V. PROJECT OUTCOME CRITERIA

321 CONNECT addresses the criterion established by USDOT. The discussion for each criteria is augmented by supplemental materials.

PROJECT DESCRIPTION

The North Carolina Department of Transportation (NCDOT) seeks $156 million in Multimodal Project Discretionary Grant (MPDG), INFRA or Mega, funds to maintain the project schedule for the shovel ready 321 CONNECT (Calibrating Our National Network to Encourage Commerce and Tourism) project between Gastonia and Lenoir, North Carolina. The funding will allow NCDOT to move forward with 2024 – 2033 State Transportation Improvement Program (STIP) project U-4700. Due to costs, the project has been split into multiple construction phases. U-4700A will improve US 321 from US 70 to US 321 Business in Hickory and is the only funded phase in the current STIP. MPDG funds will allow for the construction of NCDOT STIP project U-4700A, which has already been delayed due to escalating materials costs, to move forward. MPDG funding will allow NCDOT to construct critically needed improvements to US 321 in this western Piedmont area, including the replacement of two aging, functionally obsolete bridges over the Catawba River. MPDG funding will also allow the installation of broadband from Gastonia in Gaston County to Lenoir in Caldwell County, addressing critical educational and commercial needs.

CRITERION 1 - SAFETY

Safety is the number one priority of USDOT. The current facility was designed in the 1950s and the last major upgrade of US 321 within the project area was in 1978. The current roadway does not meet current design standards. The construction of U-4700A, enabled by MPDG funding, will improve the operations and safety of this congested area.

An at-grade crossing of US 321 and Caldwell County Railroad (CWCY), a shortline railroad, is just south of the Catawba River crossing and utilized by four trains per week. The U-4700A project will replace the at-grade crossing with a grade separation. This will remove the existing railroad conflict, thus eliminating crossing closures as well as the potential for collisions between trains and highway traffic. The grade separation of the railroad is part of the structure over Catawba River. Crossing both the railroad and the River necessitates an increase in height compared to the existing structure, which will also improve resiliency to future flood events.

321 CONNECT will replace the current conventional intersections with reduced conflict intersections (RCIs). Reports in 2010 from North Carolina State University and in 2017 from the Federal Highway Administration found that:

- RCIs without traffic signals reduced crashes 46 percent compared to conventional intersections.
- RCIs with traffic signals reduced crashes 15 percent compared to conventional intersections.

A study of seven RCIs by the Indiana Department of Transportation found that this intersection type:

- Reduced fatal and injury crashes by an average of 81 percent.
- Reduced property-damage crashes by an average of 58 percent.
- Reduced crashes of any severity by an average of 68 percent.

The crash history of US 321 in the U-4700A project corridor shows that, since 2007, there have been six bicycle and 19 pedestrian crashes on or approaching the facility. This has resulted in four fatalities and 17 crashes that resulted in injuries (from possible injuries to serious injuries). The redesign of US 321 will provide safer bicyclist and pedestrian crossings, reducing the potential for crashes. With the anticipated increase in bicyclist and pedestrian usage anticipated with the completion of the Hickory Trail, 321 CONNECT is essential to improve safety for non-motorized transportation.

RCIs not only provide safer crossings for bicyclists and pedestrians; they also allow cities to synchronize traffic signals to control vehicular speed. If a traveler

drives at the posted speed, they will encounter green traffic signals throughout the signal-controlled corridor. If they exceed the speed limit, they will encounter a red traffic signal at the next controlled intersection. Over time, drivers adjust to this and are more likely to maintain the posted speed.

Discussed more fully under Criterion 6, 321 CONNECT broadband installation will also install cameras, ITS devices and communications infrastructure that will allow NCDOT to detect traffic issues, inform drivers and prepare the facility for the future automated/ connected vehicles that will traverse this important freight and tourism corridor.

The improvements described will yield substantial safety improvements. Based on an analysis of the current facility and the improvements proposed to US 321, it is anticipated that 321 CONNECT will produce an estimated $161.2 million with a net present value in 2021 dollars of $38.9 million of benefits through the design year of the project.

CRITERION 2 - STATE OF GOOD REPAIR

Due to the limited nature of federal and state transportation funds, it is critical that grant funding results in facilities that require minimal maintenance after construction. In the case of U-4700A, a no-build or "do-nothing" alternative would result in substantial on-going maintenance operations to keep the US 321 corridor in good operating condition. For this reason, MPDG funding is critical to maintain the construction schedule of U-4700A.

This is exemplified by the maintenance requirements of the bridges crossing the Catawba River. The bridge rating for the southbound bridge (367) was 36.94 out of 100, in June 2022, and the facility, which was constructed in 1962, is considered structurally deficient. The inspection noted metal deterioration in one location, which is considered a critical find, as well as ten additional items that were assigned as priority maintenance. Cracking was noted in the surface asphalt of the structure, which required additional maintenance activities. The northbound bridge (0366) was also inspected in June 2022. The structure had a sufficiency rating of 69.48 out of 100 and is also considered to be structurally deficient. The structure, which was built in 1983, has corrosion and cracking, with some exposed rebar noted. A total of nine items were assigned as priority maintenance activities. While routine maintenance will enable the continued use of the structures, the southbound bridge is at the end of its useful life and the northbound bridge does not meet current design standards. In 2021, U-4700A funded stop-gap renovations of the Catawba River southbound bridge. The total cost of the repair/ rehabitation project was $1,915,072.35.

Figure 1: Rehabilitation Work on US 321 Southbound Bridge over the Catawba River

The 321 CONNECT broadband installation will efficiently address the needs of all transportation modes. ITS will allow the use of dynamic message signs to inform travelers on US 321 to be aware of crashes, flooding or other conditions that could mandate emergency stops. Given the rolling topography of the region, and the fact that upgrades to the entire US 321 corridor from Gastonia to Lenoir are currently cost-prohibitive for NCDOT, automated signage is the best way to minimize emergency stops along the project corridor. The ITS and broadband installation will also help prepare the 321 CONNECT corridor for the coming generation of automated/connected vehicles.

In addition to the structure maintenance costs, there are likely additional costs that would be borne by the state if construction of U-4700A were delayed. Some portions of 321 CONNECT area have not been substantially improved since 1955. Even the most recent improvements for the US 70 interchange date to 1978. Once the proposed improvements are completed, NCDOT estimates that the savings on repaving costs along the US 321 corridor would average $300,000 per decade.

The state of good repair benefits are estimated to be $29.3 million, with a net present value in 2021 dollars of $8.8 million.

CRITERION 3 - ECONOMIC IMPACTS, FREIGHT MOVEMENT, JOB CREATION

The City of Hickory has recovered from the furniture industry downturn by embracing its past while developing manufacturing and emerging technologies. 321 CONNECT directly impacts the performance of these industries. In the project area, both Commscope and Corning Optical Communications employed more than 1,000 people, based on 2021 data from NC Office of State Budget and Management, while Apple Computer, Inc. and Prysmian Communications Cables each employed more than 500 people. Food processing and distribution facilities, including Target and Walmart, as well as Pierre Foods, Inc., Performance Food Group and Cargo Transporters, Inc, have workforces of 1,000 or more individuals. Merchants Distributors, Inc. (MDI) is a major food distributor for independent groceries throughout western North Carolina, delivering over 40,000 products across multiple categories and price points. MDI is the largest employer in Caldwell County, with over 2,000 employees.

Figure 2: MDI Facilities on US 321

Furniture remains a part of the area economy, with Bernhardt Furniture Company employing more than 1,000 people while Century Furniture, McCreary Modern, Inc., Bassett Furniture Industries of NC and Sherill Furniture Company each employ more than 500 people.

In addition to its use as a freight corridor, US 321 provides quick access to many cities and tourist attractions. It is within 150 miles of Bristol and Roanoke, Virginia and Knoxville, Tennessee, as well as the North Carolina cities of Asheville, Charlotte, Durham and Raleigh. Closer to Hickory, US 321 provides easy access to Blowing Rock, the Blue Ridge Parkway and Boone, and the excellent outdoor recreational opportunities in these locations. For this reason, there is an increase in traffic through the project corridor during the autumnal "leaf season."

Figure 3: Travel Destinations for US 321 Through Traffic

Counties in the 321 CONNECT corridor have provided extensive training opportunities for area residents that will benefit from the proposed broadband installation. The Catawba Apprenticeship Program (CAN) through Catawba Valley Community College (CVCC) has worked to develop apprenticeship

opportunities. Participating companies work predominantly with high school students and offer opportunities for complete scholarships for a two-year Associates' degree.

Other programs include:

- Manufacturing Solutions Center (CVCC) – covering hosiery, textiles, engineering and testing
- US 321 Workforce Innovation Center (CVCC) – with Hickory Aviation Museum, robotics, maritime technology and avionics
- Catawba Valley Furniture Academy
- Alexander County Furniture Academy

These programs are critical in the 321 CONNECT Broadband corridor, where much of the population lacks a high school education (see Criterion 6). Of the 26 census tracts proposed for broadband installation through 321 CONNECT, 24 have 10 percent or more of the population that have less than a high school education. Overall, 18 percent of the residents living in 321 CONNECT broadband census tracts lack a high school education.

The economic, freight movement, and job creation benefits from travel time are estimated to be $284.5 million, with a net present value in 2021 dollars of $68.6 million.

CRITERION 4 - CLIMATE CHANGE/RESILIENCY, ENVIRONMENT

Based on the National Transportation Dashboard Mobility Indicator, the 219 miles of National Highway System roadways in the Hickory Urban Area produced 672 metric tons of CO_2 per mile. On a per mile basis, this is higher than the Raleigh-Durham Urban Area. Highway widening projects increase the capacity of the facility, which will likely lead to some induced traffic, increasing greenhouse gas (GHG) emissions. NCDOT has implemented mitigation measures that can partially offset this increase. This includes integration of US 321 improvements with the Hickory Trail project. This integration will increase mobility and connectivity leading to increased opportunities for bicyclists and pedestrians. The widening of US 321 will also reduce current and future delays during peak hour traffic conditions, reducing GHG emissions from idling vehicles. In addition, NCDOT Divisions 11 and 12 encourage the use of recycled asphalt and concrete during construction, as well as the use of warm mix asphalt as appropriate.

While the increases in VMT and emissions are negative benefits ($193.4 million and $57.1 million), respectively, they are at least partially mitigated by the increased resiliency, drainage improvements, encouraged use of recycled materials, and the addition of a much needed flood gauge on Frye Creek. The integration of these practices will also serve as best practices that could be implemented on future projects as applicable.

321 CONNECT crosses the Catawba River, a vital resource as well as a noted recreational site. As part of the safety improvements for the project, US 321 will be grade-separated from the railroad just south of the river. This will necessitate raising the new bridges over the Catawba River by 25 feet. This height increase ensures more resilient structures that will retain connectivity even under more extreme precipitation events.

Frye Creek has a floodplain that crosses US 321. As shown in Figure 4, the stream banks are overgrown, which contributes to flooding concerns. Recent years have seen an increase in intensified precipitation events in North Carolina. This trend is expected to continue. 321 CONNECT will install a flood gauge at Frye Creek, which will be connected to North Carolina's Flood Inundation Mapping and Alert Network for Transportation (FIMAN-T). FIMAN-T was developed as a partnership between NCDOT and NC Emergency Management (NCEM) to provide NCDOT officials and emergency management stakeholders with real-time and forecasted flood inundation depths along roads, bridges, and other NCDOT assets in support of risk-based decision-making during flooding events. The application features an interactive dashboard allowing users to navigate between current conditions, modeled scenarios, and forecasted conditions, where available. The system reports critical emergency response information such as bridge freeboard (the

Figure 4: Frye Creek During a Rain Event

distance between the water surface and the bridge's low chord elevation) allowing for a more informed response by NCDOT, NCEM, and other stakeholders. This application allows for a timely response to increased precipitation events caused by climate change.

In addition, one of the less obvious results of an extensive road project is that it allows the opportunity to update the roadway drainage system. 321 CONNECT will update undersized and overgrown drainage structures, providing increased storage capacity for stormwater and reducing flooding concerns along Frye Creek and other streams along US 321.

CRITERION 5 - EQUITY, MULTIMODAL OPTIONS, & QUALITY OF LIFE

321 CONNECT will offer substantive enhancements to multimodal transportation options for residents of Hickory and the Long View communities. The improvements will also address equity in Historically Disadvantaged Communities (HDCs). Based on the criteria established in the Notice of Funding Opportunity, over 65 percent of the population in the 321 CONNECT corridor live in a census tract classified as an HDC. Approximately 31 percent live in an Area of Persistent Poverty (APP). Using the HDC criteria, 321 CONNECT meets Justice40 goals. NCDOT has worked with area stakeholders to provide substantial benefits to area residents. The project will improve access for those households who have access to one or fewer cars.

By providing increased access to educational, occupational, and medical resources, communities on the 321 CONNECT corridor, many of which are disadvantaged will benefit, especially those with health vulnerability, social vulnerability, economic burden, or transportation insecurity issues. Using USDOT's Equitable Transportation Community (ETC) Explorer, the following information was obtained for communities that would benefit from 321 CONNECT. **Bold text** indicates that the community is considered disadvantaged for that criterion.

- Lenoir ranks in the top 84 percent for **health vulnerability**, and over 50 percent for climate and disaster burden, environmental burden, social vulnerability, and transportation insecurity.
- Sawmills ranks in the top 70 percent for **health vulnerability**, and over 50 percent for climate and disaster burden, environmental burden, and social vulnerability.
- Granite Falls ranks over 50 percent for environmental burden, health vulnerability, and social vulnerability.
- Hickory ranks in the top 72 percent for **environmental burden** and ranks at 50 percent or higher for climate and disaster burden, health vulnerability, and social vulnerability.
- Long View ranks in the top 67 percent for **transportation insecurity**, top 65 percent for **social vulnerability**, and top 72 percent for **environmental burden**.
- Maiden ranks in the top 69 percent for **transportation insecurity** and at 50 percent for environmental burden.
- Lincolnton ranks in the top 72 percent for **health vulnerability** and ranks over 50 percent for climate and disaster burden, environmental burden, social vulnerability, and over 66 percent

for transportation insecurity.

- High Shoals ranks in the top 77 percent for **transportation insecurity**.
- Dallas ranks in the top 67 percent for **environmental burden** and over 50 percent for health vulnerability.
- Gastonia ranks in the top 73 percent for **economic burden** and ranks over 50 percent for climate and disaster burden, health vulnerability, and social vulnerability.

321 CONNECT will build on previous RAISE grant-funded construction of an expanded City of Hickory Greenway system, which provided a connection for Long View residents over US 321.

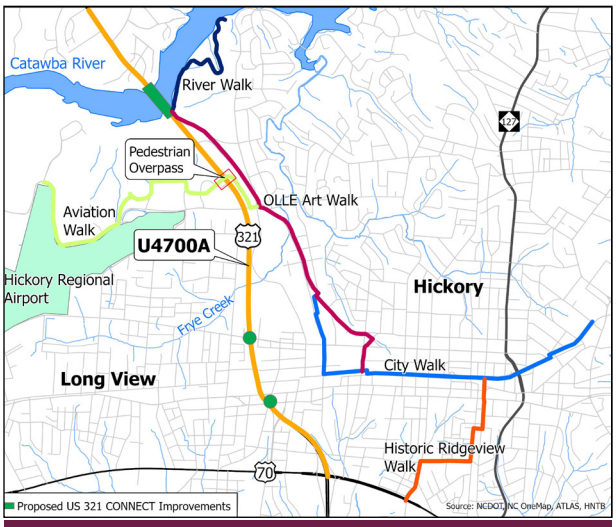

Figure 5: Hickory Trail with proposed 321 CONNECT additions

Figure 7: Hickory Trail Overpass on US 321

The current northbound bridge over the Catawba River will be transformed into a multimodal facility to connect the current greenway network to the Lake Hickory Marina. The project will construct an improved bicycle/pedestrian facility across 2nd Avenue SW. In addition, the RCI design will provide safer bicycle and pedestrian crossing options across US 321 at 2nd Avenue NW and other areas along the corridor with a history of bicycle and pedestrian crashes. The project offers improved access to employment, food, medical, educational and recreational opportunities. This is especially critical for nearby Catawba Census Tract 109. Based on 2019 American Community Survey 5-Year Estimates, in this census tract 27 percent lack access to motor vehicles and over 41 percent have one vehicle available.

Figure 6: Hickory Trail Connections to LP Frans Stadium and the Catawba River Crossing

Critically, the proposed improvements provide benefits to HDCs along the project corridor. The pedestrian facilities at 2nd Avenue SW make the improvements of US 321 less of a barrier to residents of west Hickory and Long View. 321 CONNECT provides increased accessibility to goods and services, especially for residents with one or no cars. Active transportation options can improve the health and life expectancy of area residents. The inclusion of broadband in this proposal will increase learning opportunities.

Broadband is a critical part of 321 CONNECT. Based on NCDOT data, at least 1.1 million households in North Carolina lack household access to high-speed internet. This lack reduces opportunities to develop the skills needed to fully participate in a digital economy. North Carolina Governor, Roy Cooper, has developed a plan to leverage $1 billion in federal American Rescue Plan funds and $30 million in state funds to addressing this "digital divide." The divide impacts school children, workforce and employers, as well as health care patients and other area residents. North Carolina has developed broadband adoption scores for all counties in the state. In the 321 CONNECT project area, the Adoption score index scores (100 is the maximum positive score) are as follows:

- Caldwell County 43.16
- Burke County 37.25
- Catawba County 61.85
- Lincoln County 63.71
- Gaston County 62.25

321 CONNECT will bring critically needed broadband access to a part of the state that is working to develop as a manufacturing and technology hub for western North Carolina.

Finally, NCDOT has a legislatively mandated Disadvantaged Business Program to ensure disadvantaged businesses have the opportunity to do business with the Department. The N.C. Department of Administration administers the Historically Underutilized Business Program to promote economic opportunities for historically underutilized businesses in state government contracting and procurement.

The quality of life benefits from the increased access to bicycle and pedestrian facilities total $200 Million with a net present value in 2021 dollars of $51.5 million.

CRITERION 6 - INNOVATION

Technology

NCDOT has broken this Criterion into five Dimensions.

D1: Advancement of Automated/ Connected Vehicles

321 CONNECT will seek to advance the automated and connected vehicle program by supporting both near-term and intermediate-term deployment of automated and connected vehicle technologies:

- Near-term deployments will utilize vehicle to infrastructure (V2I) and robust systems for vehicle control, traffic optimization and platooning (V2X) technologies that are integrated with the NCDOT Advanced Traffic Management System (ATMS) and Cloud Services to enable direct push of safety data and traveler information to in-vehicle systems. Potential near-term deployments within the study include work zone alerts, incident alerts, congestion ahead alerts and alternate route recommendations that coincide with response plans generated through the regional integrated mobility management system.
- Near-term deployments will also include evaluation of autonomous vehicle signage and sensor support along the route.
- Long-term deployment technologies include the construction of a resilient public-private broadband infrastructure to enable the deployment of roadside V2I infrastructure as well as build-out of 5G infrastructure to enable 100 percent V2I and V2X coverage along the project route.

D2: Active Traffic Management

The safety, mobility and environmental benefits of Active Traffic Management (ATM) have been proven through numerous studies by FHWA. 321 CONNECT will seek to augment existing traffic operations along the corridor with a more extensive ATM program. This will include the following technologies:

- Enhanced situational awareness and incident detection technologies will be deployed at key locations along the 321 CONNECT corridor to enhance detection and mitigation of safety risks.
- Enhanced traveler information capabilities through dynamic message signs at key locations and through the near-term V2I technologies listed under Dimension 1.

D3: Broadband Deployment

To ensure the foundational infrastructure is

sufficiently robust to support advanced technologies, the Department proposes the use of MPDG funding to build a broadband-ready fiber network from US 74 in Gastonia to Lenoir, which would include the entire U-4700 corridor. This network will be constructed in a manner that enables expansion of public-private partnership for broadband connectivity. Extending the limits of the existing broadband fiber network will be a cost-effective value-add for the deployment of technologies along this 50.8-mile stretch. This would allow future connections to broadband corridors along I-85 and US 64, north of Lenoir.

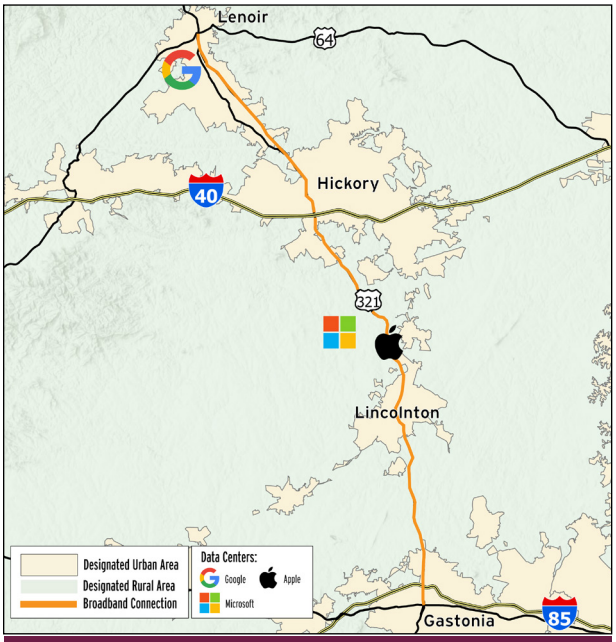

Figure 8: US 321 Data Centers

This corridor is critical to NCDOT traffic operations because it serves:

- As a primary alternate route for significant incidents that may occur along I-77 and I-85 between Charlotte and I-40.
- As a primary commuter route for access to the Metrolina region from Gaston, Lincoln and Catawba counties.
- As an important connection between current ITS fiber along the US 74/I-85 corridor and planned ITS fiber along the I-40 route that will enable statewide redundancy and resiliency for ITS operations.

The 321 CONNECT corridor has also been identified as a key corridor for broadband commercialization by the State's current commercialization contractor in recent meetings due to the presence of multiple data centers for hyperscalers (reportedly the best broadband customers), such as Apple and Microsoft, located nearby. Apple has an existing data center located off the Startown Road and US 321 interchange and Microsoft is planning four data centers in Catawba County, with at least two being within 1 mile of US 321.

NCDOT has developed an operations analysis to evaluate the anticipated infrastructure needs in the 321 CONNECT corridor. The following specifications will be proposed for the broadband.

- Four conduits along the corridor, with two being dedicated to NCDOT uses and two reserved for future broadband commercialization.
- Installation of 288 fibers for NCDOT ITS Operations use, enabling ample growth for ITS deployments in the area, future connected vehicle expansion and redundant statewide connectivity.
- Installation of six Dynamic Message Sign (DMS), with two each being located near the critical interchanges of US 321 and I-40 and I-85 and two being located mid-route for alternate route and congestion messaging.
- Installation of 22 cameras to enable operational situational awareness at each interchange along the corridor and at key mid-point locations for incident and emergency management.
- Installation of 22 connected vehicle roadside units, co-located at camera cabinets at a marginal cost to expand NCDOT's connected vehicle capabilities.

In addition to specific benefits for NCDOT, the introduction of high-speed telecommunications can demonstrably improve economic prospects for businesses, individuals and communities, while also providing a variety of collateral benefits for health care, education and public safety. The presence of this infrastructure can provide a critical connection point that would encourage the development of

Figure 9: Appalachian State University - Hickory Campus

communities.

This is particularly important along the U-4700A corridor because all census tracts in the area have 15 percent of more of the population that have no greater than a high school education. Broadband construction in this area would also benefit the Appalachian State University Hickory Campus, set to open in the fall of 2023. The new campus will offer a combination of academic and technical classes, including offerings on sustainable business practices, digital and general marketing, business and computation mathematics, supply chain management, environmental economics and policy, and international business and economics.

The 321 CONNECT project area is in a unique position to take advantage of US-made broadband cable availability. On March 23, 2023, CommScope and Corning announced they will invest over $540 million, combined, to build American-made fiber optics cables, with the aim of expanding access to broadband internet in rural areas.

"CommScope is pledging $47 million for its expansion. The Commerce Department notes the facility in Catawba, North Carolina is already the largest hybrid-fiber-coaxial facility for broadband networks globally, and will specifically produce a new fiber optic cable intended for use in rural areas.

Corning, meanwhile, is planning to expand its manufacturing campus near Hickory, building on the $500 million invested in fiber and cable manufacturing since 2020. The company is also partnering with NTCA - The Rural Broadband Association to dedicate a portion of the cable it manufactures to small, rural providers and co-ops as part of expanding broadband access."

D4: Regional Integrated Mobility Management System

As detailed in Criterion 5, 321 CONNECT will integrate seamlessly with the construction of the Hickory Trail, forming a coherent transportation network that integrates access to education, food, jobs and recreation.

D5: Crash Detection and Mitigation

Given the rolling topography of the project area, advance warning of crashes has the potential to significantly reduce the threat of chain reaction collisions. ITS will be installed as part of the broadband effort. Please see Dimension 6 for additional information. Please refer to Dimension 3 for the discussion of ITS safety goals for broadband/ITS.

D6: Leveraging and Building Upon the Statewide ITS Resilience Program

NCDOT has invested in a Statewide ITS Resilience Program that seeks to implement best practices in ITS and broadband infrastructure resilience. The program employs an integrated work order management, asset management and network management framework to actively monitor, assess and improve traffic operations system uptime and availability. This framework, combined with a statewide, performance based ITS Resilience Contract, enables the previously listed technologies (I2V, ICM, ATM, etc.) to remain in constant operation with high availability. This program seeks to enhance these safety and congestion relief strategies through improved infrastructure resilience.

Fiber Optic and ITS benefits were estimated to provide benefits of $48.3 million, with a net present value of $11.7 million.

Project Delivery

Because U-4700A has completed ROW plans and begun ROW acquisition, innovative contracting, permitting and project delivery methods are not anticipated to be appropriate for this project.

Project Financing

Innovative financing approaches are not anticipated for this project. However, should commercialization efforts be successful, NCDOT will share in proceeds from that effort, which will be used to pay for a high standard of ITS device maintenance, benefitting the motoring public. Shared revenues exceeding ITS maintenance costs would be invested in general roadway maintenance for the corridor.

Supplemental Materials can be found on the 321 CONNECT website.