

Traffic Operations

MAY 2026

Project Title: Traffic Signal Systems Operations and Management

Task Number: 4397

Start Date: January 1, 2023

Completion Date: June 30, 2026

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TPF-5(519) - Expansion: Enhanced Traffic Signal Performance Measures - Pooled Fund Study

Continued/Expanded Research on Enhanced Traffic Signal Performance Measures.

WHAT IS THE NEED?

The previous Pooled Fund Project TPF-5(377) was led by Indiana and included participation from the Federal Highway Administration (FHWA), California, Connecticut, Georgia, Minnesota, North Carolina, Ohio, Pennsylvania, Texas, Utah, and Wisconsin. That project developed methodologies and tools for using high-resolution vehicle trajectory data to compute enhanced traffic signal performance measures. Similarly, TPF-5(377) is now simulating a second generation of commercial implementation of trajectory-based traffic signal performance measures. The previous TPF-5(377) ended in June 2023. Therefore, a new pooled fund study was created to expand on the enhanced Traffic Signal Performance Measures research.

Pooled Fund Information:

- Indiana Department of Transportation (DOT) – Lead State for Pooled Fund Study (PFS)
- 10 Participating State Departments of Transportation or Agencies
- Full Members: California DOT, Connecticut DOT, Georgia DOT, Minnesota DOT, Mississippi DOT, North Carolina DOT, Ohio DOT, Pennsylvania DOT, Texas DOT, Utah DOT
- California Department of Transportation's (Caltrans) current commitment:
 - FY 2023/2024 \$40,000
 - FY 2024/2025 \$120,000

WHAT ARE WE DOING?

1. Identify available commercial probe data sets and



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procure one month of probe data for each participating state.

2. Perform penetration analysis of connected vehicle data to understand how it varies by state.
3. Update performance measure analysis techniques to examine how a mix of commercial vehicles and passenger cars impacts a traffic signal operation.
4. Identify transit agencies in participating states that have AVL/connected bus data available to share with the research team.
5. Integrate trajectory data and high-resolution data to characterize how performance measures such as split failure and arrival on green vary depending on whether they are calculated using trajectory data or traditional high-resolution data.
6. Integrate trajectory data and high-resolution controller data for multi-modal analysis.
7. Prepare final report.

WHAT IS OUR GOAL?

A pooled fund effort that focused on the following areas:

- Broadening performance measures to additional modes that are impacted by traffic signal systems, particularly transit and pedestrians.
- Identify use cases for enhanced probe data beyond the current trajectory and hard braking/acceleration data.
- Conduct Integrated Analysis of High-res Controller Data and Trajectory Probe Data

These initiatives would complement and expand the past work the multi-state team has done in the area of enhanced traffic signal performance measures using connected vehicle data.

WHAT IS THE BENEFIT?

This effort will provide guidelines for Caltrans and other agencies to improve signal system operations. The intent is that agencies adopting the resulting recommendations will achieve a 10-15% reduction in motorist delay and emissions.

WHAT IS THE PROGRESS TO DATE?

October 1 – December 31, 2025

- Purdue purchased Streetlight Connected Vehicle (CV) data for member states for 1 week in November 2025 to conduct formal evaluation of the latest market penetration rates and impacts of privacy filters on deriving intersection performance measures.
- Initiated an automated procedure for locating center of intersection to facilitate fast integration of new signals into dashboard.
- Developed a white paper that defines a procedure for assessing the impact of “big box” facilities such as Walmart/Meijer/Malls that are frequent destinations now filtered with new GM privacy filter. This new filtering now introduces some undesirable sample bias in the signal analytics. We plan to develop this into a manuscript in the Spring semester for panel review.
- The following paper was published during this quarter:
 - C. M. Gartner, R. S. Sakhare, J. C. Desai, J. Sturdevant and D. M. Bullock, “A Scalable Data Model for Signalized Intersection Performance Measures,” in IEEE Access, vol. 13, pp. 197851-197863, 2025, <https://doi.org/10.1109/ACCESS.2025.3635007>

January 1 – March 31, 2026

Regional and National Presentations regarding work related to TPF-5(519) included the following:

- **2026 Transportation Research Board (TRB) Annual Meeting Presentations:** A Scalable Data Model for Signalized Intersection Performance Measures
- **Indiana Institute Transportation Engineers Tech Lunch Presentation February 17, 2026:** Connected Vehicle Data Use Cases for Practitioners
- **2026 Purdue Road School Transportation Conference and Expo (March 17-18, 2026):** Real World Uses of Connected Vehicle Data

WEBSITES

<https://www.pooledfund.org/Details/Study/751>