

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

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

INSTRUCTIONS:

Project Managers and/or research project investigators 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(377)		Transportation Pooled Fund Program - Report Period: Quarter 1 (January 1 – March 31) <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) Quarter 3 (July 1 – September 30) Quarter 4 (October 1 – December 31)	
Project Title: Enhanced Traffic Signal Performance Measures			
Name of Project Manager(s): James R. Sturdevant	Phone Number: (317) 691-9091	E-Mail jsturdevant@indot.in.gov	
Lead Agency Project ID: TPF 5(377)	Other Project ID (i.e., contract #):	Project Start Date: July 1, 2018	
Original Project End Date: June 30, 2021	Current Project End Date: June 30, 2021	Number of Extensions: 0	

Project schedule status:

On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$293,000	\$44,163.69	20%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	\$31,861.28	33%

Project Description

Background

The Pooled Fund Project TPF-5(258) led by Indiana and with participation from FHWA, California, Georgia, Minnesota, Mississippi, New Hampshire, Pennsylvania, Texas, Utah, Wisconsin, and City of Chicago produced the following technical reports:

- Performance Measures for Traffic Signal Systems: An Outcome-Oriented Approach.
<http://dx.doi.org/10.5703/1288284315333> [1]
- Integrating Traffic Signal Performance Measures into Agency Business Processes.
<http://dx.doi.org/10.5703/1288284316063> [2]

The following states have made commitments totaling \$750,000 for TPF-5(377): Enhanced Traffic Signal Performance Measures: Georgia, Minnesota, Texas, Utah, Wisconsin, North Carolina, Pennsylvania, Ohio. Indiana has committed \$275,000 via SPR-4205 Connected Vehicle Corridor Deployment and Performance Measures for Assessment. In addition, College Station, TX, has committed \$3,000 to join the PFS as a local agency partner.

Project Objectives

The project will address the following initiatives that complement and expand on the past work the multi-state team has done in the area of traffic signal performance measures:

1. **Traffic Signal Data Logger Update:** Update the data logger specification to provide secure file transfer, incorporate new enumerations that have emerged, and logging new connected vehicle messages.
2. **Probe Data:** Current probe data tools are focused on freeway data. There is a need to build upon the work of Indiana and Pennsylvania DOTs to develop methodologies and tools for using high resolution vehicle trajectory data to compute traffic signal performance measures.

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

July 1 – September 30, 2018

- Conducted telecom for participating states on May 2, 2018, and reached concurrence on the project objectives, task list and timeline.
- INDOT issued a purchase order for \$30,000 to Purdue University to establish the project. Additional funds will be transferred to Purdue as funds are received by INDOT from participating states.
- Participating states approved tasks for University of Alabama for work on the traffic signal data logger update. A sub-contract proposal was submitted by University of Alabama to Purdue University for those tasks.

October 1 - December 31, 2018

- Additional funds were received by partner states and INDOT issued a purchase order to increase the project budget by \$170,000.
- Established a subcontract to University of Alabama for work on the traffic signal data logger.
- A project kick-off telecom is scheduled for January 23, 2019.
- A face-to-face meeting is scheduled on the Purdue University campus for March 27-28, 2019.

With regards to the scope of work, the following tasks have been accomplished by University of Alabama:

(#1) Identify a set of current issues – This list is based on the issues identified by UDOT and Kittelson.

- **Pedestrian call** – issues with event codes 45 and 90 and how they were reported for multiple ped button actuations (source: Jamie Mackey, UDOT)
- **Coordination** – Event code 150 and 151 are handled differently for the local zero and transition (source: Jamie Mackey, UDOT)
- **Phase gap out** – Event code 10 and event code 9 are being reported differently between controllers. The definition of phase gap out may be interpreted multiple ways. (source: Kittelson)

The manufacturers were asked about this, but no additional issues were identified.

The following University of Alabama tasks are underway:

- **(#3) Characterize the current issues** – YouTube videos and write-ups are being generated for the Econolite, Intelight, and Siemens controllers.
 - Siemens M50
 - **Data:** <https://youtu.be/nEESZ0V9bmw>
 - **Ped:** ***FLASH***
 - Intelight X3
 - **Data:** <https://youtu.be/Cm8JM0kSBtU>
 - **Ped:** https://youtu.be/a0cJpPLlr_4
 - Econolite Cobalt
 - **Data:** <https://youtu.be/MKD3ulsM9Qs>
 - **Ped:** <https://youtu.be/X5rXC7SKzxE>
- **(#4) Develop and define a new XML specification** – The computer science team is working on this specification. Many details such as the header information, filename, and other key data have been examined.

January 1 – March 31, 2019

The pooled fund study face-to-face two day meeting was held at Purdue University on March 27-28, 2019. The meeting was attended by representatives from FHWA, state DOT's (California, Utah, Minnesota, Wisconsin, Georgia, Pennsylvania, Ohio, North Carolina, Indiana), City of College Station, private sector (McCain, Iteris, Econolite, Siemens, Miovision, Intelight, TT Ford).

- Each participating agency provided an overview of their signal infrastructure, including updates on central system initiatives, communication architecture, detection and signal controllers. They also shared various challenges and success stories using SPM's. Finally, they wrapped up with related innovations for signal management, especially preparations for connected vehicle deployments

- Dr. Alex Hainen from University of Alabama shared his updates on potential ambiguities in the current data logger specifications. He highlighted the inconsistency on “phase gap-outs” across three signal controllers and proposed relevant solutions. His team also stressed on the importance of secure file transfer protocol (SFTP) to combat cyber security threats. His team will reach out to all participating agencies and vendors to gather other potential inconsistencies and concerns before publishing the draft version of the recommendations in the next 3-6 months.
- Private sector participants provided a brief overview of the topics-of-interest for the vendor panel discussion to follow the next day. The vendor moderated panel on day 2 discussed the enumerations activities, challenges and future opportunities. Representatives from the auto industry (Audi/Ford) discussed interests of automotive industry in traffic signal performance measures



Photography of panel meeting on March 28, 2019 in West Lafayette, IN.

April 1 – June 30, 2019

- Professor Alex Hainen and the University of Alabama team met with traffic signal vendors to review enumerations and develop recommendations for revisions and additions.
- A webinar for participants was held on June 25. Alex Hainen provided an overview of the process to obtain feedback and engage with signal vendors. This process resulted in recommendations for 24 new enumerations and revision of 3 existing enumerations.
- Following discussion of the recommendations, the revised Indiana Traffic Signal Hi Resolution Data Logger Enumerations document was distributed to the panel for review.

Anticipated work next quarter:

- Panel members will submit their review comments on the enumeration recommendations by July 1, 2019. Professor Hainen will incorporate and submit a final version of the enumerations for publication by mid-August, 2019.
- A webinar will be scheduled to provide updates on research activities related to potential traffic signal performance measures using enhanced probe vehicle and connected vehicle trajectory data.

Significant Results:

N/A – work on project was delayed pending transfer of funding for year 1.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

INDOT awards PFS funds to Purdue University after they receive transfer of funds from the partner states. Initially, the project was funded for \$30,000, which was insufficient to initiate subcontract with University of Alabama and fund panel meeting planning and travel.

An additional \$170,000 funding for year 1 was awarded to Purdue in early October 2018. We do not anticipate that the 90-day delay in year 1 funding will significantly affect the timeline for the project. The funds received to date will be used to initiate the sub-contract to University of Alabama, fund the first annual meeting for the partner states and begin engagement with industry stakeholders for probe data.

A total of \$293,000 in year 1 funding has been awarded to Purdue as of June 30, 2019. Additional transfers from Texas, Connecticut, and FHWA are pending.

Potential Implementation: N/A at this time.