



Traffic Signal Maintenance & Modernization (TSM&M) Program

TSITE Summer Meeting (July 28, 2021)

Nathan Vatter and Steve Bryan, Tennessee DOT

Agenda Topics

- Background
 - Traffic Signals in Tennessee
 - TSSUG
- Traffic Signal Maintenance & Modernization (TSM&M) Program
 - The Beginning (TSMP)
 - Growing the Program (TSM&M)
 - TDOT Preventative Maintenance Inspection & Inventory Program (PMII)
 - TDOT Region 3 PMII Findings
- NOCoE Case Study
- TDOT Next Steps



Background

Traffic Signals in Tennessee

Maintenance and Responsibility

The Department does not own, operate, or maintain traffic signal devices located along state highways

No one other than the Department may permit the installation of a traffic signal on any state highway (Tenn. Code Ann. § 54-5-601) except within an incorporated municipality (Tenn. Code Ann. § 54-54-5-603).

All Traffic Control Devices on State Routes and Roadways Open to the Public are obligated to comply with the requirements of the MUTCD.

New Signals inside a City

- TDOT will execute a Memorandum of Understanding (MOU) for signals inside City jurisdiction

New Signals inside a County

- TDOT will execute a Memorandum of Approval (MOA) for locations outside a City jurisdiction with the County jurisdiction



Tennessee Traffic Signal Users Group (TTSUG)



TM

Background

Background

Tennessee Traffic Signal Users Group (TTSUG)

- 2017 Steering Committee created Representatives from TDOT, FHWA, local agencies, academia, and engineering consultants

- 2018 TDOT partnered with the American Council of Engineering Companies (ACEC) to create the Tennessee Traffic Signal Users Group (TTSUG).

Background

Tennessee Traffic Signal Users Group (TTSUG)

- The **Mission** of the TTSUG
 - Provide a framework and resources to facilitate collaboration and information sharing in the State of Tennessee, and to advance the knowledge and understanding of safe and efficient management and operations of traffic signal systems.
- The **Vision** of the TTSUG
 - To lead the State of Tennessee to excellence in traffic signal systems.
- **Membership**
 - Over 400 local agency members
 - Over 220 local agencies



Background

- **Tennessee Traffic Signal Users Group (TTSUG) Steering Committee meetings**
 - **2017:** TTSUG membership survey indicated response differences between large agencies (20+ traffic signals) and small agencies (<20 traffic signals).
 - **2018:** TTSUG held eight face-to-face meetings with local agencies focusing on further identifying the needs of both large and small agencies.
 - **2019:** The creation of the TDOT Traffic Signal Modernization Program (TSMP).
 - **2021:** TSMP was expanded to include Preventative Maintenance Inspection & Inventory (PMII) Program, the Program is now called the Traffic Signal Maintenance & Modernization (TSM&M) Program



TDOT Traffic Signal Modernization Program (TSMP)



From the Beginning



TDOT Traffic Signal Modernization Program (TSMP)

- TSMP was developed to support communities to modernization of existing traffic signal equipment on state highways
- 100% state funds, and the Department established a goal to begin these projects within 12 months of project selection.
- Traffic Signal Modernization Program was approved for \$250,000 in 2019-20 FY





TDOT Traffic Signal Modernization Program (TSMP)

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%
Retroflective 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%

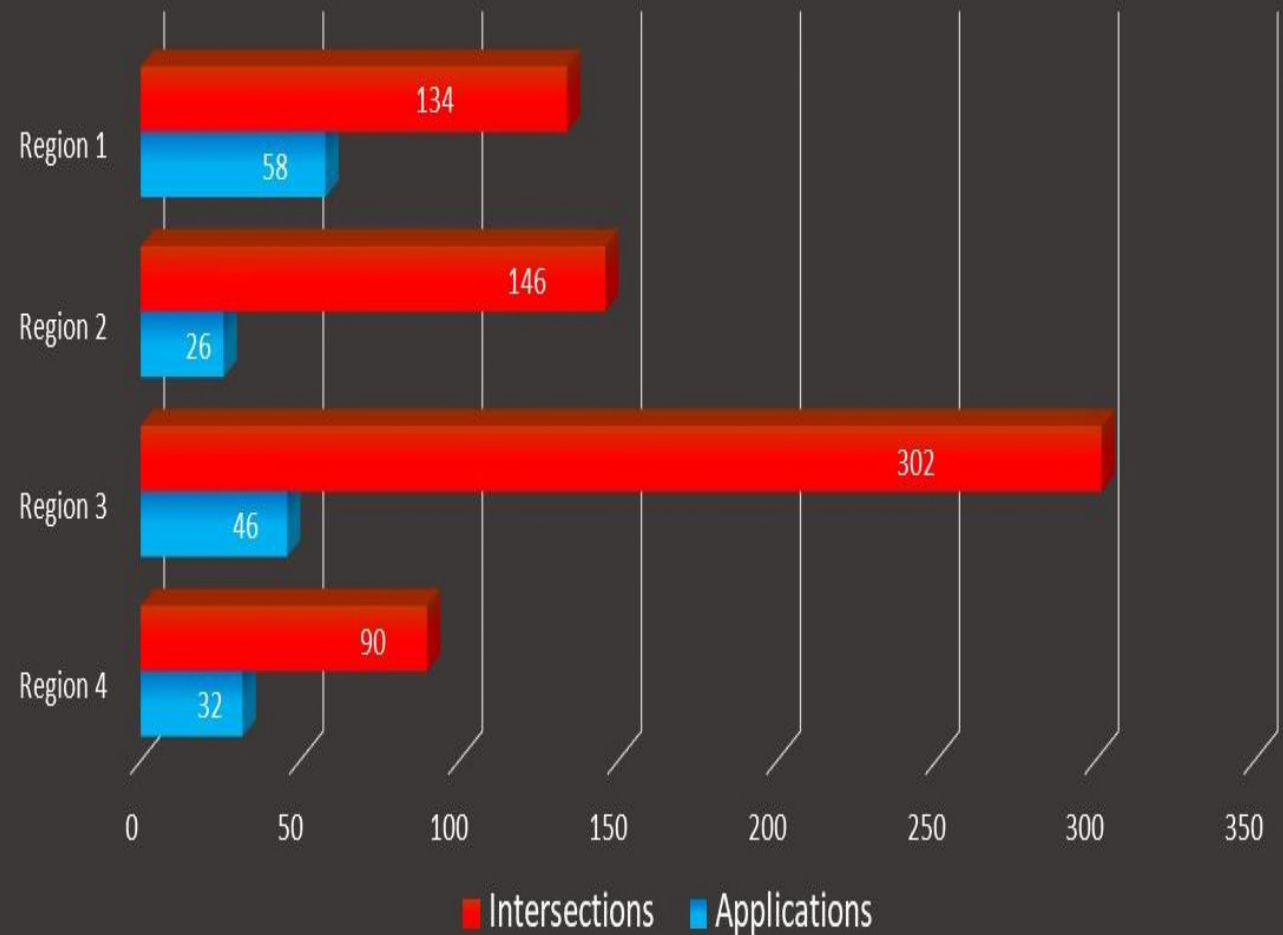
TDOT Traffic Signal Modernization Program (TSMP)

2019-20 TSMP

- 162 TSMP grant applications received
- Representing 96 local agencies and
- 672 signalized intersections
- Requests totaling \$30 million



TSMP APPLICATIONS & INTERSECTIONS BY TDOT REGIONS



TDOT Traffic Signal Modernization Program (TSMP)

2019-20 TSMP Grant Applications

TRAFFIC SIGNAL MODERNIZATION PROGRAM - OVERALL SUMMARY					
Categories	No. of Applications	No. of Intersections	Years Avg. Age of Equipment	Estimated Construction Costs	
				Per Int.	Total
Statewide	162	672	19.0	\$45,036	\$30,264,400
Non-At-Risk + Distressed (N)	131	568	18.3	\$43,394	\$24,647,900
At-Risk (AR)	24	86	21.7	\$50,009	\$4,300,800
Distressed (D)	7	18	30.9	\$73,094	\$1,315,700
At-Risk + Distressed Counties Combined	31	104	23.3	\$54,005	\$5,616,500
No. Local Agencies	96				
No. Counties (Total)	62				
No. Counties (N)	39				
No. Counties (AR)	16				
No. Counties (D)	7				
No. Counties (AR+D)	23				

TDOT Traffic Signal Modernization Program (TSMP)

- **Project Selection Process**

- County economic status
- Quick implementation of project (i.e. within 12 months of project selection);
- Age of the traffic signal equipment;
- Possibility of design and ROW issues;
- Estimated project cost; and
- Local agency participation in the TTSUG.

TDOT Traffic Signal Modernization Program (TSMP)

Program **supports Governor Lee's First Executive Order** by prioritizing projects in economically distressed and at-risk counties

12 of the 14 TSMP project selections (**86%**) were in either an economically **distressed or at-risk county**.

No.	Local Agency	County	Distressed or At-Risk County	State Route	Intersection
1	Carter County	Carter	Yes	SR-91	Broad Street/ Rufus Taylor Road
2	Town of Vonore	Monroe	Yes	SR-33	SR-360
3	Town of Oneida	Scott	Yes	US-27	Claude Terry Drive
4	Town of Erwin	Unicoi	Yes	SR-107	N. Elm Avenue/ Jackson Avenue
5	Town of Livingston	Overton	Yes	SR-111	Old SR-42/Rickman Road
6	Overton County	Overton	Yes	SR-84	Difficult Lane
7	City of Bolivar	Hardeman	Yes	SR-15	Old SR-64
8	City of Brownsville	Haywood	Yes	SR-1	Dupree Avenue
9	City of Union City	Obion	Yes	SR-431	S. Miles Avenue
10	City of Dresden	Weakley	Yes	SR-54	Wilson Street
11	City of Winchester	Franklin	No	SR-15/ SR-16	From Vine Street to Bypass Road Corridor (Traffic Signal Timing Optimization)
12	City of Sparta	White	Yes	SR-111	Taft Church Road
13	City of Lewisburg	Marshall	No	SR-11	Water Street
14	City of Savannah	Hardin	Yes	SR-15	From Pickwick Road to Bell Lane (Traffic Signal Timing Optimization)

TDOT Traffic Signal Modernization Program (TSMP)

The logo consists of a red square with the white letters 'TN' inside. Below the red square is a thin dark blue horizontal bar.

TN

A large dark blue rectangular box containing the text 'NOCoE Case Study' in white.

NOCoE Case Study

NOCoE Case Study



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 (TSMF) has identified 14 TSMF 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.

NOCoE Case Study

1



Tennessee DOT worked with local government agencies to modernize traffic signal systems in both small and large agencies to reduce crashes, improve traffic operations, and increase system reliability.



READ THE FULL REPORT AT:
TRANSPORTATIONOPS.ORG



Traffic Signal Maintenance & Modernization (TSM&M) Program



**TDOT Preventative
Maintenance Inspection &
Inventory Program (PMII)**

TDOT Preventative Maintenance Inspection & Inventory Program (PMII)

Funding

- \$ 1 Million for Maintenance
- \$ 1 Million for Modernization

Project Selection Process

- Traffic signals on State Routes in non-CMAQ Counties .
 - **1,341** Traffic Signals identified in TRIMS within **254 local agencies**.
- First Year of Program – Local agencies with a population less than 2,500 and county-maintained signals.
- **163 total intersections** were identified using the above criteria.
 - **112 traffic signals in cities** with populations <2,500.
 - **51 traffic signals** in unincorporated areas within counties.

TDOT Traffic Signal PMI/Inventory Checklist Traffic Operations Division – Traffic Engineering Office



Section 1: General Information (Use pull down menus where provided)

Region	Choose an item.	County	Choose an item.	Date	Click or tap to enter a date.
Local Maintaining Agency					
Major Street Name*		<input type="checkbox"/> NB/SB <input type="checkbox"/> EB/WB		Posted Speed Limit: Choose an item.	
Minor Street Name*		<input type="checkbox"/> NB/SB <input type="checkbox"/> EB/WB		Posted Speed Limit: Choose an item.	
IMSA Name		Level	Choose an item.	ID No.	

*If applicable, include State Route and/or US Route Numbers along with Local Street Name.

Record **BEGIN TIME** to start this PMI/Inventory Checklist Form

Section 2: Site Check

- Use either Sheet 8 or 9 form to draw a sketch of the intersection layout. (show street names, north arrow, travel lanes including shared/exclusive turn lanes, pavement markings, controller cabinet, vehicle/pedestrians signal heads, vehicle/pedestrian detection, overhead traffic signal related signs, sidewalk, handicap ramps, and any other traffic signal related item that would assist in the review of this intersection)
- Take photos of each approach about 100 feet in advance of the stop lines. These photos should capture some of the adjacent approaches to provide overlap. (label image files)
- If applicable, take additional photos of the intersection related to traffic signal. (label image files)

Are the stop line pavement markings in good condition? Choose an item.

If **Other** to the previous question, then describe the situation.

Are the other intersection related pavement markings in good condition? Choose an item.

If **Other** to the previous question, then describe the situation.

TDOT Preventative Maintenance Inspection & Inventory Program (PMII)

Overall Summary of Local Agencies with a Population Less Than 2,500 and in Unincorporated Areas within Non-CMAQ Counties

Locations	Counties	Local Agencies ¹	Intersections
Region 1	13	18	45
Region 2	15	26	64
Region 3 ²	13	19	31
Region 4	12	16	23
Totals	53	79	163

¹Local Agencies includes both cities and counties which follow the program criteria.

²Region 3 PMII efforts became a pilot program.

Traffic Signal Maintenance & Modernization (TSM&M) Program



**TDOT Region 3
PMII Findings**

TDOT Region 3 PMII Findings

- Region 3 PMII efforts consisted of:
 - 31 Signalized Intersections
 - 13 Counties
 - 19 Local Agencies
- The TDOT PMII form was completed in an average time of 81 minutes, or about 1.5 hours.
- Over 310 photos were taken.
- Three intersections involved railroad tracks being within 200 feet of the intersection on an approach.
- A fourth intersection involved a railroad being within 200 feet, but its tracks did not cross on an approach.

TDOT Region 3 PMII Findings

➤ Vehicle Signal Heads Check:

- One intersection had 8" lenses.
- Two intersections had 4-way signal heads.
- 11 intersections had at least one signal head with less than 17.5 feet vertical clearance above the roadway. The lowest vertical clearance reading was 14.7 feet.
- Out of 121 intersection approaches, 18 of them had at least one of the traffic signal heads less than 40 feet from the stop line. The closest traffic signal head was 13 feet from the stop line.
- None of the 121 intersection approaches had a traffic signal head greater than 180 feet from the stop line.
- Overall average vehicle signal head rating: 2.7 (out of 4.0).



➤ Pedestrian Signal Heads Check:

- Only two intersections had pedestrian signal heads. Both intersections were solid symbols.
- Overall average pedestrian signal head rating: 3.0 (out of 4.0).

TDOT Region 3 PMII Findings

➤ **Cabinet Check:**

- All were NEMA TS1 cabinets except one being a NEMA TS2, Type 2 cabinet.
- 13 intersections had issues with the fan, filter, and/or thermostat.
- Overall average cabinet rating: 2.2 (out of 4.0).

➤ **Controller/Conflict Monitor Check:**

- Controller Brand Composition:
 - Siemens/Eagle – 17 Intersections.
 - Peek/Transyt – 9 Intersections.
 - McCain – 3 Intersections.
 - Econolite – 2 Intersections.
- No intersections contained a master controller in the cabinet.
- Overall average controller/conflict monitor rating: 2.4 (out of 4.0).



➤ Conflict Monitor Brand Composition:

- EDI – 20 Intersections.
- Peek/Transyt – 6 Intersections.
- Reno – 4 Intersections.
- Econolite – 1 Intersection.

TDOT Region 3 PMII Findings

➤ Vehicle Detection Check:

- Vehicle Detection Composition:
 - Loops – 21 Intersections.
 - Video – 3 Intersections.
 - Loops/Radar – 1 Intersection.
 - Loops/Video – 1 Intersection.
 - None (Pretimed) – 5 Intersections.
- Eight intersections had bad loops and/or detectors.
- Overall average vehicle detection rating: 2.4 (out of 4.0).

➤ Pedestrian Detection Check:

- Only two intersections had pedestrian pushbutton detection and none of them were not ADA compliant.
- One intersection did not have working pedestrian pushbuttons.
- Overall average pedestrian detection rating: 2.0 (out of 4.0).



TDOT Region 3 PMII Findings

➤ **Signal Pole Supports Check:**

- Signal Support Composition:
 - Strain Poles/Span Wire – 14 Intersections.
 - Wood Poles/Span Wire – 11 Intersections.
 - Mast Arms – 6 Intersections.
- Two of the wood poles were leaning.
- Overall average signal pole support rating: 2.5 (out of 4.0).

➤ **Some Additional Maintenance Comments:**

- Nine intersections did not have recommendations for maintenance items needed.
- Three intersections were recommended for complete rebuild.
- One intersection had cables sagging low.
- One intersection had damaged overhead signs.



TDOT Region 3 PMII Findings

- **Overall Summary of intersection check ratings (out of 4.0):**
 - 2.7 – Overall average vehicle signal head rating.
 - 3.0 – Overall average pedestrian signal head rating.
 - 2.2 – Overall average cabinet rating.
 - 2.4 – Overall average controller/conflict monitor rating.
 - 2.4 – Overall average vehicle detection rating.
 - 2.0 – Overall average pedestrian detection rating.
 - 2.5 – Overall average signal pole support rating.

- **2.3 – Overall Intersection Maintenance & Operations Rating (out of 4.0).**

Traffic Signal Maintenance & Modernization (TSM&M) Program



TDOT Next Steps

TDOT Next Steps TSM&M

Traffic Signal Maintenance (Part)

- Complete the Preventative Maintenance Inspection & Inventory (PMII) efforts for the other three TDOT Regions.
- Develop a statewide comprehensive list of items to address PMII issues and share those issues with the local agencies.
- Prepare four TDOT Region Traffic Signal Maintenance bid packages for an upcoming 2022 letting.

TDOT Next Steps TSM&M

Traffic Signal Modernization (Part)

- Finalize the five 2020-21 Traffic Signal Modernization Program (TSMP) projects for the December 2021 letting.
- Send out notifications for the upcoming 2021-22 TSMP Grant Application process. The notifications should be sent out in Fall 2021.
- Evaluate and rank the submitted 2021-22 TSMP Grant Applications. Provide recommendations for awarding the upcoming TSMP design projects.

Eligible Items for Signal Modernization Program

Controllers & conflict monitors	Advance & stop bar detection
Controller cabinet & equipment	Pedestrian signal heads and devices
Additional or replacement signal heads	Pedestrian push buttons and devices
Supplemental signal heads and backplates	Pedestrian ramps, handrails and landings
Signal poles, arms, spans and foundations	Timing optimization plans
Signal wiring, cable and communication	Flashing beacons and various signs
Upgrade or replace traffic signal	Upgrade features to meet ADA/PROWAG standards

Questions and Contact Information



Nathan Vatter, P.E.
TDOT Traffic Operations Division
Nathan.Vatter@tn.gov
Telephone: 615-741-0995

Steve Bryan, P.E., PTOE
TDOT Traffic Operations Division
Steve.Bryan@tn.gov
Telephone: 615-741-2152