STATEWIDE CENTRAL SIGNAL SYSTEM INITIATIVE

By: North Carolina Department of Transportation

BACKGROUND

North Carolina is responsible for the second largest state-maintained roadway network in the country. Since counties in North Carolina do not maintain roads, the network represents the vast majority of the mileage in the state. Due to the breadth and depth of the highway system, North Carolina also maintains and operates one of the largest signal networks in the country with over 10,000 traffic signals from the Outer Banks to the Great Smoky Mountains.

North Carolina’s 10,000+ signals have historically existed in one of three operational spaces: a municipal system (3,800 signals), a closed loop system (2,400 signals), or isolated (4,100 signals). Each of the 19 municipal signal systems across the state consists of a centralized Traffic Management Center to which the signals are connected via fiber optic communications, as well as traffic signal operations staff that monitor and operate the network. This model has proven to provide a high level of service to these systems, in terms of both maintenance and traffic operations. In 2017, with the vision of moving the state’s closed loop systems towards high-resolution data, automated traffic signal performance measures, and connected/autonomous vehicle capability, the decision was made to begin transitioning away from isolated closed loop systems by establishing a statewide central signal system server to which the hundreds of closed loop systems across the state could communicate.

TSMO PLANNING, STRATEGIES, AND DEPLOYMENT

With NCDOT’s spending push several years ago came dozens of major interstate widening projects. The increase in capital projects forced NCDOT’s Traffic Operation’s decision-makers to consider how they would manage traffic during major incidents, which typically increase in both frequency and duration in significant work zones. Oftentimes, the adjacent corridors to which freeway traffic is diverted have a combination of coordinated signal systems and isolated signals. There was a need to manage this diverted freeway traffic and the solution was statewide centralized signal communications. This would provide the ability to remotely communicate with all of the signals along a corridor (even previously isolated signals) for the purpose of activating predeveloped timing plans designed to handle the additional traffic volumes.

NCDOT currently has a contract with Econolite for traffic signal controller software and therefore selected Econolite’s Centracs Advanced Traffic Management System for the centralized management of the statewide signal system. Because laying fiber optic cable from all over the state back to the Centracs Core Server in Raleigh is infeasible, NCDOT worked with Verizon to have a dedicated traffic signals subnet created on their network. In doing so, communications between the Core Server and signals anywhere in the state can be established utilizing a secure connection via 4G wireless modems.

Additionally, efforts are underway to develop and standardize a method of connecting remote signal systems to the Core Server utilizing existing NCDOT ITS fiber. After successful initial implementation of a signal system in Wake County, and with the goal of streamlining the upgrade process, the Signal System Timing and Operations (SSTO) group began putting together

IN THIS CASE STUDY YOU WILL LEARN:

1. About the 19 municipal signal systems as well as operations management across the state of North Carolina.
2. How the central signal system helped manage traffic during interstate widening projects.
3. The numerous benefits to be had from getting North Carolina’s signal systems on a statewide central system.
standards and procedures for the upgrade of existing closed loop systems. This included hardware and software requirements, cost estimate templates, 4G modem request forms, standardized IP communication configurations, setup videos for ethernet switches and radios, and hardware setup block diagrams and example photos. All of these documents were combined and distributed across the state to all 14 Highway Divisions. Finally, NCDOT began leveraging Spot Mobility and Transportation Improvement Program (TIP) funding to facilitate the upgrade of existing systems. In addition to pushing for the upgrade of existing systems, NCDOT's signal system communications standards have been updated to ensure that any newly constructed or upgraded signal system will utilize ethernet communications and be connected to the Statewide Centracs Server.

COMMUNICATIONS, PLANNING, AND EXECUTION

Once the proof of concept was successful and the decision to continue upgrading systems had been made, the Signal System Timing and Operations group began the process of disseminating details to the 14 Highway Divisions that manage and operate the closed loop signal systems.

In August 2018, SSTO staff visited each Division to give a presentation and discuss the following details regarding the Centracs software:

- Hardware requirements
- Software requirements
- Communications requirements
- Maintenance benefits
- Operational benefits
- Security benefits

In order to ensure that all of North Carolina's transportation stakeholders were aware of this effort, this initial outreach was followed by presentations at Division Traffic Engineer meetings, Regional Traffic Engineer meetings, IM/ITS quarterly meetings, MPO annual meetings, Regional Transportation Alliance meetings, and the 2019 ITS Carolinas Conference.

OUTCOMES, BENEFITS, AND LEARNINGS

Large scale system upgrades began in spring of 2018. Over the proceeding 18-month period, the outcome of this effort resulted in approximately 500 of the 2,400 closed loop system signals being upgraded and operational on the Statewide Centracs Server. Additionally, as part of ongoing construction-related Interstate Incident Management efforts, server to server communications are being established between the Statewide Centracs Server and the Asheville, Gastonia, and Charlotte signal systems, which represent an additional 900+ signals. There are numerous benefits to be had from getting North Carolina's signal systems on a statewide central system, such as around-the-clock signal communications, which allows NCDOT maintenance staff to no longer be reliant upon citizens.