Statewide ITS Resiliency Project

By North Carolina Department of Transportation
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Benefits Statement

The Statewide ITS Resilience Project by North Carolina DOT (NCDOT) improved ITS device uptime from 48% to over 98%, enhancing traffic management and safety, which saves lives. The project's pay-for-performance model ensures cost-effective maintenance, maximizing return on investment and minimizing long-term costs. Upgrading outdated technology, like replacing analog cameras with digital ones, leads to further savings. Overall, the project fosters a safer, more efficient transportation system, significantly saving lives, time, and money.

In this case study you will learn:

1. How NCDOT significantly improved the uptime of Intelligent Transportation Systems (ITS) devices from 48% to over 98%, enhancing traffic management, safety, and reliability.

2. How NCDOT implemented a pay-for-performance maintenance contract that incentivized contractors to meet specific uptime goals, resulting in more efficient maintenance practices and better allocation of resources.

3. How NCDOT improved coordination among departments and garnered active involvement through weekly meetings.

BACKGROUND

In 2022, the North Carolina Department of Transportation (NCDOT) owned and operated 689 cameras, 352 dynamic message signs (DMS), and four ramp meters that supported incident management and traveler information systems. However, NCDOT determined that only about 48% of the ITS devices were consistently available due to maintenance issues. The substantial downtime of ITS devices impacted the effectiveness of incident management and traveler information systems, two programs focused on reducing congestion and emissions through improved traffic flow.

Historically, NCDOT provided maintenance support through a blend of in-house maintenance staff and on-call maintenance contracts, each managed individually by NCDOT's 14 divisions. This approach, along with lack of funding and an expertise gap due to staffing challenges, resulted in varying levels of maintenance effectiveness within the overall program. To mitigate these contributing factors and increase device availability and reliability, NCDOT initiated the Statewide ITS Resilience Project, with a defined ITS device uptime goal of 93% or higher.

Obtaining Funding and Planning for Improvements

NCDOT first procured funding by obtaining a Congestion Management and Air Quality (CMAQ) grant focused on supporting practices that sustain greater operational performance by increasing device reliability. This grant facilitated pursuit of a Request for Proposals for a contractor that could provide preventive maintenance (PM) and responsive maintenance (RM) on ITS devices through a pay-for-performance (PFP) model contract. The contract defined compensation based on the ability to meet clearly defined uptime goals for specific device classifications. Additionally, the contract defined incentives for surpassing goals for device uptime and disincentives for not achieving

uptime goals and for not completing device or fiber repair within specified time frames. CMAQ funding required that the contract focus on non-attainment areas in the Triangle, Triad, and Metrolina regions of the state. This footprint allowed the contractor to focus resources around areas with a higher density of ITS devices.

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

Establishing the Baseline

The contract included an initial assessment and repair phase focused on critical ITS devices that needed to be addressed. This assessment inventoried devices that were fully functional and would become the daily responsibility of the contractor under the PFP model and those that required RM to be fully operational. This phase also included transition of NC811 locating responsibility and liability to the contractor.

Transitioning Devices into PFP

If a device was determined to need RM, the Contractor submitted a proposed work order to repair the device. Once the device was operational, it entered the PFP model and became the responsibility of the contractor. These work orders allowed the contractor to make repairs per the line-item bid provided in their proposal.

Repair or Replacement Needs Outside PFP

Knowing many devices were damaged or otherwise inoperable, the contract allows for initial repair or replacement to be billed at line-item bid prices without negatively impacting the contractors PFP model. Once operational and under the responsibility of the contractor, subsequent maintenance or repair would be included in the PFP model. Examples of damaged infrastructure included communication infrastructure, cabinet replacement, and pole replacement.

*Damaged pole replaced utilizing responsive maintenance*

Additionally, ITS device replacements can be identified and implemented at NCDOT's discretion. Examples include replacing analog cameras with digital cameras and upgrading end-of-life DMS. These replacements are not part of the PFP model and are paid for separately through work orders. NCDOT has utilized this contract to transition all analog cameras to digital cameras within the study area and is proactively assessing end-of-life DMS to replace them before they stop functioning.
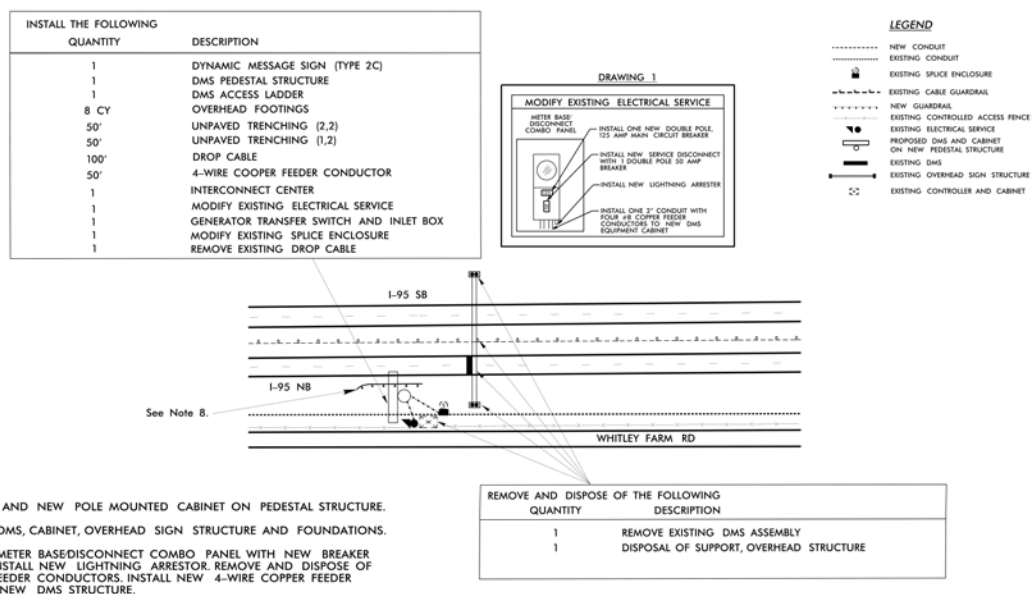
Example of DMS Replacement Design
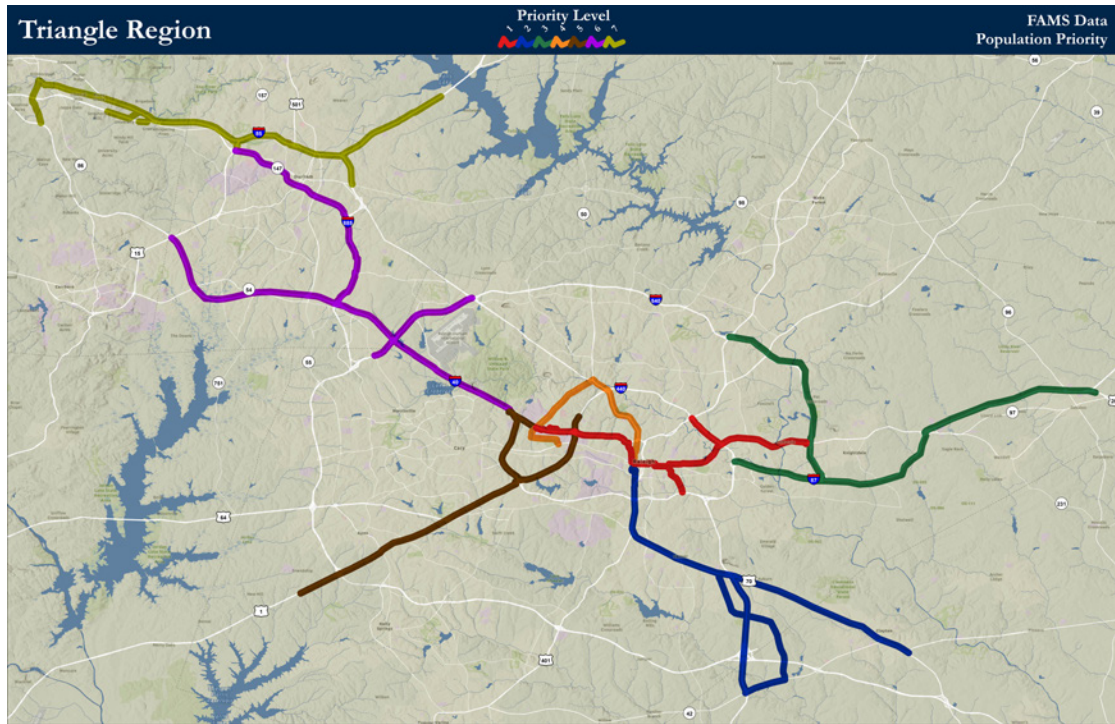
Documentation and Monitoring Operational Improvements

As noted, NCDOT was experiencing 48% device uptime statewide in 2022. At that time, the devices in the regions that constitute the ITS Resilience Contract were experiencing device uptime of 59% on average. A component of the contract required a dashboard to monitor device uptime. The dashboard is supported by a centralized system that captures information such as installation dates, device photos, model numbers, and firmware versions. Most importantly, the system tracks the dates and nature of maintenance activities to support continuous analysis of devices and determine trends associated with more problematic devices.

Fiber Asset Management System

The contract also includes field investigations of fiber optic cable infrastructure to enable more accurate and effective documentation and population of NCDOT's Fiber Asset Management System (FAMS). NCDOT has identified priority areas for the Contractor to begin collecting data and populating FAMS.

COMMUNICATIONS PLANNING AND EXECUTION

Implementation of this project has involved extensive coordination among NCDOT Divisions, NC Department of Information Technology (NCDIT), NCDOT GIS Unit (GISU), and the Contractor. Throughout the first phase of the project, NCDOT held internal meetings to inform various Departments and Divisions of the project requirements and expectations. Subsequent weekly meetings have been held between NCDOT and the Contractor to discuss recent and upcoming activities and identify potential challenges or specific details of the weekly work plan. NCDOT Divisions are primarily responsible for coordinating PM and RM requests with the Contractor for their regions, including management of NC811 and temporary traffic control.

Since NCDIT maintains the network infrastructure equipment throughout the state, coordination between NCDIT and the Contractor is required to monitor connectivity across the network, making them an integral partner. To implement the FAMS portion of the project, several meetings were conducted with NCDIT and GISU to develop a standardized platform that was accessible both internally to NCDOT and contractors.

Statewide ITS Device Performance

OUTCOME, BENEFITS AND LEARNINGS

The Statewide ITS Resilience Project has been in place for over 1.5 years and has experienced immense success in improving ITS device uptime. The goal of the project was to improve ITS device uptime to an aggressive goal of 93%. For the currently monitored devices, the uptime is now over 98%. This substantial increase in device uptime has fortified NCDOT's return on investment in these ITS devices and the contract. The improved reliability of the devices has also improved the mobility and safety of North Carolina motorists and reduced vehicular emissions.
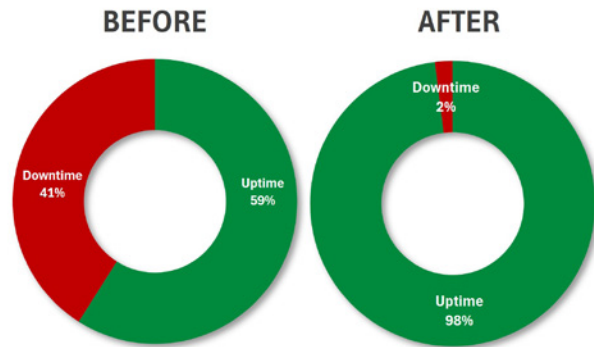
In addition to a substantial increase in ITS device uptime, this project has:

- Significantly improved the NC811 locating process by creating a centralized and unified process.

- Implemented a state-of-the-art asset management system for ITS devices and fiber infrastructure.

- Provided work order-based task orders for initial device repair, replacement of obsolescent technology, and data collection/population of the fiber asset management system.

- Upgraded over 300 analog cameras.

Notable lessons learned from this project are:

- A vital component of proper and timely maintenance of ITS devices is asset management. This has been achieved through

the systems being continually updated and monitored through this contract.

- A process of enabling temporary fiber repair to restore uptime immediately followed by a more comprehensive scheduled repair is imperative. Since fiber has high demands and requirements for repair and often impacts several devices, this allows uptime to be restored as soon as possible while also ensuring a complete repair at a later date.

- Construction coordination is vital for a successful performance-based maintenance contract. This has been accomplished through increased coordination with Divisions when maintenance and construction activities have overlapping project limits.

- Though increased levels of coordination have been required, communication among representatives from the state, regions, and contractor(s) is crucial. The weekly meetings have been essential to this project's success by garnering active involvement at all levels.