

# TRAFFIC SIGNAL MODERNIZATION PROGRAM

By Tennessee Department of Transportation

## IN THIS CASE STUDY YOU WILL LEARN:

- 1** How Tennessee DOT worked with local government agencies to modernize traffic signal systems in both small and large agencies to reduce crashes, improve traffic operations, system reliability.
- 2** How TDOT partnered with the American Council of Engineering Companies (ACEC) to create the Tennessee Traffic Signal Users Group (TTSUG) with the mission of providing a framework and resources to facilitate collaboration and information sharing among local signal agencies in Tennessee.
- 3** How the Traffic Signal Modernization Program (TSMP) has identified 14 TSMP projects, with 12 of the 14 projects (86%) are in either an economically distressed or at-risk county.

However, maintaining and operating the traffic signals might be a challenge to some small local agencies. A statewide survey from 68 different local agencies revealed that there is a clear distinction between local agencies that maintain less than 20 traffic signals (aka. small local agencies) and local agencies that maintain more than 20 traffic signals (aka. large local agencies). For many smaller local agencies who manage traffic signals in most of the rural areas, they don't have adequate financial or staff resources for signal maintenance activities. In addition, there is a gap in Federal funds to support such projects since most rural areas are not eligible for Congestion Mitigation and Air Quality (CMAQ) or Surface Transportation Block Grants (STBG) funds. Many of the traffic signals in rural areas were installed many years ago and are in poor condition. The need to update and modernize the existing traffic signals is clear. Traffic signals in large local agencies are also in need of modernization to leverage opportunities for optimization and more proactive signal operations and maintenance. Traffic signal modernization in both small and large agencies is proven to reduce crashes, improve traffic operations, system reliability and further support the Department's mission to provide a safe and reliable transportation system for people, goods, and services that support economic prosperity in Tennessee.

## BACKGROUND

In the State of Tennessee, the Tennessee Department of Transportation (TDOT) generally does not own, operate, or maintain traffic signals along state highways. Ownership, along with responsibility for operation and maintenance, reverts to local government agencies after a traffic signal is installed and a Right-of-Way Agreement is executed.

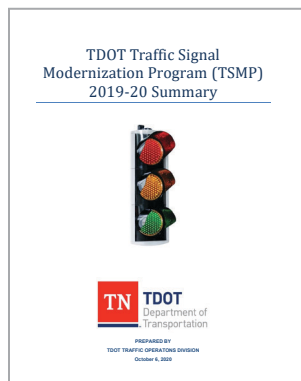
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## TSMO PLANNING, STRATEGIES AND DEPLOYMENT

To assist with communities and local traffic signal maintaining agencies in modernizing the existing traffic signal equipment and operations, TDOT's Traffic Operations Division requested \$250,000 in Department maintenance funds (100% State funded and contracted) to initiate the Traffic Signal Modernization Program (TSMP). A project selection process was introduced to consider the following six factors:

- County economic status where the project is located
- Quick implementation of the project
- Age of the traffic signal equipment
- Possibility of design and ROW issues
- Estimated project cost
- Participation of local agency in the Tennessee Traffic Signal Users Group (TTSUG)

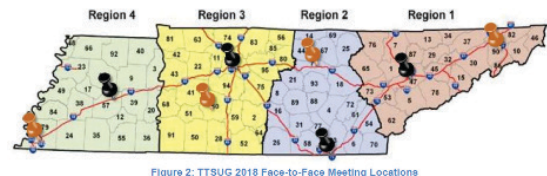
For the shortlisted traffic signal projects, site reviews were conducted to verify the information in each TSMP grant application and to document the condition and type of traffic signal equipment located at the intersections. Depending on the scope of the TSMP projects, some projects were bundled with other TDOT project for bidding purposes, while others were handled through TDOT's Traffic Operation Division on-call traffic signal design consultant contracts. The timeline for project implementation was 12 months. In the first year of this program, the Department received 162 grant applications representing 672 signalized intersections. In Fiscal Year 2019-20, the Department selected 14 projects for the TSMP. Ten of these projects included primarily equipment upgrades. A group of the TSMP projects were bundled into three regional projects to create a larger opportunity for bidding purposes. The remaining four projects were handled



through a Traffic Operations Division traffic signal design on-call consultant, which included two corridor traffic signal timing optimization projects and two traffic signal controller replacement projects. Offering traffic signal retiming assistance as well as infrastructure upgrades provides a benefit to both our small and large local signal agencies.

## COMMUNICATIONS PLANNING AND EXECUTION

To identify the needs for traffic signal infrastructure improvements across the state, in 2018, TDOT partnered with the American Council of Engineering Companies (ACEC) to create the Tennessee Traffic Signal Users Group (TTSUG). The TTSUG Steering Committee consists of traffic signal subject-matter experts from TDOT, the Federal Highway Administration (FHWA), local agencies, academia, and consultants (via ACEC). The mission of the TTSUG is to provide a framework and resources to facilitate collaboration and information sharing among local signal agencies in Tennessee, and to advance the knowledge and understanding of safe and efficient management and operations of traffic signal systems. Currently, there are over 400 local agency members in the TTSUG representing over 220 local agencies. One of the first activities that TTSUG Steering Committee was to identify the needs of traffic signal maintenance and operations from local agencies by conducting a survey. From this survey, responses were received from 68 different local agencies that reflected a clear distinction between small local agencies (maintain less than 20 signals) and large local agencies (maintain more than 20 signals).



Following up on the survey, the TTSUG Steering Committee held eight face-to-face meetings (two in each TDOT Region) across the state, from Memphis to Bristol, between May 2018 and July 2018. In the process of site review of the shortlisted intersection projects, TDOT engineers were able to communicate and learn from local agency staff on the critical issues they have with maintenance and operations of these traffic signals. The site reviews produced a lot of valuable information that assisted in the final selections of TSMP projects and future needs that can be tackled by the TTSUG.

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## OUTCOME, LEARNINGS AND PUBLIC BENEFIT

The TSMP is helping communities and their local traffic signal maintaining agencies modernize existing traffic signal equipment and operations. This program generated significant interest in its first year of existence, as shown by receiving 162 grant applications representing 672 signalized intersections, with an overall funding request totaling over \$30M.

The TSMP project selection process is committed to supporting the preservation of signal infrastructure and Governor Lee’s First Executive Order by prioritizing projects in economically distressed and at-risk counties. With the implementation of the TSMP, the Department has identified 14 TSMP projects. 12 of the 14 projects (86%) are in either an economically distressed or at-risk county. The average age of traffic signal equipment was 21.7 years in at-risk counties and was 30.9 years in distressed counties, as compared to 19 years for other TSMP grant applications. In addition to economically distressed and at-risk counties, the TSMP is also providing needed assistance to large signal agencies to more proactively manage signal systems and mitigate congestion in our urban communities.

The combined efforts of the TTSUG Steering Committee and the positive reception of the TSMP has ushered in a new era of partnership between TDOT and local signal agencies. Effective traffic signal operations and maintenance is a critical element of Transportation System Management and Operations (TSMO) and accomplishing the TDOT mission to provide a safe and reliable transportation system for the people of Tennessee.

Improvement Strategy	Benefits	Crash Reduction
Controller, Controller Cabinet, and Cabinet Equipment	Reduction in maintenance costs, increased reliability and improved traffic operations	30%
Signal Timing Optimization and Coordination	Signal Timing and Phasing should be updated to meet traffic demands using the intersection, this reduces intersection delay and provide appropriate phases to the critical movements at the intersection. Coordinated systems improve capacity on corridors	32%
Supplemental Signal Heads	Supplemental signal heads are added to improve the approach sight distance to the signal or at wide intersection where visibility of the signal changes based on the vehicles approach	28%
Stop Bar and Advance Detection	Increase reliability in vehicle detection, reduction in congestion, improved operations and reduction in red-light running and severe crash frequency	20%
Install Advance Warning Signs	Advance warning signs are recommended when visibility of the signal is insufficient or for isolated traffic signals that may need warning for unfamiliar drivers	22%
Retroreflective Backplates	Backplates with retroreflective borders is a safety treatment to alert drivers to signalized intersections during periods of power outages when the signals would otherwise be dark, and non-reflective signal heads and backplates would not be visible	15%
Upgrade Signal Heads to 12" LED	Improve visibility of signal indications, improves safety and savings in energy efficiency	24%

Table 1: Traffic Signal Modernization Program Strategies

In 2019-20, the TSMP utilized \$250,000 of state funding without any local or federal matching funds. These projects were designed and delivered for construction lettings within 12 months of project selection. The low-cost signalization improvements included in the TSMP projects are proven to be a cost-effective way to reduce crash rates, improve safety and reliability of transportation system and the success from the first year is a step for program to grow to meet the growing needs in Tennessee. TDOT plans to expand the size and scope of the program in the coming years.