uses a three-dimensional model to evaluate thousands of potential routes between two given points, looking for routes that meet the model's design standards—such as speed limit and maximum grade—and identifying locations where tunnels or bridges are likely needed to maintain the desired design standards. Quantm also used NCDOT cost data to estimate construction costs. The use of the software saved valuable time and budget to arrive at a faster consensus among stakeholders.

Innovative Project Delivery

The preliminary engineering phase of STIP Project A-0009C took an innovative Planning and Environmental Linkages (PEL) approach to project development prior to entering the environmental review phase. This collaborative and integrative “Fresh Start” approach (see Partnership and Collaboration) allowed stakeholders to provide input on environmental, community, and economic goals; and then use this information to inform Project development and the environmental review process. Through the PEL process, NCDOT engaged Tribal Partners early and often, which was critical because of potential impacts associated with the Trail of Tears and potential right-of-way impacts to Tribal lands.

NCDOT leveraged another Project delivery innovation during the environmental review process through its “Advancing Transportation Linkages, Automation, and Screening” platform (Project ATLAS). Project ATLAS is a web-based platform that consolidates spatial data from a variety of sources into a single interface, using several GIS tools for screening and mapping environmental features and constraints. Additionally, the ATLAS Workbench is a project management system that provides a forum for managing projects and storing documents. Since its release in 2019,

over 1,100 NCDOT and private engineering firm consultant staff have been trained in its use. Data from Project ATLAS was used to screen for a wide range of natural and human environmental conditions along the Project corridor, setting the foundation for an accelerated project delivery.

Team members, NCDOT used the Merger Process to achieve regulatory concurrence on project decisions to garner streamlined permit approvals.

NCDOT also leveraged its Integrated Project Delivery (IPD)²⁸ and Merger²⁹ processes for a more effective and efficient project development process. GRAHAM implemented Initial Project Coordination³⁰ methods outlined by NCDOT (2019) in the process of NCDOT's shift toward Integrated Project Delivery. Following the Internal Scoping process among NCDOT and Project



Figure 5 Concept Drawing of the Land Bridge

28 <https://connect.ncdot.gov/projects/Integrated-Project-Delivery/Pages/default.aspx>

29 <https://connect.ncdot.gov/resources/Environmental/EPU/Merger/Pages/default.aspx>

30 [https://connect.ncdot.gov/resources/Environmental/PDEA%20Procedures%20Manual%20Documents/Initial%20Project%20Coordination%20\(DRAFT%20201905\).pdf](https://connect.ncdot.gov/resources/Environmental/PDEA%20Procedures%20Manual%20Documents/Initial%20Project%20Coordination%20(DRAFT%20201905).pdf)

GRAHAM

Greater Rural Access and Highways to Accelerate Mobility

Outcome Criteria Narrative

**MPDG FFY 2023 and 2024
GRANT APPLICATION
AUGUST 2023**



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