2024 Climate Strategy Report

North Carolina Department of Transportation (NCDOT)

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Introduction

About the North Carolina Department of Transportation (NCDOT)

NCDOT's multi-faceted mission is to *"connect people, products, and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina*." Transportation is the backbone of North Carolina's economy, connecting manufacturers with supply chains, consumers with products and tourism, and people with their workplaces, homes, and communities across urban, suburban, and rural landscapes. NCDOT is responsible for the second highest number of state-owned highway miles in the country. The state contributes financial support to elements of non-highway improvements which can integrate resilience into transportation planning and measure resilience- related outcomes across multiple modes.

NCDOT's Vulnerabilities to Climate Change

High impact weather events and natural hazards disrupt the safety and reliability of North Carolina's multimodal transportation network. These weather events cause infrastructure damage and stress resources. The main hazard types found in North Carolina include meteorological (temperature, fog, precipitation, storms, hurricane, tornado, severe wind), climatological (drought, wildfire, sea level rise), hydrological (coastal storm/flood, inland flood, storm surge, saltwater intrusion, riverine flood) and geological (landslide, rockslides/mudslides, sinkholes).

NCDOT's Approach to Fulfilling the Strategies in the Climate Risk Assessment and Resilience Plan

NCDOT is constantly implementing the strategies identified in the Climate Risk Assessment and Resilience Plan. Following the adoption of its resilience policy in September 2021, the agency worked to enhance resilience in all day-to-day organizational activities and deployed a coordinated approach to manage risk to business operations. The enactment of this policy helped NCDOT manage risks from natural and man-made hazards and strengthen the transportation system's overall resilience and ability to maintain a safe, reliable, and efficient transportation infrastructure. This policy supports the agency's alignment with the U.S. Department of Transportation (USDOT) Climate Action Plan. In addition, NCDOT is exploring opportunities available through the Infrastructure Investment and Jobs Act (IIJA), also known as Bipartisan Infrastructure Law (BIL) and the Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT) Program (formula and discretionary grants), to pursue resilience efforts to reduce system vulnerabilities from climate change. The department's resilience policy and IIJA opportunities have aided NCDOT in incorporating and achieving new actions and strategies related to climate change resilience. In addition, the agency is consistently evaluating and testing our Flood Warning System (Transportation Surge Analysis Predictive Program (T-

SAPP), BridgeWatch and Flood Inundation Alert Network for Transportation (FIMAN-T)) in preparation for extreme weather events and conducting annual training.

In 2023, three NCDOT projects received regional America's Transportation Awards. The Southern Association of State Highway Transportation Officials (SASHTO) chose this year's regional winners from a pool of 19 projects nominated by nine states in the region. NCDOT submitted one project for each of the three contest groups and size categories, and all three won – the Rodanthe "Jug Handle" Bridge project (Operations Excellence, medium-sized project); the advanced flood-warning system for transportation (Best Use of Technology & Innovation, small category) and the East End Connector, I-885 project (Quality of Life/Community Development, large category).

In addition, NCDOT's flood-warning system has been recognized for multiple awards. In 2023, it was named a top-12 finalist for two prizes in the America's Transportation Awards competition. This year, NCDOT was awarded the Environmental Excellence Award for its innovative approach to flood resilience through the development of a flood warning system that allows the agency to better respond to the threats of hurricanes and other storms to its system and users. This award recognizes transportation projects, programs or organizations that incorporate environmental stewardship and partnerships with other agencies. The department was one of 14 recipients from across the country that were notified this week they had won the award presented by the Federal Highway Administration (FHWA).

Moreover, this year, NCDOT was awarded two federal grants for $1.8 million each by USDOT as part of the to provide improvements to a pair of flood-prone locations in North Carolina. One project will reinforce the shoulder and embankments where U.S. 74 crosses the Lumber River near the Columbus County town of Boardman. The improvements are necessary to reduce the potential for roadway deterioration and bridge approach damage from flooding from heavy storms. U.S. 74 is also a major east-west evacuation route connecting Wilmington and Charlotte, making it essential to communities in need of emergency and community services during extreme weather events. The second project will study the 11-mile stretch of N.C. 12 between Oregon Inlet and Rodanthe on Pea Island. The project will identify future construction projects, streamline environmental reviews, include public engagement and establish detailed, long-term plans for keeping the roadway passable during and following major storm events.

The agency is considering the application of more PROTECT grants for new projects once the next Notice of Funding Opportunities (NOFO) is released this year.

To continue supporting the agency's Resilience Program efforts, NCDOT developed a statewide multimodal Resilience Improvement Plan (RIP) this year to proactively identify critical areas vulnerable to natural events including climate change and for potential resilience improvements projects. The RIP meets the requirements of the PROTECT program overseen by FHWA and helps the agency qualify for up to 10 percent reduction in match funds for resilience projects developed with federal funds.

Reducing Energy Use

NCDOT and the North Carolina State Ports Authority (NCSPA) occupy 2,164 buildings totaling 9,500,271 gross square feet. Fiscal Year (FY) 2022 utility costs for those buildings totaled $11,411,289, and energy consumption per square foot is 29% less than during the baseline FY 2004 and a 5% improvement from FY 2021. At the conclusion of FY 2022, energy savings programs have resulted in a total energy cost avoidance of $34,681,106 and a water cost avoidance of $14,029,206 - totaling $48,710,312 over the past 18 years. By the end of FY 2022, cost savings measures have reduced energy and water usage per square foot in NCDOT facilities by 34% and 6% respectively, as measured from the baseline fiscal year of 2004. NCDOT estimates this trend continued through 2024 and estimates to see another 2% reduction in energy consumption resulting in a total 36% reduction in energy usage / square foot since the 2003-2004 fiscal year baseline.

The agency will finalize collecting utility data to update energy consumption between July 1, 2023-June 30, 2024. However, based upon the trend in prior percent changes in energy consumption / square foot for DOT buildings from the baseline year (not including NCSPA).

North Carolina Clean Transportation Plan

After the release of the Clean Transportation Plan in April 2023, NCDOT and its partners have accomplished several major milestones including:

- Sponsoring public engagement events like the Sustainable Fleet Conference and alternative vehicle ride-and-drive events to encourage electric vehicle adoption;
- Preparing a request for proposals for businesses interested in applying for federal funds available to construct and operate the first round of electric vehicle charging stations along interstates and major highways;
- Completing a comprehensive Vehicle Miles Traveled (VMT) Reduction Study and updating the VMT Reduction Toolkit;
- Securing funding to build public charging stations at NCDOT facilities to support the future electrification of NCDOT's fleet;
- Hiring a dedicated clean transportation lead staff member devoted to coordinating with external stakeholders to implement the Clean Transportation Plan;
- Working with utilities and other service providers, such as Duke Energy, to ensure grid readiness for large expansions of charging;
- Continuing investment in multimodal transportation solutions across the state with grant funding including the S-Line $1.09 billion passenger rail grant from the USDOT to begin connecting Raleigh and Richmond, V.A.;
- Securing funding for the Ecusta Trail grants from the U.S. Department of Transportation. When the trail is complete, cyclists and pedestrians will have a safer alternative to traveling winding mountain roads.

- Applying to FHWA for the Low Carbon Embodied Transportation Materials (LCTM) Grant.

For information on how NCDOT will continue implementing its Clean Transportation Plan, please refer to the accomplishment of milestones.

Addressing Environmental Injustices and Inequities

In 2022, Deputy Secretary Ebony Pittman was appointed as the environmental justice (EJ) lead for NCDOT. An environmental justice policy advisor role was created and filled to develop and implement an environmental justice strategy within the agency, by recommendation of the Andrea Harris Equity Task Force in response to the USDOT Justice40 initiative and the USDOT Equity Action Plan. In addition, the Integrated Mobility Division (IMD) developed and released an Environmental Justice and Transportation Disadvantage tool and training session. This equity tool is currently being used for project prioritization and has also been used recently to aid in distribution of funding, and further tools are being developed. NCDOT's Research and Development team has increased emphasis on research projects investigating equity and environmental justice concerns. There are several ongoing research projects addressing the Department's history and future with environmental and racial justice.

In October 2023, Gov. Roy Cooper issued Executive Order 292, Advancing Environmental Justice in North Carolina. This executive order appointed 11 Cabinet Agency leads and 11 community representatives to an Environmental Justice Advisory Council, including NCDOT's Deputy Secretary Pittman. This executive order required each cabinet agency to develop at least? three EJ goals and measurable outcomes. NCDOT developed the following five goals:

1. Strive for Excellence in Public Involvement
2. Improve Safety and Health Outcomes for Vulnerable Road Users
3. Eliminate Disparities in Access to Opportunities and Services
4. Mitigate Canopy Deserts and Address Heat Islands in EJ Communities
5. Invest in Historically Underserved Communities

A full draft of these goals can be viewed on the Governor's website. These goals are currently undergoing finalization, and public feedback is being evaluated and incorporated. One of the requirements of EO 292 is an annual reporting requirement describing goal progress every October. NCDOT has also supported the work of the Governor's EJ Advisory Council by facilitating EO-required public outreach and engagement efforts for the entire council using our existing public involvement tools and strategies. Continued work with this Council and efforts to achieve the goals set forth by this Department will be ongoing in the coming year.

Public Participation Plan

As a part of Executive Order 246, Section 8, each Cabinet agency "shall develop an agency public participation plan informed by stakeholder input. The plan shall include best practices for community engagement, meaningful dialogue, and efficient mechanisms to receive and incorporate public input into agency decision-making."

NCDOT released its agency plan, known as the Statewide Public Involvement Plan (PIP), in 2020. As a result of EO 246, the department updated the plan to strengthen language around environmental justice and Limited English Proficiency (LEP) engagement, and updates were released for public review in early June 2022. The plan and link to the survey were posted on the department's website: Statewide PIP Survey.

Over the past 20 years, NCDOT has provided fair, accessible, and meaningful opportunities for all interested and affected parties to engage in its outreach efforts. To increase this outreach, the Statewide PIP recommends that individual PIPs be developed for every plan and project.

As part of the process for developing a PIP, once a project-specific or a plan area study has been proposed, the NCDOT's Community Studies team develops a Demographic Study Area (DSA) that encompasses all residential areas near the project. The Demographic Snapshot Tool is used to pull Block Group level data on minorities, race, ethnicity, low income, zero car households, under 18 and over 65, disabled persons, and adults who speak English less than very well. Language is determined using Tract level data. These DSA Block Groups are compared with the county average for EJ and Title VI populations. Language groups are noted for each Block Group with a "less than very well" population, with LEP thresholds determined by the DSA total.

In addition to Census data, EJ and LEP populations are further assessed through site visits, satellite image review and consultations with the Local Area Resource Contacts (LARCs)/ Community-Based Organizations (CBOs) Network. These practices can identify concentrations too small to stand out at the Block Group level – affordable housing complexes, independent living facilities, disabled group homes, ethnic enclaves – and help locate important resources, such as religious facilities, cultural centers, ethnic goods and services, etc.

These data are provided to the public involvement team and project managers to aid in developing PIP. A Public Involvement Practitioners Guide was published in 2023 as a resource to project teams to provide better community and public engagement in project decisions. When working with underserved communities, a best practice is to identify and reach out to a LARC/CBO. This includes a local/community leader (i.e., reverend/pastor/priest/rabbi/imam, business owner, community activist, city/county commissioner, etc.). Local/community leaders can aid in organizing small group meetings, conduct door-to-door community outreach efforts, disseminate information, and gather input. This helps to bring trust into the process because of the LARC's relationship with the community.

The PIP serves as a critical framework for enhancing community engagement, meaningful dialogue, and transparent decision-making in our operations. It ensures our agency effectively incorporates stakeholder input and fosters relationships with all members of the public, including underserved communities and populations with limited English proficiency.

In line with the requirement to update and publish the plan annually, NCDOT acknowledges its commitment to maintaining its relevancy and effectiveness. In July 2024, NCDOT thoroughly reviewed and updated the PIP in light of any changes at the legislative, regulatory, or policy levels, both at the state and federal levels, that might necessitate updates to continue the alignment with the relevant guidelines and objectives set forth by EO 246.

NCDOT believes its ongoing efforts in community engagement and dedication to transparency reflect our commitment to the principles outlined in EO 246. NCDOT remains fully prepared to adapt the plan whenever circumstances necessitate and is committed to ensuring our stakeholders have ample opportunities to participate in the decision-making processes related to the agency's plans, projects, studies, and actions.

1.0. Reduce greenhouse gas emissions

1.1 Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels

1.1.1 Establish energy savings programs

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT has established energy savings programs to reduce the energy consumption in NCDOT and NCSPA occupied buildings. By the end of FY 2022, these programs have accomplished a reduction in energy usage per square foot in NCDOT facilities by 36% and 9% respectively, as measured from the baseline FY 2004. Some of these initiatives include monitoring and support of two guaranteed energy saving performance projects in Raleigh (five of NCDOT's largest buildings) and across the state (roadway lighting and building lighting upgrades).

NCDOT will continue to implement these programs to continue reducing energy consumption and costs in its buildings.

1.1.2 Implement energy conservation measures (ECMs) in all new buildings and repair and renovation projects

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is implementing ECMs in new or renovated buildings as per the 2018 NC State Building Code: Energy Conservation. NCDOT also specifies in plans other ECMs that a project's budget can support, and which do not add to the user's workload or require extensive maintenance to repair.

There were no changes during the past 12 months. However, the agency will continue to implement these efforts within the next 12 months.

1.1.3 Improve electrical infrastructure across NC supporting the Roadway Lighting Policy

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT's Roadway Lighting Policy was developed by the end of 2020. In response to this policy, NCDOT is planning multiple projects to improve the electrical infrastructure across the state to support energy efficient roadway lighting for interchanges and along roadways.

There were no changes during the past 12 months. Within the next 12 months, the agency will complete another seven lighting design projects that have been approved.

1.1.4 Perform energy audits to identify energy conservation measures (ECMs)

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is performing energy audits to identify ECMs that can generate enough cost savings to pay for the cost of work within 2 to 3 years – sometimes in less than one year. An audit was completed for the Transportation Building during the past fiscal year, but the agency will continue to identify other facilities where energy audits will be cost effective.

Within the next 12 months, the agency will continue to implement these efforts.

1.1.5 Upgrade, replace, and repair existing heating, ventilation, and air conditioning (HVAC) equipment to improve energy savings

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is planning multiple projects to improve existing HVAC equipment to increase energy savings. Some of these efforts include:

- Replacing chillers and split systems
- Installing more energy efficient roofs as they are repaired or replaced (many NCDOT buildings are over 40 years old)
- Replacing / upgrading existing windows with more energy efficient models
- Programmable thermostats, building automation and monitoring systems as appropriate and affordable
- Lighting upgrades

Some of the particular efforts include a new chiller and windows in the Transportation Building at 1 S. Wilmington St. in Raleigh. It is the agency's preference to install or upgrade to programmable thermostats for buildings unless a lifecycle cost analysis shows that installing a centralized HVAC control system is cost effective. The goal is to avoid installing an HVAC control system that adds to time and expense of maintaining those systems and to avoid connecting to existing remote NCDOT monitoring and control systems given the time and expense of obtaining approval by NC Department of Information Technology (NCDIT).

There were no changes during the last 12 months. Within the next 12 months, the agency will continue to implement these efforts.

1.1.6 Implement sustainable construction materials

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is currently implementing more sustainable paving materials that reduce emissions. Warm Mix Asphalt (WMA) technology reduces energy consumption due to the use of an additive that reduces the temperatures at which asphalt mixes are produced and placed. This means less fuel required at the production plant to heat the aggregates to the traditional hot mix asphalt (HMA) temperatures. With the decreased production temperature comes the additional benefit of reduced emissions at the plant and during lay down.

During the next 12 months, NCDOT will continue implementing the use of WMA where feasible.

1.1.7 Use energy rebates funded by utility companies to support energy conservation measures (ECMs)

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is planning to use energy rebates funded by utility companies to offset the cost of new construction and repair and renovation work. Note that NCDOT has used utility rebates in the past to reduce project costs and to pay for improvements to roadway lighting infrastructure. Additional rebates received from new or renovated buildings will be used to support ECMs as identified.

There were no changes during the last 12 months. Within the next 12 months, the agency will begin to implement these efforts.

1.1.8 Identify and support efforts to obtain funding for ECMs

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT will work with the Department of Environmental Quality (DEQ) and others to identify funding over the next fiscal year for ECM projects – particularly those that involve optimizing HVAC usage to reduce cooling / heating loads when buildings are not occupied Funding from the Volkswagen (VW) Settlement has been earmarked for the construction and installation of Zero Emission Vehicles (ZEV) recharging stations at the Transportation Building, Manns Harbor, and in Division 14.

There were no changes during the last 12 months. Within the next 12, months the agency will continue to implement these efforts.

1.1.9 Submit a FHWA Low-Embodied Carbon Transportation Materials (LCTM) grant

Status: Complete
Completion Date: June 2024

NCDOT submitted a grant application to FHWA for LCTM Program. The grant is to help offset the increased costs for transportation materials that require lower amounts of carbon to acquire, produce, and place them. In addition to paying for the lower-carbon materials, the grant will also pay for setting up a new voluntary Environmental Product Declaration (EPD) Program at NCDOT (primarily for pavements). The grant will also fund opportunities for the purchase of new equipment, training, testing, and travel associated with eligible grant opportunities.

1.1.10 Implement the FHWA LCTM grant

Status: Planned (expected initiation date September 2024)
Expected Completion Date: September 2031

Over the next 12 months, NCDOT will begin implementing the LCTM grant listed in the prior section. The grant will consist of various efforts, to include the establishment of a new voluntary EPD program, research, equipment procurement, testing, evaluation, travel, training, contractor incentives, and material acquisition and placement on construction projects.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.2 Support the use and expansion of energy efficient and clean energy resources

The content for this section also covered in multiple other sections/actions throughout the report.

1.3 Increase the number of registered Zero Emission Vehicles (ZEV) to at least 1,250,000 by 2030 so that 50% of in-state sales of new vehicles are zero-emission by 2030

1.3.1 Develop and implement the North Carolina Electric Vehicle (EV) Infrastructure Deployment Plan

Status: Underway
Expected Completion Date: August 2026

Under the federal National EV Infrastructure (NEVI) program, NCDOT developed an EV Infrastructure Deployment Plan to provide a framework for the deployment of EV charging infrastructure through reimbursement grants. The Federal Highway Administration approved the plan in August 2022 and well as 2 subsequent plan updates submitted in Q3 of 2023 and 2024. The plan outlines the deployment of infrastructure in two phases. Phase 1 is focused on the build out of NEVI-compliant stations along the designated along the state's Alternative Fuel Corridors (AFCs), and Phase 2 will focus on community-based public EV charging to support EO246 ZEV goals and other clean transportation priorities.

During the last reporting period, NCDOT 1) engaged with industry, disadvantaged businesses, communities, and technical experts to understand the needs, barriers and J40/equity opportunities around deployment of charging stations, 2) developed the RFP as well as a draft contractual agreement for the funding, and 3) provided opportunities for applicants to partner with disadvantaged businesses. The Phase 1 Round 1 Request for Proposal (RFP) was released in April of 2024 and requested proposals for 11 potential charging stations. The RFP closed in June of 2024 and NCDOT is currently evaluating the "best value" proposals which take into consideration a number of factors in addition to cost. NCDOT anticipates awarding funding in September of 2024. Phase 1 Round 2 RFP is anticipated to be released later in 2024. Planning and community engagement for Phase 2 will also get underway.

1.3.2 Install EV chargers for aircrafts and ground vehicles

Status: Ongoing
Expected Completion Date: August 2024

NCDOT partnered with BETA Technologies to install EV chargers for one aircraft and two ground vehicle ports at Raleigh Executive Airport. BETA commissioned the installation of these chargers in August 2024. Installation of the chargers will begin within the next 12 months.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.3 Purchase electric transit buses

Status: Underway
Expected Completion Date: Continuous

NCDOT committed $6.3M in CMAQ funds to help leverage VW settlement funds for transit electrification. This will result in 19 additional all electric transit buses added to transit agencies across NC.

Within the next few months, NCDOT will work on the contracting and procurement of buses.

Additionally, CRP funds have been programmed to fund the purchase of electric transit vehicles. An example of this is a $408,000 CRP award to the Johnston County Area Transit System (JCATS).

CMAQ and CRP funds will likely continue to fund electric transit vehicles into the future as a variety of transit operators have inquired about the possibility of using these two federal funding sources for vehicle procurement.

1.3.4 Perform need assessment for the electrification of medium- and heavy-duty sectors.

Status: Complete
Completion Date: September 2023

In support of both EO 271, "Growing NC's Zero Emission Vehicle Market", and NEVI, NCDOT is performing an infrastructure needs assessment for the electrification of light-duty and medium/heavy-duty (MHD) vehicles using Governor Cooper's goals for number of electric vehicles under the Executive Order. The study was delivered to the Governor in September of 2023 and can be found at NCDOT ZEV Infrastructure Needs Assessment

The light duty ZEV assessment indicates over 45,000 publicly available charging ports and 350,000 residential charging ports are needed by 2030. The MHD ZEV assessment estimates 32,853 Level 2 chargers in use by 2035 and the number of Direct Current Fast Chargers (DCFC) chargers in use in 2035 could range from 19,000 chargers to 58,000 chargers. This infrastructure supports an estimated 91,000 MHD vehicles, which represents between 12% and 16% of the state's MHD vehicle inventory. In 2035, NCDOT expects most of the battery electric MHD ZEVs will be charged overnight and where the vehicles are domiciled, in garages, depots, or at residences, rather than publicly accessible facilities.

1.3.5 Complete a NCDOT aircraft fleet study and request for information (RFI) on zero-emission aircraft

Status: In Progress
Expected Completion Date: April 2025

NCDOT has commissioned an RFI for candidate aircraft to enhance or replace NCDOT's existing aircraft fleet. NCDOT is analyzing the submissions from vendors to identify possible zero-emission aircraft solutions to modernize and meet the needs of NCDOT's flight operations. During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.6 Complete a NCDOT Appalachian Regional Commission (ARC) study for rural airport electrification

Status: In Progress
Expected Completion Date: July 2026

NCDOT and partner states were awarded a grant by ARC to assess the infrastructure needs of the region's airports, including upgrading electric utility capacity and installing charging capabilities required to support AAM aircraft. The project serves four Western North Carolina general aviation airports and 36 total airports in the multi-state Appalachian region.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.7 Complete a statewide airport electrification gap analysis and needs assessment

Status: In Progress
Expected Completion Date: July 2025

NCDOT is conducting an electrification needs assessment of the 72 public-use airports in North Carolina to identify existing infrastructure and upgrades needed to support electric aviation, ground transportation, and airport operations in the future. This needs assessment will be utilized to maximize future grant opportunities and other funding mechanisms.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.8 Conduct a Wave Transit zero emissions vehicles transition study

Status: Complete
Completion Date: July 2024

This study was initiated in November 2022 and will assist Cape Fear Public Transportation Authority (CFPTA), which operates as Wave Transit, with the creation of a Zero-Emission Fleet Transition Plan and the engineering and design of infrastructure for charging stations.

The study aims to identify a zero-emission strategy and develop a Fleet Transition Roadmap to incorporate battery electric vehicles (BEV) and/or hydrogen fuel cell electric vehicles (FCEV) into CFPTA's fixed route paratransit services and facilities.

The study will also perform a review focused on advancing the development of a Fleet Transition Roadmap using a phased-in approach that takes into consideration regulatory requirements and charging technology. The analysis will incorporate market availability of comparable fleet vehicles, energy modeling to determine operational feasibility, key site modifications and energy delivery and infrastructure requirements, and associated forecast capital costs.

The study was completed in January 2024 and created a roadmap for fleet transition planning for Wave Transit. Wave Transit is now proceeding with implementation options. Transitioning to battery electric buses were recommended for Wave's paratransit and fixed route services, which are services relied on by historically disadvantaged groups, furthering a socially equitable strategy for access to ZEV technologies.

1.3.9 Establish best practices and technical guidance for planning and developing an EV infrastructure network (NCDOT Research Project Number: 2024-10)

Status: Underway
Expected Completion Date: June 2025

NCDOT is sponsoring a project to develop a series of planning and policy best practices and technical guidance for siting EV charging infrastructure to support the expansion of the charging network and its management in North Carolina. This research will assess local planning policies and power utility considerations to develop guidance that informs the efficient and equitable development of a statewide EV charging network plan. The policy and planning research tasks will result in a practice-ready guidance document. This document will include guidance for local agencies, draft policies that can be locally adopted to simplify EV infrastructure permitting and approvals at the municipal and county level, and guidance that highlights opportunities for NCDOT to collaborate and support external partners in improving statewide EV infrastructure. Additionally, the technical guidance derived from models for siting EV charging infrastructure will support the charging network's expansion and provide insights on charger deployments given geographical limitations, travel demand constraints, electric power grid requirements, and equity considerations.

The research results will be practice-ready, implementable guidance on EV network sitting and development. The policy and planning best practice and EV development guidance can be used to support metropolitan planning organizations (MPOs), rural planning organizations (RPO) and local planning agencies for siting local EV infrastructure and developing planning policy that encourages the establishment of an equitable and technically sound EV charging infrastructure.

Researchers have completed EV literature review and developed a synthesis of existing efforts in EV charging deployment with equity concerns. In addition, researchers continue to review national EV State of Practice and have distributed surveys of local planning policies. During the next 12 months, the research team will continue distributing surveys, analyze and report results.

1.3.10 Develop the Light-Duty ZEV Action Plan as part of the North Carolina Clean Transportation Plan (NCCTP) stakeholder process

Status: Complete
Completion Date: April 2023

As part of EO246, NCDOT was directed to develop the NCCTP, a broad stakeholder process focused on the development of near-term strategies to decarbonize the transportation sector. Five work groups, including a group focused on the transition to Light-Duty ZEVs, have been meeting monthly since May 2022 to develop action plans to be used in the final NCCTP report. The Light-Duty ZEV work group outlined strategies to help the state achieve the EO246 ZEV goals by 2030. The Light-Duty ZEV action plan has been updated while tracking of ZEV registrations continues. NCDOT has also partnered with Atlas Policy to create an EV dashboard of ZEV data for the state.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.11 Support agencies to develop EV fleet transition plans

Status: Underway
Expected Completion Date: September 2024

The NCDOT Integrated Mobility Division (IMD) partnered with multiple transit agencies to fund the development of EV transition plans. The transit agencies included Wilson, Buncombe, Johnston, and Duplin Counties and planning was completed over the course of 10 months (beginning in October 2023).

Two of the plans resulted in applications submitted to the Low and No Emission programs federal grant in spring of 2024 which also was supported by NCDOT IMD sponsorship. This effort was part of a preliminary program that included the Wave Transit ZEV Plan and may potentially build into a more robust and standardized program offered to all transit agencies on an annual basis. Currently, the future of the program is being evaluated by NCDOT IMD.

The majority of ZEV adoption to date has been in urban areas; however, the NCDOT ZEV program caters to the subrecipient audience that NCDOT works with, with many of these transit agencies servicing rural parts of North Carolina. The EV transition plans are working on answering difficult questions related to the EV technology and how it is best implemented in rural geographies as part of an equitable approach for ZEV to reach all populations in North Carolina.

The Carbon Reduction Program (CRP) and Congestion Mitigation and Air Quality (CMAQ) programs have been assisting local governments with EV fleet transition by awarding federal program dollars for EV fleet procurement. This is currently allowable under the *Waiver of Buy America Requirements for De Minimis Costs and Small Grants (Docket No.: DOT–OST–2022–0124).*

1.3.12 Support local transit agency to increase the use of electric vehicles (EV)

Status: Ongoing
Expected Completion Date: Anticipated Fall/Winter 2026. Dependent on Flex Funds Process for Carbon Reduction Program (CRP) funding. This date includes bus delivery and electric charging infrastructure installation.

The North Carolina Department of Transportation, on behalf of the Boone and Watauga County's Public Transportation Authorities, AppalCART, will receive $2,207,758 in funding from the Federal Transit Administration (FTA)'s FY23 Low- and No-Emission and Bus and Bus Facilities program to purchase battery electric buses, charging equipment and to develop a training program for maintenance workers.

NCDOT will work closely with AppalCART for the implementation of this project within the next 12 months. In addition, AppalCART has received $4,002,062 CRP funds to purchase additional battery electric buses. The new buses will help improve service reliability and air quality for residents of Boone and Watauga Counties in the Appalachian Mountains of western North Carolina. This project is part of NCDOT's effort to ensure an equitable approach for the benefits of low or zero emission technology to reach all populations in the state including rural geographies.

1.3.13 Develop a database for EV chargers

Status: Planned
Expected Completion Date: December 2024

NCDOT's IMD is developing a database to keep track of EV charging stations for transit locations. IMD solicited and collected data from transit systems in the state that have charging infrastructure and that are interested in changing their fleets to low emission or electric vehicles. Information gathered includes identification of sites for (non-public) EV charging stations. This effort will help determine locations that may not be adequately served with charging infrastructure where current or planned and can influence decision-making to ensure equitable access is provided.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.14 Improve ZEV registration data

Status: Ongoing
Expected Completion Date: Ongoing

The ZEV registration data is now updated and posted monthly rather than quarterly. This data is available to external stakeholders and can be used to track progress on the EO80 and EO246 ZEV goals as well as determine density of EV ownership to aid in the sitting of EV charging stations.

In the next 12 months, NCDOT will continue updating the registration data. The data is posted by-monthly.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.3.15 Host ride and drive events and educational outreach

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT Partners (NC Clean Energy Technology Center (NCCETC), Plug-in NC, Clean Cities, etc.) are hosting several ride and drive events and vehicle expos.

NCDOT continues to sponsor the Sustainable Fleets Conference that was hosted on August 13-15, 2024. Many Ride and Drive events are planned throughout the state.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.4 Prioritize Zero Emission Vehicles (ZEVs) in the purchase or lease of new vehicles and for agency business travel

1.4.1 Identify NCDOT motor fleet vehicles for conversion to ZEV

Status: Ongoing
Expected Completion Date: Ongoing

Each year, the NC Department of Administration (NCDOA) identifies agency motor fleet vehicles that are candidates for replacement by zero emission or reduced emission vehicles.

The availability of charging infrastructure at NCDOT facilities remains a barrier in the conversion of replacement vehicles to ZEV or hybrid alternatives. The agency is working to use grant funding from the Volkswagen (VW) settlement and is considering other funding options. In past years, NCDOT has purchased several all-electric vehicles that are in varies places across the state.

Within the next 12 months, NCDOT will continue to look for additional vehicles that may need replacement.

1.4.2 Support the installation of electric vehicle charging stations for ZEV at NCDOT buildings

Status: Underway
Expected Completion Date: January 2025

NCDOT is working on increasing the number of EV charging stations in the state for plug-in hybrid and battery electric vehicles. Through the solicitation for projects from the Volkswagen Settlement, NCDOT applied for EV charging stations at four NCDOT owned buildings- Highway Building, Century Center, the Hatteras ferry facility and the Division 14 office. Applications included one portable solar charger and three permanent installations of Level II charging that would be open to the public.

NCDOT received funding to install 3 charging stations through the NCDEQ VW Mitigation Fund grant. NCDOT has installed a Level 2 station at the NCDOT Office in Sylva, NC, as of August 2024. NCDOT has submitted an electrical design to the State Construction Office for a Level II station at the Hatteras Ferry as of July 2024. NCDOT is working on developing an electrical design for a DCFC station at the Main Office. All the work is scheduled to be completed by January of 2025.

1.4.3 Investigate vessel electrification for the NCDOT Ferry Division fleet

Status: Underway
Expected Completion Date: October 2023

Beginning July 2021, this research focused its ferry vessel and infrastructure investigation on the Ferry Division's short haul routes which include Bayview/Aurora, Southport/Fort Fisher, Cherry Branch/Minnesott Beach, and Currituck/Knotts Island. This study's findings can be applied throughout the system.

A formal report has been created and delivered to assist the Ferry Division in considering and planning for an electric fleet. The report includes a high-level assessment of vessels, shoreside infrastructure needs, workforce requirements, emissions reduction information and potential funding opportunities.

To date, no NCDOT ferry vessels have been programmed with CMAQ and CRP funds.

1.5 Initiate other initiatives to decarbonize the transportation sector

1.5.1 Update the Vehicle Miles Traveled (VMT) Reduction Study and toolkit

Status: Complete
Completion Date: February 2024

In August 2019, NCDOT began the facilitation of a VMT reduction task force and a VMT Reduction Study. This study identified strategies to reduce VMT in urban, rural, and regional areas of NC. The VMT Reduction Study was released in April 2021 and provides summary pages as a comprehensive introductory resource to organizations considering methods to reduce VMT in their areas. Following this study, NCDOT developed the VMT Reduction Study Toolkit. The toolkit is an interactive document with information about Transportation Demand Management (TDM) measures that reduce VMT and the potential funding sources available to implement these measures.

The VMT Toolkit was recently updated with variety of new information sources and ideas in February of this year. The VMT Study was updated to include sections on a new VMT reduction target, and a section on the benefits of land use/zoning reform as it relates to VMT reduction efforts and a more efficient transportation network.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.5.2 Quantify and assess ferry vessel emissions (NCDOT Research Project Number: 2024-08)

Status: Underway
Expected Completion Date: February 2025

The Ferry Division has a long-term goal to move toward green, sustainable technology and operations. A baseline emission inventory is needed to assess which ferry vessels, routes and engine emission-reducing interventions would be the most beneficial. However, there are no empirical data based on representative and actual operations upon which to quantify baseline main and auxiliary engine emission rates for existing NCDOT ferry fleet. NCDOT is sponsoring a project to address these issues.

The objectives of this project are to: (1) establish a methodological framework to measure real-world ferry main and auxiliary engine exhaust concentrations; (2) quantify real-world ferry engine energy use and exhaust emissions; (3) develop a baseline emission inventory for NC ferry vessel engine fleet; and (4) identify and recommend opportunities to reduce emissions.

The research team will now focus on a high-level emissions analysis for the ferry fleet. Over the next few months, task will include conducting real-world emissions measurements on a selected sample of ferry vessels, searching and compiling ferry engine emission factors from existing databases and literature, and estimating engine emissions factors using a statistical simulation approach. The research team will deliver an estimated baseline fuel use and emission inventory for selected ferry vessels as well as documentation describing the methods and results for quantifying fuel use and emissions reduction potential as well as assessing the cost effectiveness and health benefits associated with ferry engine upgrades.

1.6 Initiate other projects aimed at reducing statewide greenhouse emissions

1.6.1 Develop a Transportation Demand Management (TDM) Plan for The Greater Charlotte Region

Status: Underway
Expected Completion Date: September 2024

The project was initiated in March 2023. This initiative involves partnering with the Centralina Regional Council to develop a regional TDM plan and outline immediate steps for starting up a regional program for the greater Charlotte region. The process has involved developing a vision and goals, conducting stakeholder engagement, assessing prime TDM focus locations, and developing an existing regional TDM conditions report. These initial steps have supported the development of recommendations for a TDM program support structure, creation of a prioritized list of actionable TDM strategies, and preparation of an approach for TDM program implementation. The plan will include acknowledgement of equity / environmental justice efforts.

1.6.2 Provide recommendations to the prioritization process

Status: Underway
Expected Completion Date: June 2025

Over the next 12 months NCDOT will consider making a recommendation to create a Prioritization Workgroup to consider and develop some changes to add new criteria to the project prioritization/scoring process to aimed at reducing GHG emissions of future Highway projects.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.6.3 Prepare Appalachia for a sustainable electric aviation future

Status: Underway
Expected Completion Date: June 2025

NCDOT Division of Aviation, partnering with other agencies and universities will work with state departments of aviation to prepare a plan to integrate new aviation technologies in 36 regional airports in Ohio, Kentucky and North Carolina. The ongoing development of Advanced Air Mobility (AAM) – a new generation of less expensive, more flexible electric aircraft – is expected to create economic growth opportunities and expand the availability of this aviation service. AAM aircrafts will provide new air transportation options, both within Appalachia and between the region and adjacent urban centers. This planning study will support regional airports' efforts to prepare to meet the requirements for this new aviation technology.

This project was awarded a $500,000 grant from the federal Appalachian Regional Commission (ARC). In addition, this partnership brings a combined $176,590 in matching funds to this project. Over the 12-month performance period, the project will result in the completion of one planning report addressing the AAM preparation requirements of general aviation airports in distressed and at-risk Appalachian counties in Ohio, Kentucky and North Carolina.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

1.6.4 Document recycled materials used it the NCDOT Resource Conservation Program

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT's Resource Conservation Program looks to document the amount of recycled and recyclable materials used in maintenance and construction projects, as well as general office recycling every year. The program encourages NCDOT personnel, consultants, and contractors to specify and use recycled and reclaimed materials whenever practicable. The program is looking to increase the departments use of these materials over the next 12 months. One new topic of interest is the use of recycled plastics in asphalt pavements. The reuse of materials reduces the amount of waste sent to the landfill, ultimately reducing greenhouse gas emissions emitted by the decomposition of waste.

In addition, NCDOT is using more resilient materials such as stainless-steel reinforcing, carbon fiber in the construction of coastal bridges. These materials provide better structural integrity. NCDOT is currently collaborating with N.C. State University (NCDOT Research Project 2024-14) to evaluate the performance of asphalt mixtures containing recycled asphalt materials (RAM). Increasing permissible RAM contents through effective Recycled Binder Ratio (RBR) percent specification could potentially reduce costs and waste while better preserving the environment. Over the past 12 months, the research team has completed and submitted an extensive literature review and started evaluating previous mix findings to outside supply plant mixtures. The team has also developed schematics to explain proposed processes being used to arrive at a recommended recycled asphalt pavement (RAP) preheating procedure.

1.6.5 Track agency decarbonization effort

Status: Ongoing
Expected Completion Date: Ongoing

As part of the NCCTP, NCDOT conducted an internal survey to document a preliminary inventory of known decarbonization efforts that have been achieved by the agency. This included reduced emissions from transportation-related activities, as well as building related activities, such as energy efficiency or deployment of renewable energy. The results from the survey will help summarize NCDOT's decarbonization efforts across all its divisions and units.

Progress on NCDOT's decarbonization efforts will continue to be tracked annually.

1.6.6 Develop Carbon Reduction Program (CRP) Strategy Report (FHWA program)

Status: Complete
Completion Date: November 2023

IIJA established the Carbon Reduction Program (CRP), "which provides funds for projects designed to reduce transportation emissions, defined as carbon dioxide emissions from on-road highway sources." The CRP requires each state to develop a carbon reduction strategy with updates at least every four years. NCDOT has funding available for the next five years to complete projects under this plan.

NCDOT's CRP Strategy Report was completed in November 2023. It focuses on building off previous greenhouse gas (GHG) reduction goals and targets mandated by Executive Orders over the past few years and existing plans and efforts to meet these goals. NCDOT's main focus has been in fully utilizing CRP funds by end of Federal Fiscal Year (FFY) 2024, while trying to provide funding to projects across multiple modes and with as much geographic equity as possible.

The CRP Strategy Report also identifies future areas for process improvements if CRP continues in the next federal transportation authorization bill. These improvements are but not limited to establishing a CRP workgroup that works with MPO, RPO, and other CRP eligible partners, developing a project prioritization process for statewide and rural projects for CRP to gain most GHG reduction benefit relative to cost, and improve project management and financial tracking.

1.6.7 Apply for construction funding grant for the Raleigh to Richmond segment of the Southeast Corridor along the S-Line

Status: Complete
Completion Date: January 2023

The Raleigh to Richmond segment of the Southeast Corridor will provide high performance intercity passenger rail between Charlotte and Washington, DC. Six or more roundtrips per day with speeds up to 110-125 mph are planned. The project will help divert highway trips to rail, reducing greenhouse gas emissions.

In concert with Amtrak and the Virginia Passenger Rail Authority (VPRA), NCDOT's Rail Division submitted a grant application to the Federal 2023– State Partnership for Intercity Passenger Rail Program to pursue funding to purchase right of way and construct the Raleigh to Wake Forest segment of the Southeast Corridor, which generally follows the CSX S-Line in NC.

The application builds on previous federal awards to purchase the active portion of the CSX S-Line, prepare preliminary designs and plan mobility hubs along the corridor.

In December 2023, USDOT announced the award of $1.09 billion federal grant funds to design and build the first segment of the S-Line from Raleigh to Richmond. The final design is expected to be completed by 2027. NCDOT anticipates constructing the corridor in increments.

2.0. Increase statewide resilience to the impacts of climate change

2.1 Evaluate the impacts of climate change on cabinet agencies' programs and operations

2.1.1 Conduct scour risk assessment for coastal bridges due to USACE South Atlantic Coast Study (SACS) and coastal storms (NCDOT Research Project Number: 2025-27)

Status: Underway
Expected Completion Date: July 2026

NCDOT is conducting a research project to assess the risk for coastal bridges. This project will be completed in three major steps. The first step will screen all NC coastal bridges to identify bridges that may experience scour by analyzing bridge substructures and site-specific hydraulic parameters. The second step will apply two well-established empirical methods to calculate bridge scour: the USDOT FHWA Hydraulic Engineering Circular (HEC)-18 method and the FDOT method, and both are recommended by USDOT FHWA HEC-25 to estimate bridge scour in the US. This study will estimate bridge scour under three scenarios: the current level of coastal hazards and two additional scenarios with sea level rises of 2.73 ft and 7.35 ft. The last step analyzes scour results estimated by the HEC-18 and FDOT methods. Both statistical methods and spatial analysis using a Geographic Information System (GIS) tool, ArcGIS, will be applied to quantify NC bridge scour potentials caused by coastal storms and sea level rises. This project is expected to generate two research products. The primary product is a comprehensive assessment of bridge scour in 20 coastal counties. It consists of detailed scour calculations, statistical analysis of bridge scour, and a GIS database allowing an interactive visualization of scour results. The second product is a technology transfer workshop on NC coastal bridge scour analysis. The workshop will facilitate the implementation of project products at NCDOT. Safety concerns along with environmental justice and equity considerations will be incorporated into the bridge assessments.

Over the next 12 months, the research team will conduct a literature review, gather datasets and develop bridge and hydraulic parameters and begin bridge scour evaluation using the HEC-18 and FDOT methods.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

2.1.2 Expand the Geotechnical Asset Management (GAM) database

Status: Underway
Expected Completion Date: Spring 2025

NCDOT Geotechnical Engineering Unit has been rating slopes of known concern for several years, while also performing geotechnical subsurface investigations and design of Transportation Improvement Plan (TIP) projects. The GAM database includes a rating system for embankments, rockfalls, rockslides and landslides in NCDOT rights of way. The expansion of the GAM database would allow for more sites to be analyzed, slopes to be rated, and preliminary investigations and designs to be made to mitigate potential disruptions.

The agency completed the assessments of the slopes for NCDOT's Highway Division 14 in the winter of 2023-2024 where the bulk of sites exist. Within the next 12 months, NCDOT will finalize contracting with a supporting consultant and begin field data collection in the fall or winter of 2024 when vegetation dies down, and slopes are easier to evaluate. The next phase of evaluation will be concentrated in Highway Divisions 11 and 13.

During the next year, NCDOT will evaluate the alignment of this initiative with environmental justice goals.

2.1.3 Linking scour evaluation and data from geotechnical, erodibility, and hydraulic investigation-an integrative approach (NCDOT Research Project Number: 2024-19)

Status: Underway
Expected Completion Date: July 2025

NCDOT partnered with N.C. State University to obtain site-specific erodibility through linking parameters with geotechnical data to assess site-specific scour magnitude, which accounts for variability of channel-bed soil layers with depth. This will provide reliable estimations of scour on the stability of bridge foundation systems. The objectives of the study are: (a) to provide a means of estimating the magnitude of sediment erodibility parameters through correlation with physical and engineering parameters obtained from site geotechnical investigation; and (b) to provide correlations between flow parameters and the flow-induced shear stress to facilitate the computation of scour and erosion magnitude for piers, abutments, and embankments. The work will develop parameters needed for rational approaches of scour assessments at bridge sites, which are important steps for NCDOT's efforts in designing, constructing and maintaining bridges.

Over the past few months, the research team has conducted a literature review, performed initial reconnaissance at two bridge sites and is continuing analysis of erodibility parameters.

Over the next few months, the research team will perform reconnaissance of a third bridge site and continue enhancing the literature review and investigating the relationship between the physical properties of soil and numerical modeling assessments. Equity considerations and environmental justice impacts will be considered.

2.1.4 Identify and prioritize vulnerable roadway segments for proactive resilience planning and response (NCDOT Research Project Number: 2024-13)

Status: Underway
Expected Completion Date: July 2025

During Hurricane Florence there were more than 2,730 pavement sites that were damaged where hydraulic structures were not involved. To improve the resilience of these pavements, it is important to conduct an engineering informed assessment, which requires a detailed understanding of the particular design features and the variation thereof inherent to the infrastructure element or system in question and pathways by which that infrastructure can fail. In light of these issues, NCDOT is sponsoring a research study to: 1) Provide a better understanding of the failure pathways and factors contributing to pavement failures during past events 2) Identify gaps and critical data linkages that hinder the use of existing NCDOT information to support resilience-based planning with respect to pavements 3) Develop a framework for identifying and prioritizing road segments as part of resilience-based improvement plans/programs 4) Develop a design feature selection and repair strategy decision tree that considers specific features, planned needs, sustainability considerations, and possible extreme event stressors at a given pavement site, and 5) Identify data gaps and critical data linkages that hinder the use of existing NCDOT information to support this effort and provide recommendations to improve data collection and information to support resiliency efforts. This research will provide NCDOT personnel with the tools necessary to take a proactive approach to inform pavement resilience project identification and prioritization based upon the as built and current condition of roadway segments.

The research team has completed an extensive literature review. The team continues analyzing damaged sites reported after floods caused by extreme events. In addition, work is being focused on developing strategies to optimize identifying vulnerable road sections. A database of road sections vulnerable to flooding to aid in understanding the deterioration process of structures is being developed and a focus on the Bertha and Isaias events are currently being studied.

The team will develop a final report summarizing the methodology, results, and recommendations. During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

2.1.5 Evaluate North Carolina bridge vulnerability and resilience feasibility to coastal storms and sea level rise (NCDOT Research Project Number: 2024-17)

Status: Underway
Expected Completion Date: July 2025

NCDOT is currently sponsoring a research project to assess the status of North Carolina bridge vulnerability to coastal storms and a projected sea level rise in the next 50 to 100 years and identify possible solutions to enhance bridge resilience to coastal hazards.

The project consists of three major steps: assessing vulnerability, defining resilience criteria, and identifying improvement options. We will start by determining bridge vulnerability to coastal storms and sea level rise. This project will utilize simulated design water levels and wave parameters from the US Army Corps of Engineers (USACE) South Atlantic Coastal Study (SACS) to calculate wave loads. In addition, the project will use the USDOT FHWA HEC-25 3rd edition "Highways in the Coastal Environment" to determine wave loads on structures. Based on this, bridge resilience criteria to coastal storms and sea level rise based on engineering practice in North Carolina and other coastal states in the US will be determined. In addition, the project will identify potential solutions or recommendations for NCDOT for project implementation. The outcomes of this project will assist NCDOT in planning for bridge upgrading and maintenance as well as helping the agency and its stakeholders make an informed decision on infrastructure planning and development in order to adopt appropriate climate change policies in response to long-term sea level rise.

The research team has developed a screening process to create a tier of bridges and includes bridges along hurricane evacuation routes. In addition, bridge data has been extracted and organized to use in quantifying storm water levels, waves and sea level rise hazards.

Over the next 12 months, the research team will continue quantifying the above parameters and calculating potential forces on selected bridges as well as host a 2-day technology transfer training workshop on coastal bridge vulnerability analysis facilitating NCDOT to implement project products. In addition, a GIS based tool will be developed to easily access and analyze the data.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

2.1.6 Conduct multimodal vulnerability assessment on Strategic Transportation Corridor (STC)

Status: Underway
Expected Completion Date: December 2024

NCDOT is currently conducting vulnerability assessments including resilience considerations on multiple strategic corridors. Socioeconomic indicators including equity areas were considered in each study. Some of these corridors include U.S. 70, U.S. 74 and future I-87. The objectives of the U.S. 74 pilot study were to determine goals and objectives for future U.S. 74 resiliency; identify and define any vulnerabilities to future extreme weather events, develop and stress-test potential mitigation and adaptation scenarios against future conditions; and quantify benefits relative to goals and objectives. This project is completed.

Similarly, the U.S. 70 pilot study assessed the vulnerability of routes to airports, ports, and the North Carolina Railroad Company rail line adjacent to the corridor including stakeholder engagements, and other agency expertise/resources.

NCDOT is conducting a vulnerability assessment along the future I-87 corridor from Raleigh to the NC/VA state line. This assessment will include people, economy, weather, and infrastructure. This assessment also takes a stakeholder-inclusive approach by including several NCDOT units, NC state agencies, federal partners, metropolitan planning organizations, and rural planning organizations.

By the end of 2024, the U.S. 70 and I-87 studies will be finalized. In addition, the team will develop a story map of the projects to make available to the public and post the reports to the NCDOT resilience website.

2.1.7 Assess the vulnerability of the Ferry Division's infrastructure assets, including waterway channels, with respect to natural hazards (NCDOT Research Project Number: 2023-14)

Status: Complete
Expected Completion Date: July 2024

In July 2024, the agency completed a project to assess the vulnerability of the Ferry Division's infrastructure assets. The scope of the study (a) assesses the vulnerability of the Ferry Division's infrastructure assets with respect to natural hazards (from the present and forecasting to the 2040 and 2060 planning horizons); (b) assesses the condition of ferry channels at present, as well as potential climate impacts; (c) prioritizes assets for adaptation measures where needed; and (d) provides recommendations on potential adaptation options as well as timeframes for implementation and ballpark cost estimates. The research team has completed a literature, and best practices review along with collecting state and federal data to be used to develop the vulnerability index.

Community impacts and environmental justice considerations will be incorporated into the assessment. All tasks have been completed for the project.

2.1.8 Develop a web-based geospatial analytics tool for quantifying freight risk and resilience in transportation (NCDOT Research Project Number: 2022-18)

Status: Underway
Expected Completion Date: October 2024

In June 2021, NCDOT embarked on a comprehensive study of the risk and resiliency profiles of North Carolina public roads, specifically primary and secondary freight routes. The objective of the study was to establish a geospatial analytics platform for transportation data integration and modeling. This platform, Geo-FRIT, provides a web-based geospatial analytics tool for quantifying freight risk and resilience in transportation. Geo-FRIT will allow for data collection and sharing among NCDOT divisions and allow for routing analytics and advanced modeling of disaster data for risk-based freight routing through spatial simulation-driven scenario analysis. This project will enhance freight management and safety via web-based data access, integration, and automation, which also promotes transportation resiliency. The Geo-FRIT tool will provide solid support for risk-based freight routing analysis that can lead to significant labor and operational cost savings for NCDOT and enhance highway safety, emergency management, community transportation planning and public health. The research team has finalized the development of the spatial simulation of alternative extreme events for scenario analysis. In addition, the team has completed a web GIS-based dashboard to support data management. Freight routing analytics in response to disruption events has also considered equitable routes as well as environmental justice considerations when suggesting route designations.

The research team has completed all tasks and is in the process of finalizing the final report.

2.1.9 Improve landslide spatiotemporal mapping, monitoring and change detection at Howard Gap slide (NCDOT Research Project Number: 2023-04)

Status: Underway
Expected Completion Date: July 2025

NCDOT partnered with N.C. Agricultural and Technical (A&T) State University to conduct a research study to create an effective 3D-geospatial framework by integrating field monitoring data with high-resolution remote sensing data (from Unmanned Aerial Vehicle (UAV) optical, Light Detection and Ranging (LiDAR) and Synthetic Aperture Radar (SAR)) using machine learning methods to assist in further understanding the mechanics of this large debris slide, and to remotely monitor other landslides that impact North Carolina transportation corridors. The study will leverage available satellite imagery to improve the Howard Landslide monitoring by expanding the spatial extent from point sampling to whole area characterizations while reducing associated time and cost compared to the current techniques. In addition, a predictive model using machine learning methods will be developed to hindcast over the last few years (testing if model correctly predicts historical events) and forecast the occurrence and extent of future debris –flow and slope failure. The research methods and outcome (codes and spatiotemporal tools) can be used by NCDOT to monitor landslides at other locations in North Carolina and establish an early warning system for the area to predict the landslide displacement and quantify the uncertainties. Researchers have conducted two flights to gather data across the Howard Gap Road region. In addition, the team has created a landslide susceptibility map for the area and an ArcGIS online portal and a data management plan.

Over the last year, the research team has continued data collection and geospatial database development and data processing. In addition, the team is completing a comprehensive comparative analysis of multiple machine learning models. The ArcGIS online tool will continue to be enhanced and a cost, accuracy and flexibility model analysis will be refined. During the next 12 months, a technology evaluation will be completed to evaluate the appropriateness, effectiveness and impact of different geospatial data options. This will help identify the most suitable geospatial data and process. Specifications and guidelines will be developed and shared.

2.1.10 Develop a statewide Resilience Improvement Plan (RIP) (NCDOT RIP)

Status: Ongoing
Expected Completion Date: April 2024 (Version 1), ongoing (Version 2)

NCDOT engaged a consultant to help with the development of a multimodal statewide RIP. This plan includes a statewide criticality map to identify the criticality of the state major routes. The main criteria to estimate roadway criticality includes "Use and Operations", "Socioeconomic" including the NCDOT Transportation Disadvantage Index (TDI), and "Health and Safety". In addition, it identifies areas and assets (bridges, culverts, roadways and rail) vulnerable to flood, including climate change, and geohazards based on existing data and tools such as Flood Warning System (Transportation Surge Analysis Prediction Program (T-SAPP), BridgeWatch and FIMAN-T) and Geotechnical Asset Management (GAM) ratings. In addition, it includes outcomes from previous pilot vulnerability assessments for I-95/I-40 east, U.S. 70, and U.S. 74. The RIP also includes a prioritization process to select potential projects for improving the resilience of the corridors/system to the identified threats. The development of the RIP will allow NCDOT to apply for project match reductions of up to 10 % under the PROTECT program for those projects identified and prioritized on the plan.

During the next 12 months, the consultant team will continue to expand on the type of assets and hazards to be included in the plan. In addition, results from the Ferry Division's vulnerability assessments will be incorporated into the next version of the RIP.

NCDOT, is also coordinating and providing support to planning organizations for the development of their RIPs to ensure their plans meet the FHWA PROTECT Program requirements. Specifically, NCDOT is working with Charlotte MPO, and the French Broad River MPO. This project includes a scoring process that incorporates flooding impacts to transportation availability to underserved communities.

2.1.11 Evaluate road network resilience to natural hazards using network analysis (NCDOT Research Project Number: 2023-16)

Status: Underway
Expected Completion Date: December 2024

The objective of this project is to improve predictions of roadway vulnerability by using network science and network analysis to understand the connectivity of road networks during extreme events. By treating road intersections as 'nodes and road segments as 'edges', it is possible to successively remove nodes based on some criteria (such as increasing elevations, akin to flooding or another extreme event) to identify the threshold where the entire network begins to fail. The network analysis proposed in this project is focused on coastal settings, and specifically flood hazards, but the methodology is broadly applicable to other regions of North Carolina and additional natural hazards (e.g., landslides). More broadly, this project will lead to a more holistic framework for identifying roadway and network vulnerability to a range of hazards and inform resilient management of roadway networks in a changing climate. The research team has developed a new network model for the rural Downeast region of Carteret County. The team has installed a camera/sensor and are monitoring flooding at sea level. The camera monitors a flood hotspot and water has been identified on the roadway 21 times since installation. The research team has also finalized solar-powered camera design and manufactured new cameras. The team has also completed a literature search and obtained permits to install cameras in Cedar Island and Davis, NC.

The research team has developed roadway metrics to assess impact vulnerability during extreme climate events. The team set up camera feeds and has developed several network models and performed analysis for several inland locations. Over the next 6 months the research team will complete the Advanced CIRCulation (ADCIRC) storm surge model data analysis and continue to deploy on-site cameras.

During the next year NCDOT will evaluate the alignment of this initiative with EJ goals.

2.1.12 Predict roadway washouts during extreme rainfall events (NCDOT Research Project Number: 2021-03)

Status: Complete
Completion Date: December 2023

In January 2021, NCDOT partnered with NC State University to complete a research project utilizing available high quality statewide elevation data, historical rainfall records and advances in computer processing to modify and develop programs to predict where washouts are likely to occur during extreme rainfall events. The purpose of this project is to develop models and test several approaches for predicting crossing washouts based on forecasted rainfall. The results will help determine if existing hydrologic models can be leveraged to accurately predict potential washout locations and to evaluate if machine learning technology can be employed for accurate flood prediction.

The research team developed a Transportation Resilience Identification and Prioritization Tool (TRIP) to compile impacts of past storms and design storms, prepare asset management summaries for existing roads and hydraulic structures, evaluate resilience of key routes and estimate costs for increasing resilience of existing routes to design storms. This project was also voted top High Value Research Project in Region 2 for the AASHTO Research Advisory Committee's Sweet 16 honors. A follow-up project is being considered to study the I-40 transportation corridor from Wilmington to I-95 that includes US-421. The goal is to identify resilient routes using the TRIP tool. The updated TRIP tool will take into consideration environmental justice and equity considerations.

The project has been completed and the report is available at: RP2021-03 Project Page.

2.2 Integrate climate change adaptation practices and resiliency planning into cabinet agencies' policies and operations

2.2.1 Incorporate resilience in long-range plans

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT has been working on multiple efforts to incorporate resilience into its long-range plans. The department's efforts are in keeping with the Fixing America's Surface Transportation Act in 2015, and FHWA and FTA metropolitan and statewide transportation planning regulations requiring agencies to take resiliency into consideration during the transportation planning process.

Within the next 12 months, NCDOT will continue the efforts to increase collaboration with local and regional agencies by sharing the flood inundation tools it has developed in the past years to help the MPOs and regional planning organizations, or RPOs, with this process.

In addition, NCDOT participated in a National Cooperative Highway Transportation Research Board (NCHRP) Synthesis for incorporating greenhouse gases and climate resilience into long-range planning and the State Transportation Improvement Program (STIP). As part of the synthesis, all DOT local offices statewide were surveyed to understand their practices.

Moreover, NCDOT is developing a document to incorporate resilience into Long-Range Transportation Planning (LRTP). NCDOT is in the process of having an information session with the Transportation Planning Division (TPD) coordinators. The document is expected to be finalized by 4th quarter of 2024.

During the next year, NCDOT will evaluate the alignment of this initiative with environmental justice goals.

2.2.2 Increase consideration of resilience in freight rail programs

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT's Rail Division revised its Freight Rail and Rail Crossing Safety Improvement (FRRCSI) program criteria to reflect resilience when evaluating proposed projects. Under the Short Line Infrastructure Assistance (SIAP) arm of FRRCSI, the Rail Division included a new Resiliency question and scoring metric in time for state fiscal 2024 SIAP Call for Projects. The state fiscal 2024 SIAP Call for Projects cannot occur until the state budget becomes law. Under the new Freight Rail Diversion arm of FRRCSI, projects that connect and/or divert freight from highways to rail provide resiliency in the event one mode is blocked by a climate or human-induced event. The Rail Division collaborated with NCDOT IT Enterprise Business Services (EBS) group to get this programmed into our online EBS application 2024 update.

During the next year, NCDOT will evaluate the alignment of this initiative with EJ goals.

2.2.3 Investigate incorporating resilience into design guidance

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is implementing resilience design considerations into projects. Examples include improvements to I-95 in Robeson County. The interstate improvements include widening and elevating the road, improving hydraulic conveyance through bridge elevation and lengthening, and drilling holes in a concrete median to facilitate faster roadway water runoff. In addition, the Alligator River Bridge replacement (STIP project: HB-0001) is considering resilient construction materials with a design life through 2100 that also requires projected sea level rise (SLR) and storm activity to be considered in the design year. Similarly, the sea level rise analysis for Wilmington, Beaufort and Manteo areas is for future design and planning support. The Alligator River Bridge was awarded a $110 million federal grant this year for replacement.

Currently, NCDOT is working on the express design of I-40 between mile markers 385 and 420 to incorporate resilience criteria to meet the 100-year flood event plus 1.5 feet of freeboard. Flood resilient alternatives are being assessed near Burgaw and Rockfish Creek as well as other locations identified in the I-95/I-40 Flood Resiliency Feasibility Study. NCDOT has been in contact with the Minnesota Department of Transportation (MnDOT) to research updating our design standards for developing standard plans for in slope armoring of the road embankment.

2.2.4 Incorporate resilience within Integrated Project Delivery (IPD)

Status: Ongoing
Expected Completion Date: Ongoing

The current objective for incorporating resilience within IPD will require an inventory of products and map resiliency outputs for NCDOT system-wide planning, project prioritization and programming, and individual project planning and development. To facilitate this, there will be a survey conducted to better understand how our business units and partners are using NCDOT products and information and how they could better use them in the future. The overall goal of IPD is to streamline how projects move from planning to construction, a crucial part of which is having appropriate resiliency information readily available where relevant in the process.

Risk assessment criteria and benefit-cost-analysis (BCA) are some of the factors that are being considered in the U.S. 74, U.S. 70 and I-87 pilot vulnerability studies. The results of these studies will help determine how these factors can be utilized by specific Project Development Networks within the IPD.

Current resilience projects in planning and design phases (I-6064 and HB-0001) also provide examples of how and when resilience may be considered within IPD.

2.2.5 Continue the development of flood inundation tools

Status: Planned
Expected Completion Date: N/A

NCDOT, in collaboration with other agencies, has developed multiple flood inundation tools. Some of the inundation tools already developed include the Coastal Roadway Inundation Simulator (CRIS), the Roadway Inundation Tool (RIT), and Wave Analysis Tool. These tools allow planners and emergency managers to simulate predicted roadway inundation from coastal and inland flooding, quantify potential effects of inundation, and see potential overtopping depths on the roadway system.

The roadway inundation tool represents the entire state. However, there are gaps in the tool that need to be addressed due to the limited amount of available data in western NC.

Within the next 12 months, NCDOT will continue to develop the data that is needed to continue the development of the tool. This includes leveraging the pluvial flood modeling completed by the NC Floodplain Mapping Program (NCFMP) by greatly expanding the Roadway Inundation Tool (RIT) to include pluvial, impacts to one-fifth of the state. This area will expand as additional modeling is completed. Currently, NCFMP is conducting modeling of the French Broad River Basin and over the next three years will complete mapping the rest of the state. The tool will also be updated to include updated ground elevation data. These tools have been used to support the development of vulnerability studies to assess the exposure of the transportation network to different levels of flooding. This provides underserved areas with a better understanding of their flood risk and impacts to the community.

2.2.6 Predict resilience and reduce failure of stormwater control measures (SCMs) to extreme storm events (NCDOT Research Project Number: 2023-15)

Status: Ongoing
Expected Completion Date: December 2024

Due to multiple failures of stormwater infrastructure (including stormwater control measures) from several extreme rainfall events during the past few years. NCDOT is conducting a project to better understand how large a storm is when SCMs no longer provide hydrologic mitigation and are likely to fail, leaving significant structural degradation and costly reconstructive repair. Moreover, the study will identify if there are simple retrofits to existing SCMs (or design features for to-be-built SCMs) that can enhance or extend hydrologic mitigation and reduce the chances of failure. Researchers have completed a literature review and selected four sites determined to be undersized bioretention basins and formatting data to determine the best models for determining undersized basins.
Over the last 12 months, the research team has calibrated the models and is currently running various storm scenarios. SCM breaking points have been determined and design enhancement selection criteria are being determined. Data analysis scenarios are being modeled and analyzed.

Over the next 6 months, the research team will continue running storm scenarios and refining design enhancements. A final report will be provided at the end of the year. The report will include modeling scenarios, enhanced design recommendations and data analysis. Equity considerations and environmental justice concerns will be addressed when running storm scenarios.

2.2.7 Expand flood warning tools

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT, in collaboration with NC Emergency Management, has developed multiple flood monitoring tools including T-SAPP, BridgeWatch and FIMAN-T. These tools help detect, prepare for, alert and record potentially destructive flooding events that affect structures. They also allow NCDOT to monitor bridge and roadway infrastructure in real-time so NCDOT can better respond to or prevent hazardous, costly and potentially catastrophic events. The agency is constantly evaluating, testing and improving these tools in preparation for extreme weather events. In addition, training on these tools is continuously provided. A total of 120 NCDOT staff members were trained on the flood warning tools in July 2024. In 2022-2023, an additional 16 stream gauges were installed across the state using Better Utilizing Investments to Leverage Development (BUILD) grant funds. These sites and others have also been added into FIMAN-T to bring the total sites with mapped road impacts up to 83. These sites have been added to BridgeWatch. In addition, 25 new stream gauges were installed along the U.S. 74 corridor from Charlotte to Wilmington as part of an Infrastructure for Rebuilding America (INFRA) grant. Eighteen of these gauges have been added to FIMAN-T with the remaining to be added in the next few months.

In 2023, the system was nationally recognized by the American Association of State Highway Transportation (AASHTO). In the spring of 2024, the FHWA awarded NCDOT an Environmental Excellence Award for its flood warning system.

Within the next 12 months, two new gauges will be installed on two of NCDOT's three river cable ferries to provide remote access to river levels to increase the operational efficiency of each site. Other gauges have been installed by local agencies in Greene and Cumberland counties. Through our continued partnership with North Carolina Emergency Management, 300 existing sites without road impact data will be evaluated for expansion into FIMAN-T. This will provide a much more complete coverage of sites across the state in particular in the Piedmont and rural areas.

2.3 Assist the communities served by each cabinet agency to implement climate change adaptation practices and resiliency planning

2.3.1 Implement N.C. Highway 12 (N.C. 12) Task Force Plan

Status: Ongoing
Expected Completion Date: Ongoing

The primary mission of the N.C. 12 Task Force is to develop a long-term, prioritized transportation plan for N.C. 12 that identifies vulnerable highway locations (a.k.a. "hotspots"), projects future challenges related to erosion, storms and sea level rise, refines and recommends location-specific solutions, and identifies funding strategies and a timeline for implementation. The N.C. 12 Task Force stakeholders developed a plan designed to accomplish the following:

- Recognize the need for safe, reliable routine and emergency transportation for the thousands of residents in communities in Dare and Hyde Counties and the millions of visitors that travel to the area from around the world.
- Incorporate information on climate change and sea level rise which may exacerbate existing transportation challenges and present new ones.
- Recognize the missions of the refuge, seashore, and other public lands within the project area and balance ecological values and the restoration of barrier island processes while maintaining public access.
- Be collaborative and include substantial opportunities for input from stakeholder agencies, organizations, and the public.
- Utilize existing NCDOT transportation feasibility studies and other information as important, foundational information that contributes to a regional plan.
- Evaluate the economic impacts associated with the status quo and other transportation options.
- Develop a strategic financial plan that leverages existing funding and identifies new funding sources.
- Be designed to help overcome barriers to coastal resilience and adaptation planning and support a proactive and sustainable approach to resilient transportation planning and project implementation.

NCDOT was awarded a PROTECT discretionary grant to conduct a planning and environmental study. The agency will receive over $1.8 million to conduct a study along an 11-mile stretch of N.C. 12 between Oregon Inlet and Rodanthe on Pea Island. The goal of the study is to develop long-term, comprehensive plans for keeping the roadway passable during and following major storm events. The project will identify future construction projects, streamline environmental reviews, include public engagement and establish plans to secure the resiliency of the highway.

During the next year, NCDOT will evaluate the alignment of this initiative with EJ goals.

2.3.2 Provide technical transportation resilience assistance to communities

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is requested by communities to join their transportation resilience projects as a stakeholder. This past year, NCDOT has assisted the Lumber River Council of Governments, and of Asheville in their studies to identify and evaluate resilient transportation routes and generate conceptual solutions.

Within the next 12 months, NCDOT will continue to assist communities as requested.

During the next year, NCDOT will evaluate the alignment of this initiative with EJ goals.

2.3.3 Assist Pender County with N.C. Highway 210 (N.C. 210) hurricane evacuation route resiliency analysis

Status: Complete
Completion Date: Fall 2023

NCDOT assisted Pender County with conducting a resilience analysis of the N.C. 210 Hurricane Evacuation Route corridor that has historically experienced significant flooding in multiple locations after hurricanes or large storms. The deficiencies of N.C. 210 affect the most densely populated areas in the county and about 29% of all Pender County residents. NCDOT provided guidance to incorporate resiliency into their project alternatives that meet NCDOT design criteria.

During the next year, NCDOT will evaluate the alignment of this initiative with environmental justice goals.

2.3.4 Assist Town of Leland with transportation infrastructure resilient routes project

Status: Complete
Completion Date: July 2024

NCDOT assisted Leland with the Leland Resilient Routes Project which identified critical routes in and surrounding the town limits. These routes include evacuation routes, NCDOT-owned roadways, town-owned roadways, and privately-owned roadways. The routes were analyzed to determine how resilient each route is to coastal hazards such as flooding and storm surge. For routes that exhibit vulnerabilities to coastal hazards, potential solutions to mitigate the vulnerability were identified.

The project developed a project prioritization matrix and generated the final modeling. The project was completed in July 2024 and presented at the August 15th town council meeting.

2.4 Help complete initiatives in the Natural and Working Lands Action Plan and Executive Order 305, An Order to Protect and Restore North Carolina's Critical Natural and Working Lands

2.4.1 Coordinate the NCDOT Land Stewardship Program - Restoration

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT completed construction on a 312-acre mitigation project in New Hanover County adjacent to the future Hampstead bypass project (STIP project: R-3300) in the spring of 2023. The project will restore 121 acres of wetlands to offset impacts associated with transportation projects in the region. The project is in a key re-charge area for the Castle Hayne aquifer, a major source of freshwater in the Wilmington area.

Over the next 12 months, NCDOT will continue seven years of hydrologic and vegetation monitoring. The agency is currently in the second year of monitoring. Once monitoring is completed, the site will continue to be protected through annual site inspection assessments.

2.4.2 Coordinate the NCDOT Land Stewardship Program - Protection

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT Land Stewardship Program is responsible for the long-term monitoring and protection of stream and wetland mitigation lands statewide. The program currently manages over 38,000 acres of forested stream, wetland and/or riparian buffer properties statewide. These lands are protected through acquisition or conservation easement. The stewardship and protection of these forested lands helps with floodplain protection, carbon sequestration, and mitigation of greenhouse gas emissions.

Over the next 12 months, 393 site inspection assessments totaling over 38,000 acres will occur to ensure the continued protection of these diverse lands.

2.4.3 Coordinate the NCDOT Land Stewardship Program – Property Transfers

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT Land Stewardship Program is responsible for the transfer of legacy mitigation properties to appropriate third parties for assistance with long-term land protection. To date, NCDOT has transferred 11,048 acres to the N.C. Wildlife Resources Commission (NCWRC), 1,300 acres to North Carolina State Parks, and 68 acres to Wake County. The transfer of these properties increases recreation and tourism opportunities for North Carolina's residents and visitors.

Over the next 12 months, NCDOT will enroll an additional 586 acres as game lands with NCWRC. This will provide boating and fishing opportunities adjacent to the Tar River in Grimesland, N.C. This area of Pitt County is classified by the USDOT as an Area of Persistent Poverty (APP) and a Historically Disadvantaged Community (HDC).

During the next year, NCDOT will evaluate the alignment of this initiative with EJ goals.

2.4.4 Incorporate nature-based solutions (living shoreline) to improve coastal resilience on N.C. 24

Status: Complete
Expected Completion Date: July 2023

As part of NCDOT efforts to increase the resiliency of the state's highway infrastructure, NCDOT in partnership with NC Coastal Federation completed a living shoreline along N.C. 24 in Swansboro, a first of its kind project for the department. The construction included removing stone and asphalt, restoring marsh vegetation, and installing an artificial reef, which in the coming months will bring oysters. A natural design like this is not only more resilient during a storm, but also more cost-effective and sustainable.

2.5 Initiate other projects aimed at increasing statewide resilience to the impacts of climate change

2.5.1 Quantify future precipitation extremes within N.C. for resilient design (NCDOT Research Project Number: 2020-57)

Status: Underway
Expected Completion Date: June 2025

In June 2020, NCDOT partnered with N.C. State University to conduct a study to improve confidence in climate change projections by quantifying future precipitation extremes within North Carolina for resilient design (e.g., precipitation intensity, duration, frequency curves). This project incorporates guidance developed for the National Cooperative Highway Transportation Research Board, NCHRP 15-61, with additional methods and numerical model experiments to improve confidence in future precipitation extremes, and to inform design concepts for potential future events. The research team has developed a co-production framework to guide the project and is continuing to improve confidence in future precipitation data. Researchers have completed initial simulations of Hurricanes Floyd, Matthew and Florence based on future projected climate conditions to predict potential damage from such events. The team is finalizing the development of ATLAS 14 scale factors for future precipitation and working on future hurricane simulations for the mountains of North Carolina.

Researchers have assisted NCDOT with climate adoption and resilience planning associated with Executive Order 80 (EO 80) by giving several presentations to various groups and societies on future precipitation research using statistical and historical analysis. Researchers are creating future gridded Intensity-Duration-Frequency (IDF values and determining confidence percentiles. Work is also being performed on how the precipitation characteristics could change in the future.

Within the next 12 months, researchers will continue to improve confidence in future flood risks and work on PGW (pseudo-global-warming – simulation strategy in climate modeling) for downstream hydrology modeling. Researchers will continue analyzing model simulations for eastern North Carolina and continue developing production quality simulations for western North Carolina. Future high flows and hydrology modeling will be developed to produce tailored high-resolution climate model projections. Equity considerations and environmental justice concerns will be developed and analyzed when flood risks are considered to impact marginalized communities.

2.5.2 Improve the resilience of transportation infrastructure to hurricane damage (NCDOT Research Project Number: 2021-08)

Status: Complete
Completion Date: August 2023

In January 2021, NCDOT partnered with N.C. State University to conduct a research project to study the effectiveness of repairs and design strategies after damage from hurricanes. This project has four objectives: 1) evaluate the design process for roadway infrastructure that was repaired following Hurricanes Matthew and Florence; 2) identify the specific elements of the new infrastructure that positively contributed to improved performance during Hurricane Florence; and 3) develop recommendations on design elements that improve the resilience of NCDOT roadways.

A series of detailed case studies were carried out to identify the design factors and repair/maintenance decisions that led to better performance during Hurricane Florence. Conclusions are that actions taken by the NCDOT Hydraulics Unit and maintenance operations group following recent hurricanes have been effective at increasing robustness and reparability (resilience) of roadways with pipe crossings. Redesigned pipes and culverts following hurricane damage have resulted in larger structure sizes and other variables have had a positive effect on the overall resilience.

During the next year, NCDOT will evaluate the alignment of this initiative with EJ goals.

2.5.3 Develop a geospatial map for consolidating resilience initiatives

Status: Planned
Expected Completion Date: Fall 2025

During the past five years, NCDOT has invested in numerous resilience, vulnerability and climate change initiatives.

Within the next 12 months, the department, in coordination with a consultant, will work to develop a geospatial map to consolidate past, current and planned resilience initiatives. This map will help the agency showcase its resilience efforts in a more visual way and will help with the development of the agency's Resilience Business Case to help justify future resilience investments.

2.5.4 Evaluate primary and secondary roadway pavement conditions using deep learning (NCDOT Research Project Number: 2023-01)

Status: Underway
Expected Completion Date: December 2024

NCDOT partnered with the University of North Carolina at Charlotte (UNC-Charlotte) to assist the department in making appropriate pavement maintenance decisions. This study proposes to evaluate primary and secondary roadway pavement conditions using deep learning, a state-of-the-art artificial intelligence technique. Roadway surfaces will be videotaped using a vehicle mounted camera. These video footage and raw roadway surface images provided by the data collection vendor will be labelled at a high resolution to develop high quality datasets for training, testing and validation, and then deep learning algorithms will be developed to recognize roadway surface distresses in an automatic manner. Deliverables are expected to aid in pavement distresses being automatically recognized at a more accurate and cost-effective level, leading to a substantial increase in the effectiveness of the pavement condition assessments carried out by or on behalf of NCDOT. This methodology will also provide the opportunity to correlate how pavement deteriorates with changes in climate condition.

Over the next few months, the research team will continue to review recently published technical papers, continue annotation of images collected and fine tune the existing algorithm and test a new algorithm. Equity considerations and environmental justice impacts will be addressed. A final report will be completed and submitted to NCDOT.

2.5.5 Explore resilience funding opportunities

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is continuously exploring funding opportunities from IIJA, in particular under the PROTECT program, focusing on resilience planning and making improvements to existing transportation infrastructure and evacuation routes. NCDOT was awarded two PROTECT grants, one for planning purposes to solving access for N.C. 12 in Dare County, and the other one for community resilience and evacuation routes for protecting U.S. 74 at the Lumber River. The agency is considering PROTECT grant application for new projects once the next Notice of Funding Opportunities (NOFO) is released this year. In addition, NCDOT is working with local entities to prioritize transportation and emergency response improvements and address vulnerabilities. NCDOT is pursuing other grant opportunities beyond PROTECT such as different grants from the National Oceanic and Atmospheric Administration (NOAA), Rebuilding American Infrastructure with Sustainability and Equity (RAISE), National Culvert Removal, Replacement & Restoration grants (Culvert Aquatic Organism Passage (AOP) Program), and FEMA Building Resilient Infrastructure in Communities (BRIC) grants.

Within the next 12 months, NCDOT is planning to develop a landing webpage for federal discretionary grants that will also include opportunities for projects beyond resilience. The webpage would include information on grant opportunities, resources, and SOPs, and how to request letters of support for NCDOT to act as the grant administrator on behalf of other agencies. The state agency is also planning to include a Listserv as part of that activity. The expected completion date for that effort is Spring 2025.

2.5.6 Establish University Center of Excellence (COE): Sustainable and Resilient Infrastructure (NCDOT Research Project Number: 2024-39)

Status: Underway
Expected Completion Date: December 2026

NCDOT is sponsoring the NC Sustainable and Resilience (SuRe) Infrastructure Center of Excellence (COE) focusing on sustainable and resilient infrastructure research. Our proposed research consortium brings together diverse interdisciplinary approaches and expertise to address issues of sustainability and resilience in the transportation system. Our team consists of researchers from N.C. State University, Fayetteville State University, and East Carolina University with multiple areas of disciplinary expertise spread across nine departments and research centers. The consortium will also engage undergraduate and graduate students at the three universities. Through these efforts, students will receive workforce development opportunities that prepare them for the future.

The proposed research projects included in the consortium were developed by the research team to address specific sustainability and resiliency needs outlined by NCDOT's request for proposal, as well as the agency's staff. The projects developed for the Center of Excellence are focused on the three specific themes, each of which are designed to address disruptions in the transportation system stemming from natural hazards, everyday disruptions, and other unexpected large-scale disruptions to the network. The three projects proposed for the center of excellence will address the following themes:

- Theme #1: Resilient Infrastructure and Asset Management
- Theme #2: Electric Vehicle (EV) Resilience
- Theme #3: Resilient Cyber Security

The proposed consortium of universities and researchers address these three sustainable and resilient research themes. Research products from these projects will yield future-focused, practice- ready solutions for enhancing the sustainability and resilience of NCDOT transportation infrastructure investments. Community impacts and equity considerations for implementation will be studied and incorporated into the final guidance documents.

In June 2024, a COE Kick Off Meeting was held, the COE team has been making needed data requests, formulating communication plans and developed a COE website.

Within the next 12 months, the COE research teams will complete extensive literature reviews, mining and organizing data, begin model coding, scheduling policy interviews and conducting security resilience cyber threat reviews.

2.5.7 Develop a spatially explicit deep learning-based underground pipe prediction for urban stormwater management (DeepPipe) (NCDOT Research Project Number: 2024-18)

Status: Underway
Expected Completion Date: June 2026

NCDOT partnered with UNC Charlotte to develop a spatially explicit network modeling framework and software package (DeepPipe) based on deep learning, a state-of-the-art artificial intelligence approach, for automated characterization and anomaly detection of NCDOT's existing underground storm drainage pipe network. DeepPipe will focus on the prediction of pipe location, features, and service life using deep learning-based graph neural network techniques as pipe networks are fundamentally graphs. To enhance underground stormwater pipeline network management, robust spatially explicit deep learning algorithms and other machine learning techniques will be developed as a core component of DeepPipe. This will aim to resolve the challenge facing the auto-recognition, extraction/migration and transfer of pipe network data. Web- and mobile app-based implementations will be provided to facilitate the use of the DeepPipe system within in-situ environments. The DeepPipe system can be used by several NCDOT divisions and other government entities working on veracious aspects of urban flooding management. Over the past 12 months, the research team has conducted a literature review and begun data collection. The team has made improvements to the Pipe Assessment and Selection Software functionality and conducted preliminary experiments to identify potential new metrics. In addition, a geodatabase management dashboard is being developed. Urban flooding management will also take into consideration equity and environmental justice impacts.

Over the next few months, the research team will continue to refine the literature review and collect corresponding data, investigate additional improvements to the pipe assessment software, and refine the deep learning-based model and geodatabase management dashboard.

3.0. Address the public health impacts of climate change

3.1 Increase understanding and awareness of the health impacts of climate change

This section is not applicable to the mission of NCDOT.

3.2 Advance health equity

3.2.1 Strengthen access to N.C. ferries to support coastal communities' resiliency, health and mobility (NCDOT Research Project Number: 2022-20)

Status: Complete
Completion Date: September 2024

The N.C. Ferry System faces challenges such as declining ridership, keeping pace with evolving technology, operations affected by extreme weather events, and a lack of sustainable funding sources. Prior studies have examined N.C. ferry operations and made recommendations regarding ways in which future passenger ferries can enhance ridership and improve operations. This includes building connections to existing shuttle terminals and extending transit services. These studies have been oriented to tourism and existing business owner interests and do not fully account for the broader community goals related to economic opportunities, health and transportation access. They also do not account for the unique needs of marginalized populations. In this project, NCDOT's transdisciplinary team is investigating ways in which innovations related to walking, bicycling, micro mobility, transit operations, and mobility on demand (MOD) services may be employed to support NCDOT's work to ensure that transportation projects provide far-reaching and equitable benefits to communities, the economy, and the quality of life and health of North Carolinians. Researchers have completed a literature review and listening sessions with peer states and North Carolina stakeholders. The team also completed a spatial data analysis of residential, business and government services to create a "walkability" profile for each of the ferry sites. Community impacts along with equity considerations and environmental justice will be included in the "walkability" profiles.

The project has been completed. The research team completed a literature review, data collection and interviews with peer states and North Carolina stakeholders. Short- and long-term plans were developed. The research team submitted a final report and will post on the NCDOT's Research and Development website.

3.2.2 Utilize better construction materials that withstand climate change and improve working health conditions

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT is always exploring the use of more advanced materials that are sustainable and resilient. The agency is currently using Warm Mix Asphalt (WMA) when feasible. WMA typically incorporates the use of an additive to allow a reduction in the temperatures at which asphalt mixes are produced and placed. Thus, asphalt can be placed in cooler temperature conditions often found at night, early and late in the paving season, and during changing weather conditions. The ability to lay asphalt outside of the hottest part of the day will decrease the potential for heat-related illnesses among outdoor workers. The application of this type of asphalt also provides much healthier working conditions at both production plans and construction sites, making workers inhale far less smoke and dust.

During the next 12 months, NCDOT will continue to implement using WMA when feasible and researching the use of this material. in this area.

3.2.3 Include equity in benefit-cost analysis (BCA) (NCDOT Research Project Number: 2022-17)

Status: Complete
Completion Date: August 2023

Transportation planning and funding decisions often have significant equity impacts; however, few transportation agencies today integrate equity considerations into their transportation prioritization processes. Most practitioners and decision-makers sincerely want to achieve equity objectives, but transportation equity can be difficult to evaluate because there are various factors such as demographics, income, ability, geographic location, and travel considerations. In 2021, NCDOT started a project to establish user-friendly approaches to integrate equity into NCDOT's BCA processes. This involves the development of two cross-modal measures: air quality and physical health, that can be included in NCDOT's strategic planning and prioritization processes. As a key component of this project, cross-modal measures will be validated through three hypothetical project prioritization scenarios. These scenarios will discuss the potential changes in transportation project scoring outcomes based on the benefits and costs selected for analysis.

As part of this project, the research team has conducted a two-part workshop, conducted a literature and data review, developed Physical Health and Air Quality measures, and a prototype of a GIS tool.

The research team conducted three case studies and produced a GIS web tool and a workbook tool that work in tandem to account for physical health, air quality and equity benefits or costs associated with prospective transportation projects in North Carolina.

4.0. Invest in historically underserved communities

4.1 Increase affordability for low- and moderate-income households

This section is not applicable to the mission of NCDOT.

4.2 Create jobs and economic growth

4.2.1 Increase the On-the-Job Training Program capacity for the clean energy sector

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT Office of Civil Rights (OCR) is continuing to provide opportunities for North Carolina's workforce and businesses. The On-the-Job Training (OJT) Supportive Services Unit is working with non-profit organizations, community colleges, and local governments to provide training focused on clean energy. In the past 12 months, presentations were made to three cohorts of the STEPS4GROWTH (S4G) Clean Energy Program at Edgecombe, Wilson and Nash community colleges. An Introduction to current and emerging transportation careers in clean energy has been added to the Highway Construction Trade Academy and Transportation Summer Accelerator. Research and development work continues so course content can include training on the installation, maintenance and repair of electric vehicle charging stations.

OCR continues to secure funding and work with stakeholders to implement training opportunities. Initial trainings, hiring events, and business development activities are expected to start in the next year.

4.2.2 Establish the Transportation Apprenticeship Program (TAP+)

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT established the Transportation Apprenticeship Program (TAP+) in partnership with NC Community Colleges. According to the North Carolina Community College System (NCCCS), "about 40 of North Carolina's 58 community colleges serve at least one rural county, which is close to 70% of the state's community colleges."

The program provides individuals with the ability to gain the skills and experience needed to succeed in careers in transportation engineering and construction. Launched in 2023, NCDOT's TAP+ program is a federally registered apprenticeship program that recruits apprentices as transportation workers and engineering technicians. The one- and two-year programs prepare apprentices for 21st century transportation and construction leadership careers. The first round of recruitment will focus on engineering technician apprentices, who will have the opportunity to participate in a variety of projects such as design, construction, bridge work, erosion control, aviation, rail, integrated mobility and maritime. This type of knowledge and capacity development will provide the tools to design, construct and plan for more reliable and resilient infrastructure.

Apprentices are hired at the start of the program and continue as full-time employees after apprenticeship completion. This ensures job stability, benefits and possible career paths with NCDOT.NCDOT also provides TAP+ pre-apprenticeships through the agency's On-the-Job Training and Transportation Summer Accelerator programs. The 2023-24 TAP+ goal is to deliver 100 apprenticeships and pre-apprenticeships and challenge industry partners to exceed NCDOT's performance.

4.2.3 Establish the Transportation Summer Accelerator Program

Status: Ongoing
Expected Completion Date: Ongoing

NCDOT's Transportation Summer Accelerator Program, offered through the Office of Civil Rights (OCR) and Supportive Services Unit, delivers a compact summer program to high school youth across North Carolina. The program seeks to engage, immerse and inspire students about careers in transportation construction and engineering. The current two- week program delivers five industry-valued credentials, including OSHA 10 safety certification, flagger certification, Cardiopulmonary resuscitation (CPR)/First Aid certification, Defensive Driving Certification, and the National Center for Construction Education and Research (NCCER) Introduction to Transportation Certificate. It is also a federally registered pre-apprenticeship that delivers classroom and hands-on learning. The 2024 program has seen 32 students graduate at the time of this report. Those students came from four different schools in NCDOT's Highway Divisions 3, 4, 12 and 13. Schools that participated in the program were located in low-income tracks, such as Halifax, Yancey and Cleveland Counties. Over 50% of the participates are from underserved communities.

Year-round activities are scheduled to start in September with a webinar on the apprenticeship.

4.2.4 Collaborate with agency partners to offer internships and fellowships focused on clean energy

Status: Planned
Expected Completion Date: Fall 2025

NCDOT's Office of Historically Black Colleges and Universities (HBCU) Outreach manages the NCDOT HBCU/Minority Serving Institution (MSI) internship program for undergraduate students and fellowship program for graduates and graduate students. These programs provide opportunities for students attending a historically black college or university or a minority serving institution to explore career opportunities in transportation. The program aims to diversify the department's workforce and enhance workforce development efforts.

During summer 2023, HBCU Outreach, with a consortium of other state agencies (Department of Health and Human Services (DHHS), Department of Public Safety (DPS), and Department of Natural and Cultural Resources (NCR)), visited DEQ for an informational session on sustainability and the agency. Additionally, the interns and fellows were able to meet other HBCU/MSI interns from the agency consortium.

Continuing in summer 2024, HBCU Outreach will work with the consortium on planning a visit to DEQ. HBCU Outreach will incorporate educational experiences within NCDOT for all interns and fellows on clean energy.

4.2.5 Incorporate business and workforce development as a recovery support function in state disaster framework

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT Office of Civil Rights (OCR) has included its programs in a recovery support function in the N.C. Department of Commerce's State Disaster Framework. The Business Opportunities and Workforce Development unit has created and will maintain a database of contractors who are qualified and capable of mobilizing for emergency event cleanup efforts, including waste removal and hazardous materials, and hauling, to respond to disasters across the state. The On-the-Job Training and Supportive Services unit will be able to quickly launch "pop-up" versions of its programs in impacted areas. Programs can include OSHA-10, Flagger, and CPR-First Aid credentials plus a focus on erosion control, snow and ice removal, basic work zone safety, and use of hand-held power tools. Additional training opportunities could be offered according to specific disasters. These tasks could include debris removal, trenching, excavation, and bridge carpentry.

In August 2024, NCDOT's OCR hosted a Disaster Recovery event in Highway Division 3 that focused on how firms should position themselves to be "ready, willing, and able" to assist following a disaster, given the relevant impacts from Tropical Storm Debbie.

4.2.6 Incorporate clean energy components into Science, Technology, Engineering and Math (STEM) programs

Status: Planned
Expected Completion Date: Fall 2025

NCDOT's Office of Historically Black Colleges and Universities (HBCU) Outreach manages the National Summer Transportation Institute (NSTI) for middle and high school students. The institute provides students with hands-on experience in transportation.

Beginning in the summer or fall of 2024, staff in the HBCU Outreach program will encourage NSTI program coordinators to incorporate a clean energy component into the curriculum to encourage students to consider clean energy courses in college.

4.2.7 Increase Disadvantaged Business Enterprise (DBE) Certified Businesses in the Clean Energy Program

Status: Ongoing
Expected Completion Date: Ongoing

The NCDOT's Office of Civil Rights (OCR) is continuing to develop policies and programs to increase the number of Disadvantaged Business Enterprise (DBE) Certified Businesses in the Clean Energy Program. DBE companies that are using innovative research to develop energy efficient and clean energy technologies receive support from OCR's Business Opportunity Workforce Development (BOWD) program. Training, webinars and research are provided to those DBE firms to increase their opportunities to compete for contracts as a subcontractor. The BOWD program will continue to partner with the OJT program to facilitate connections among training providers and organizations that are interested in collaborating with NCDOT's workforce development and training programs. This effort is in accordance with the Clean Energy & Clean Transportation in NC: A Workforce Assessment report.

In June 2023, NCDOT developed and approved a Small Professional Services Firms (SPSF) Procurement Policy. Through this policy and the SPSF Procurement Procedures, NCDOT will administer the Small Business Program to foster growth of small firms so they can build capacity and manage projects as primes.

Those areas that utilize professional consultants for delivering projects and services, including the chief engineer for NCDOT's Division of Highways, the agency's deputy secretary for Business Administration, the deputy secretary for Multimodal Transportation, and the executive director for the N.C. Turnpike Authority, will ensure that procurement of Small Professional Services Firms is considered. At a minimum, a yearly report will be prepared, coordinated between the Chief Engineers Office and the OCR on the utilization of SPSF firms.

In the next year, the agency will continue its efforts to increase DBE opportunities.

The OCR continues to educate and engage with communities across the state about National Electric Vehicle Infrastructure Program (NEVI) contracting opportunities for small businesses. From August 2023 to August 2024, nine outreach events to small and disadvantaged businesses included discussion and notice of NEVI contracting opportunities.

At the N.C. Transportation Summit in May 2024, the OCR sponsored 17 DBEs to attend the summit and the pre-event which featured autonomous vehicles, electric vehicles and buses and unmanned aerial systems, and electric wheelchair charging stations.

4.3 Alert residents and businesses, particularly those in underserved communities, of state and federal grant opportunities

4.3.1 Host several webinars to bring together a wide and varied group of people and business, albeit over the internet

Status: Ongoing
Expected Completion Date: Ongoing

The webinars consist of participation from subject matter experts to increase the content available for interested parties. Webinars address common questions and concerns harbored by residents and businesses. Webinar recordings can be converted to blog posts or Questions and answers (Q&A) articles and videos can be viewed later. A collection of Q&A, as well as poll data information is used to build a profile for future grant topics. This effort can also provide a demographic of the audience for future marketing strategies. NCDOT hosted webinars related to NEVI and created an online database for companies interested in working together on EV charging efforts.

In addition to the online database, NCDOT's NEVI Requests for Proposal (RFPs) included areas where applicants could be credited under the agency's scoring criteria for their efforts to a) site EV charging stations within 1 mile of disadvantaged communities and b) partner with businesses from disadvantaged communities.

Please use the following link to subscribe to get emails updates regarding the NC NEVI Program webinars and other related events.

4.3.2 Develop a stakeholder list for awareness of state and federal grant opportunities

Status: Underway
Expected Completion Date: Fall 2024

In the fall of 2022, NCDOT developed a statewide list, including stakeholders from all municipalities, counties, MPOs, RPOs, the NC Rural Center, the NC Metro Mayors, and transit providers to make them aware of state and federal grant opportunities.

Within the next 12 months, NCDOT will finalize updates to the stakeholder list.

4.4 Initiate other projects aimed at investing in underserved communities

4.4.1 Use socioeconomic data in project prioritization

Status: Ongoing
Expected Completion Date: Ongoing

In 2021, NCDOT partnered with N.C. State University to conduct a research project (NCDOT Research Project Number: 2021-17) to enable the agency to incorporate data into the Prioritization Process that has been historically challenging to integrate, including geo-located socio-economic (social, health, economic, etc.) datasets. The project provided NCDOT with implementation-ready tools to incorporate data-driven socioeconomic measures into the STI prioritization process for pedestrian, bicycle and transit projects. Equity considerations and environmental justice impacts are also considered in the prioritization processes.

NCDOT is continuously looking for opportunities to using these tools to incorporate socioeconomic parameters and equity component into the decision-making process.

4.4.2 Implement the inclusion of equity in Benefit Cost Analysis (BCA) (NCDOT Research Project Number: 2024-34)

Status: Underway
Expected Completion Date: September 2024

NCDOT partnered with N.C. State University for implementation assistance in relation to methodologies and concepts previously developed. The research team prepared a State of the Practice review that builds on previous work to include recent examples of project prioritization processes that include equity. The team also reached a unified understanding with the workgroup on what is meant by equity. The team also provided a detailed accounting of how to use the methodology, workbook, and GIS tool to evaluate complete streets benefits within the prioritization process. It is anticipated that some of the results of these implementation activities will be considered for implementation for the NCDOT Project Prioritization Process, Prioritization 8.0 (P8.0) cycle (new version of the current Prioritization 7.0 cycle). Throughout this implementation effort, the research team will work closely with both the Strategic Transportation Prioritization (SPOT) team and Workgroup to help address emerging needs as they arise through the end of this project.

Over the past several months, the research team has completed a State of the Practice Review. The team has also led group facilitations and developed a timeline and key milestones for group facilitations and documenting results. In addition, the research team has calibrated the equity in the BCA methodology, the workbook tool and GIS tool.

Currently, the research team is finalizing the final report and deliverables.

4.4.3 Assess metrics and indicators for the Office of Civil Rights (OCR)

Status: Complete
Completion Date: July 2023

The NCDOT OCR recently completed an extensive state of the practice review and documented its applicable findings to assess metrics and indicators for the OCR. The findings revealed limited availability of literature on civil rights Key Performance Indicators (KPIs) in transportation, indicating a need for comprehensive and sound indicators to be developed across agencies. In OCR, there is a need for data collection, indicator use, and testing for disproportionate impacts. This study sets the groundwork for how programs can be better assessed and how KPIs can be implemented within each program across OCR.

4.4.4 Assess environmental justice & historical transportation impacts in North Carolina (NCDOT Research Project Number: 2023-29)

Status: Complete
Completion Date: June 2024

NCDOT sponsored a research project to develop a methodology of best practices to use when analyzing inequitable transportation impacts and how to best prevent those impacts. This method was designed to capture before-and-after impacts at the community level, including a consistent collection of current and historical data.

The research team developed a plan to establish a framework NCDOT can use to identify and address transportation inequity at the community level. The research team proposed an approach that included:

- Conducting research and developing a series of best practices.
- Developing a definition for “transportation inequity.”
- Performing an extensive data review and gap analysis to capture existing data and geospatial coverage.
- Conducting case studies of communities impacted by transportation inequity.
- Developing a framework that can be implemented to identify and address historical and potential transportation inequities.

Researchers completed the final report. In addition, the final ArcGIS storyboard online platform is being enhanced. It is being reviewed by NCDOT’s Communications Office before it is published.

4.4.5 Pilot the FHWA Environmental Justice (EJ) training course

Status: Complete
Completion Date: September 2023

NCDOT participated in a pilot course of forthcoming FHWA-NHI-142095: Environmental Justice Analysis in the National Environmental Policy Act (NEPA) In-Person Training. The purpose of the training was to provide participants with the methodology to conduct an environmental justice analysis and document it within the NEPA process. The goal of the pilot was to collect input from an expert audience about the user experience with the training content and exercises and identify any areas needing modification.

4.4.6 Analyze incorporation of equity for Long-Range Transportation Planning (LRTP) (NCDOT Research Project Number: 2023-12)

Status: Underway
Expected Completion Date: December 2024

The gaps in transportation planning, implementation of projects, and differences in service opportunities became more evident during the COVID-19 pandemic for certain population groups, including people with limited access to transportation. The objectives of this research are: 1) to review the recent developments in transportation equity related research, the recent research initiative "RP 2022-17: Including Equity in Benefit-Cost Analysis" (refers to initiative 4.4.4. in this report) and identify the best practices, existing gaps, limitations and challenges; 2) to survey the staff of MPOs, RPOs, and other state departments of transportation (DOTs) as well as conduct focus group meetings and gather information on how equity can best be addressed in the early stages of long-range transportation planning. Another goal of this research focuses on the timely delivery of perishable necessary goods; 3) to identify data, data sources, specific performance measures and evaluation tools for equity analysis in long range transportation planning; and 4) to develop guidelines and propose a complementary methodology that can be applied to ensure equity is appropriately addressed during project proposal development and alternatives analysis for long range transportation planning in North Carolina. Researchers have completed a literature review, completed a review of deliverables for RP2022-17, surveyed MPOs, RPOs and other agencies to identify equity needs and practices, surveyed other state DOTs to identify equity practices and conducted focus group meetings.

Over the past several months, the researchers have developed, distributed and compiled survey results and completed three focus group meetings. Ranking scenarios are completed and the team is currently working on methodologies. Over the next few months, the research team will refine the developed guidance to address equity, complete the methodology/assessment tool and prepare the final report and associated project deliverables.

4.4.7 Develop Statewide Local Area Resource Contacts (LARC)/ Community-Based Organizations (CBOs) Network stakeholder database within PublicInput customer relationship management (CRM)

Status: Underway
Expected Completion Date: December 2024

NCDOT teamed with a consultant to source contact information for development of a Local Area Resource Contacts/Community- Based Organizations (LARC/CBOs) Network database of local stakeholders and community organizations statewide. The database empowers NCDOT to discover and manage LARC/CBOs to reach critical stakeholders in hard-to-reach communities. Some of the categories included in the LARC/CBOs Network include:

- Faith-based organizations
- Professional organizations and chambers of Commerce
- Housing development foundations
- Parent-teacher associations
- Public health organizations
- Environmental and natural resource organizations
- Public media and news organizations
- Anti-discrimination organizations
- Public libraries
- Rural and urban economic development groups.

The LARC/CBOs Network includes over 500,000 contacts and it is integrated to CRM, the Equity Mapping, and has customizable targeting options to allow planners and consultants reference to contacts in their project's area and documentation of this step as part of their public involvement process.

The first version of the database has been released and a 30-minute video was created to guide users through the features and functionalities of the CBO Module and Network.

Within the next 12 months, NCDOT will continue to encourage the use of the database.

4.4.8 Create an Environmental Justice (EJ) Public Involvement Plan (PIP) for State Transportation Improvement Program projects (STIP projects: R-5876 and U-4434)

Status: Underway
Expected Completion Date: Spring 2026

NCDOT is working on developing environmental justice public involvement plans (EJ PIPs) for the STIP projects R-5876 and U-4434.

For project R-5876 NCDOT, in collaboration with the S.C. Department of Transportation (SCDOT), is proposing to extend the Carolina Bays Parkway from S.C. 9 in Horry County, S.C. to U.S. 17 in Brunswick County, N.C. The purpose of the project is to improve the transportation network in the study area. The goal is to enhance mobility and connectivity for traffic moving in and through the project study area. A draft environmental impact statement (EIS) is being prepared for the Carolina Bays Parkway Extension Project. Public input collected during the development of the draft EIS has indicated that there could be impacts to some low-income and minority communities in the project study area. An EJ PIP was created in 2022 to engage these communities in discussing alternatives and ways of reducing possible harm.

Due to anticipated impacts to EJ communities, additional outreach was conducted to ensure they were aware of the project and get feedback on the proposed alternatives. This outreach effort and the EJ Outreach Plan will be included in the EIS for the project.

Similarly, for project U-4434, NCDOT is proposing to construct a multi-lane facility at a new location in New Hanover County, N.C. Located within the urban core of Wilmington, the proposed 1.7-mile-long project would be an extension of the existing Independence Boulevard (SR 1209). As part of this project an EJ PIP was also developed.

Within the next 12 months, the agency will update the PIPs for U-4434 and R-5876. The draft environmental impact statements for both projects is expected to be approved in the next few months. This will kick off the next round of public engagement with updates made as necessary.

4.4.9 Develop cemetery mapping for indigenous and enslaved people's remains (NCDOT Research Project 2025-11)

Status: Underway
Expected Completion Date: June 2026

NCDOT has partnered with N.C. State University's Institute for Transportation Research and Education (ITRE) to expand upon existing NCDOT and Office of the State Archaeologist (OSA) mapping and datasets by providing a methodology to capture the cultural and historical significance of burial sites, use-community driven approaches to identify new sites, employ a field verification process, and highlight opportunities to embed these approaches into existing NCDOT project planning and development processes. Beyond expanding a mapping dataset for cemeteries and burial sites, the project team will develop a community engagement methodology to allow community members to participate in the identification of unmapped burial sites and inform the historical and cultural significance of sites. Using a county-level project study area, with Edgecombe County as the pilot, this project will yield a proof of concept and a community participation roadmap for engaging communities around the state in an effort to map previously unmapped cemetery and burial sites. The project will focus on cemeteries of indigenous and enslaved peoples and culturally historic community cemeteries. Equity considerations and environmental justice impacts will be studied and addressed in the final product.

In the next 12 months, the research team will (1) develop a community-informed data collection process, (2) establish a typology of cultural significance developed with a stakeholder advisory board, (3) conduct and document a field verification process, (4) develop a tool for communities to collect and report local burial sites and (5) develop a process for NCDOT to work with local communities to expand and maintain the cemetery mapping dataset.

4.4.10 Work with stakeholders on strategic NCDOT projects within the state to create opportunities in underserved communities

Status: Ongoing
Expected Completion Date: Ongoing

The OCR through its BOWD and the OJT is coordinating with NCDOT's projects and programs to connect communities to opportunities. Current projects in collaboration with OCR include:

- Rail Division, Virginia DOT S-Line Corridor-Eastern Region development,
- Toyota Battery Plant,
- Central region I-26 in Asheville, N.C.,
- Western North Carolina, and N.C. Clean Transportation, and
- Equitable outcomes in NEVI plan development and implementation.

In service to these projects and programs, OCR has developed public information sessions and partnerships to provide training that increases participation in department activities. A research project was completed in July 2023 that will enable OCR to understand qualitatively and quantitatively the best ways to measure the impacts of NCDOT projects on communities of color that can inform policy and project decisions.

In addition, NCDOT worked with the Governor's Office and Wake Tech Community College on a pilot certification program for EV charging station repair and maintenance. In June 2024, the first cohort graduated from the Wake Tech EVSE certificate course. NCDOT held a webinar in June 2024 to educate community members and obtain feedback on community EV charging stations being built under the NEVI program. Additionally, the OCR used feedback from recent listening sessions to inform the development of a comprehensive list of considerations for small businesses. This list is a useful reference for North Carolina's small businesses to best participate in NEVI contract opportunities.

The NEVI Charging Site Business Considerations include 1) electricity cost analysis and utilization of site, 2) profit, payback period, and reimbursement schedules, 3) capital investment and variable costs (20% match to federal funds), 4) site amenities and opportunities for additional sales of food/merchandise while charging, 5) operations and maintenance – replacement, insurance, and 6) access to capital and partnerships.

4.4.11 Implement the Environmental Justice (EJ) / Transportation Disadvantage Index (TDI) tools

Status: Underway
Expected Completion Date: Ongoing

Interactive mapping and data tools have been created to help NCDOT staff and external partners understand and visualize potential transportation disadvantages and the disproportionate impact of transportation barriers on certain populations. These tools also help inform policies, planning and project development decision making.

NCDOT has conducted internal and external agency training on these tools as well as advertised the capabilities and potential uses of these tools. In 2024, the TDI tool was updated to include limited English proficiency (LEP) data as an additional metric of transportation disadvantage, bringing the total variables to seven (disabled population, poverty status, youth population, elderly, black, indigenous and people of color, carless households, and now LEP population) that calculates a block group's TDI score. Also in 2024, NCDOT updated the methodology for the TDI tool to change minimum scores for each variable to be zero instead of 1, so scores will range from 0-21 (updated from 6-18).

In addition to releasing the new data, ongoing maintenance goals include updating the online resources that describe the tool metadata and methodologies for users. The TDI was also included in shaping an interactive mapping tool from the Governor's Office-led environmental justice initiative which combined equity metrics and geospatial data across multiple state agencies.

Additional Information

The 2023 North Carolina Appropriations Act (S.L. 2023-134, § 5.6(f)) authorized the Emergency Management Disaster Relief and Mitigation Fund (EDRMF) to provide funding for grants to help North Carolina communities become more resilient. The fund can be used for resilience projects, which can be applied for by state agencies, local governments, nonprofit organizations, and public authorities. The funds can be used to address the following areas: flood mitigation, transportation resilience, disaster relief, technical assistance for small and underserved communities, and local cost share assistance for federal funds on approved federal mitigation grants. NCDOT is part of the review and selection committee in charge of the bill.