TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Indiana Department of Transportation

INSTRUCTIONS:

Lead Agency contacts should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *TPF-5(514)*	**Transportation Pooled Fund Program - Report Period:** ☐ X Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 1 – December 31)
TPF Study Number and Title: TPF-5(514) Work Zone Analytics	

Lead Agency Contact: **John McGregor**	**Lead Agency Phone Number** **317 899-8617**	**Lead Agency E-Mail** jmcgregor@indot.in.gov
Lead Agency Project ID: **TPF-5(514)**	**Other Project ID (i.e., contract #):**	**Project Start Date:** July 1, 2023
Original Project Start Date: **July 1, 2023**	**Original Project End Date:** **6/30/2026**	**If Extension has been requested, updated project End Date:**

Project schedule status:

☐ X On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Funds Expended This Quarter	Percentage of Work Completed to Date
$643,600	$100,691.02	58%

Project Description:

Background & Impact
For the past 3 years, Purdue University and the Indiana Department of transportation have been monitoring congestion and hard braking data across all 2600 miles of Indiana Interstates using connected vehicle data. Hard braking data has been found to a modern day surrogate for looking for skid marks on the road and predicting potential areas of concern for crashes.

These hard braking events can be used to identify specific locations along a road that should be looked at further by comparing the before construction with the connected vehicle hard braking data during construction.

Research Needs
These reports have evolved over the past 3 years in Indiana and there is a need to develop a multi-state consensus on the most effective reports. This will provide a framework to formalize the reporting models, data reduction processes and decision making process so these techniques can be scaled to other states so they can pro-actively identify emerging safety concerns in their work zones, conduct effective after action reviews of past work zones, and ultimately identify best practices for future work zones that minimize congestion, hard braking and ultimately crashes.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

April 1 – June 30, 2023

The solicitation for TPF-5(514) was posted in Spring 2023.
The following agencies have committed a total of $380,000 to TPF-5(514) as of June 30, 2023.

- FHWA
- Pennsylvania
- Texas

The project has a start date of July 1, 2023, and will be funded incrementally by Purdue University as funds from the participating states are transferred.

July 1 – September 30, 2023

Webinar with panel members to obtain feedback on the project scope were held on August 10, 2023, with participation from FHWA, Texas, Pennsylvania, and Purdue.

During the past quarter, Michigan DOT and Wisconsin DOT have indicated their intention to join TPF-5(514).

The Purdue team has adapted some of the Indiana analytics to Interstate routes in PA and TX

To date, $30,000 in funding for TPF-5(514) has been received by Purdue University. Significant work on the PFS project is pending additional transfer of funds from the partner states.

October 1 – December 30, 2023

Webinars to obtain feedback on the project scope were held on October 3 and October 23, 2023, with participation from FHWA, Indiana, Texas, Pennsylvania, Michigan, Wisconsin, and Purdue. In addition, an update was provided to the Work Zone ITS Subcommittee at the ATSSA Mid-year meeting in Chicago to generate interest among other states.

During the past quarter, Illinois, Michigan, Utah and Wisconsin committed to TPF-5(514). The Work Zone Analytics study team now includes the following:

- FHWA
- Illinois
- Indiana
- Michigan

Pennsylvania
Texas
Utah
Wisconsin

During this quarter, the Purdue research team has been seeking to identify an alternative connected vehicle data source other then Wejo (which suspended operations on June 1, 2023) as well as developing a tutorial on how to read heatmaps.

An alternative data source, Solaris, has been identified and is scheduled to begin providing a reasonable trajectory data set on January 15, 2024, that can be used for monitoring work zones.

Scheduling is underway for a webinar with all partners during the first quarter of 2024 in order to further define the scope and prioritize future activities.

January 1 – March 31, 2024

A webinar with held on February 15, 2024 with representatives from FHWA and partner states (IL, IN, PA, TX, WI). The research team shared examples of weekly heatmaps using Omnitracs connected truck data. Partner states were requested to submit interstate Workzones of interest for their states, with Sharepoint sites set up for each state to receive the weekly heatmaps.

Subsequent to the meeting, states submitted work zones of interest. Weekly heatmaps are being generated and distributed through the Sharepoint sites. A summary of the number of work zones of interest submitted by each state is shown below.

Partner State	# Work Zones of Interest
Illinois	6
Indiana	7
Michigan	4
Pennsylvania	4
Texas	5
Utah	6
Wisconsin	10
Total	42

The next webinar for partner states is scheduled for May 10, 2024. At that meeting, case studies of work zones of Interest will be shared.

April 1 – June 30, 2024

The Purdue Research team presented “Work Zone Analytics” at the Midwest Work Zone Roundtable on May 9, 2024, to share activities of TPF-5(514) with a broader audience.

Webinar with TPF-5(514) partners (FHWA, IL, IN, MI, PA, TX, UT, IN) was held on May 10, 2024. Agenda included review of the weekly heatmaps for the partner states and selected case studies for work zones of interest submitted by states.

Weekly heatmaps are generated for all interstates for each state that is part of the PF study along with heatmaps specific to work zones (43 total) submitted by states and are updated every Monday in a shared one-drive folder.

Publication of heatmap monograph entitled “Measuring and Visualizing Freeway Traffic Conditions: Using Connected Vehicle Data” that demonstrates approximately 50 use cases. Citation listed below in Significant Results.

July 1 – September 30, 2024

Beginning in July, the weekly heatmap distribution to partner states included commentary that identified the top 2 or top 3 noteworthy changes from the week before for each state.

Webinar with TPF-5(514) partners (FHWA, IL, IN, MI, PA, TX, UT, IN) was held on August 9, 2024. Agenda included review of the weekly heatmaps for the partner states and selected case studies for work zones of interest submitted by states. Dialog on available data sources to monitor work zones included the following:

- Truck data is more affordable, but in some cases passenger car data provides better coverage of work zones
- Potential application of Hard braking data to monitor work zones
- Use of Vizzion truck dash cam images to monitor work zones conditions

Tactical webinars with individual states provided opportunities to discuss their work zones of interest, review associated heatmaps and noteworthy changes from previous weeks. State webinars were held as follows:

- July 29, 2024 Wisconsin
- July 31, 2024 Illinois
- Aug. 2, 2024 Texas
- Sept. 13, 2024 Illinois

October 1 – December 31, 2024

Distribution of weekly heatmaps to partner states continued during this quarter.

Maryland and Delaware joined the PFS during this quarter and weekly heatmaps were initiated for their states.

Webinar with TPF-5(514) partners was held on October 30, 2024. Discussion included the following:

- Fielding Tipton from INDOT explained how the agency is using heatmaps and hard braking data for agile monitoring on work zones in Indiana.
- Purdue team discussed select cast studies from each state.
- Partners indicated strong interest in the commercial truck dashcam roadway imagery and the hard braking data.

Tactical webinar with Illinois was held on November 14, 2024 with their central office staff. Subsequently, they have initiated dialog with their district construction engineers The Purdue team will do a day trip to Springfield, IL on Feb 18 to present to their district construction engineers.

Ingestion has been done on a new CV data source (CompassIoT) using a sample of data from Texas. Adding a second CV data source has two advantages: 1) Introduces redundancy if one of the data providers decides to suspend CV data and 2) Establishes market competition.

Regional and National Presentations regarding work related to TPF-4(514) included the following:

- Ohio Traffic Engineering Conference on October 9, 2024
- Virtual National Work Zone Management Conference on October 22, 2024
- FHWA Advance Warning Workshop on October 30, 2024.

January 1 – March 31, 2025

Distribution of weekly heatmaps to partner states continued during this quarter.

Webinar with TPF-5(514) partners was held on February 5, 2025. Discussion included the following:

- Update on connected vehicle data from Omnitracs and emerging opportunities with CompassIoT.
- Workzone Safety and Mobility Rules Performance Measures that can by supported by work of the PFS. In preparation for our April webinar with partner states, the team is working on developing example performance measures.

Site Visit to Illinois for presentations during their Statewide Traffic Control Supervisor Meeting was done on February 18, 2025. Presentations included the following:

- Connected Vehicle Heatmap Demonstration
- Illinois Case Studies

Begin ingesting CompassIOT connected vehicle data to evaluate feasibility of incorporating this data into the weekly work zone reports and/or Workzone Safety and Mobility Rules Performance Measures.

Regional and National Presentations regarding work related to TPF-4(514) included the following:

- ATSSA Annual Conference (March 2, 2025): "Monitoring Work Zone Maintenance of Traffic Using Crowdsourced Dash Cameras"
- Center for Connected and Automated Transportation (CCAT) Global Symposium (March 28, 2025): "Methodologies for Monitoring Work Zone Performance Measures Across State Border Highways Using Connected Vehicle Data"
- 2025 Purdue Road School Transportation Conference and Expo (March 18-19, 2025)
    - Assessing the Coverage of Commercial Truck Dash Cam Images on Interstate Roads
    - In-Cab Alerts Impacts on Connected Truck Speed Reductions

Anticipated work next quarter:

- Continue to prepare and distribute weekly heatmaps for the partner states with a high level summary and key changes from previous week for quick access and reference.
- Purdue will create heatmaps for partner states using the New CompassIOT data to begin comparing/contrasting the CompassIoT data with Omnitracs data.
- Continue outreach activities to share findings with broader audience and solicit participation in PFS for Work Zone Analytics.
- Continue to develop and strengthen private sector partnerships for collecting and analyzing connected vehicle data for work zone analysis activities.
- Prepare for April 23, 2025 webinar with state partners.

Significant Results:

Sakhare, R. S., Desai, J., Mathew, J. K., McGregor, J., Kachler, M., & Bullock, D. M. (2024). *Measuring and visualizing freeway traffic conditions: Using connected vehicle data* (Joint Transportation Research Program No. TPF-5(514)). West Lafayette, IN: Purdue University. https://doi.org/10.5703/1288284317751

R. S. Sakhare, J. Desai, J. K. Mathew and D. M. Bullock, "Assessing the Interstate Coverage of Commercial Trucks Capable of Providing Roadway Imagery via On-Vehicle Dash Camera in the United States," in IEEE Access, https://ieeexplore.ieee.org/document/10758643

Potential Implementation: N/A