

WHAT IS A CONNECTED INTERSECTION?

A connected intersection is defined as an infrastructure system that broadcasts signal phase and timing (SPaT) data, mapping information, and position correction data that has been tested and verified to be standards compliant and to accurately represent the current status of the intersection.

PROJECT GOALS

To help Infrastructure Owner Operators (IOOs) deploy connected intersections that meet or exceed minimum system performance needs to effectively communicate with applications operating in production vehicles.

To address:

- geographic and equipment variations,
- security, and
- message consistency.

To validate that the connected intersections tested in this project work with production vehicles.

Connected Vehicle Pooled Fund Study (CV PFS) Connected Intersections Project

Connected Intersections Program Brief

Why is this Project Needed?

Traditional traffic signals have visible traffic signal head displays. These displays serve as both a testing mechanism for the IOOs to verify the signals are operating properly and also communicate signal status to human drivers as they approach the intersection.

The concept of connected intersections is to broadcast signal phase and timing (SPaT) data with supporting MAP messages and position correction data to be received by in-vehicle applications operating on connected vehicles. These connected vehicles will rely on the data being communicated to accurately represent the status of the intersection signal controls and to provide accurate mapping information and position correction data to identify the vehicle's lane of travel. Additionally, the data not only needs to be accurate, it also needs to strictly conform to national standards for data exchanges in order to eventually allow production vehicles that approach any connected intersection to successfully receive and use that data that is broadcast.

For these reasons, the success of connected intersections relies on consistent deployment, testing, and validation of connected intersections throughout the United States. This project is leveraging several foundational efforts and will assemble guidance for connected intersection deployments that can be used by CV PFS members and other IOOs at the state, county, and city levels to deploy standards conforming and accurate connected intersections.

Foundational Efforts to this Project

Many industry activities have contributed to advance Connected Intersections (CIs). Some projects that have enabled this effort include:

- SPaT Challenge: <https://transportationops.org/spatchallenge>.
- Cooperative Automated Transportation (CAT) Coalition *Clarifications for Consistent Implementations (CCI) for Connected Intersections*.
- CV PFS efforts, like MAP Message Preparation Guidance: <https://virginia.app.box.com/v/MAPGuidanceFinal> and ongoing Multi-Modal Intelligent Traffic Signal System (MMITSS) efforts: <https://engineering.virginia.edu/cv-pfs-projects-and-research#accordion610410>.
- The USDOT/ITE CI project developed a CI Implementation Guide to support Red Light Violation Warning applications: <http://www.ite.org/pub/76270782-B7E4-7F75-BC72-D5E318B14C9A>.
- A multi-layered project in Ann Arbor, MI was created and supported by the Crash Avoidance Metrics Partnership (CAMP) to develop connected intersection verification tools and to verify compliance with the ITE Implementation Guidance.
- Multiple CV PFS members have deployed connected intersections that meet most or all of the ITE Guidelines.
- SCMS Manager is progressing toward an industry accepted approach for creating certificates that secure communications.

These activities collectively established an opportunity to work collaboratively, leverage outcomes and products, and ensure that a broader representation of IOOs (i.e., CV PFS members) could be engaged in the testing and verification of connected intersections.

OVERALL PROJECT APPROACH

- Support testing and verification of connected intersections at three locations;
- Support IOO involvement in the Security Credential Management System (SCMS) and provide security foundation in production environment to ensure trust with production vehicles;
- Develop clear guidance materials to support IOO deployment and clarity on testing and operations to ensure infrastructure provides information vehicles can interpret and trust.
- Share project findings and guidance materials industry-wide through the CV PFS website.

Guidance materials will be posted to the CV PFS website [<Link to be added>](#)

How Will IOOs Benefit From This Project?

Each project activity will deliver one or more deliverables that IOOs (both those in the CV PFS and those who are not) will benefit from as they consider, plan, and eventually deploy connected intersections. The project activities and benefits are summarized in the table below.

Project Activities	Benefits to CV PFS Members
<i>Support Field Testing of Connected Intersections</i>	<ul style="list-style-type: none"> • Demonstration of the complete process of thoroughly testing and verifying CIs at three locations, including automobile manufacturers successfully receiving an using the data with Red Light Violation Warning applications • Connected intersection testing and verification plan and supporting tools for IOOs to consider and use when deploying connected intersections at their locations
<i>Support IOO Involvement in Security Credential Management System Development</i>	<ul style="list-style-type: none"> • The IOOs needs and perspectives are represented in discussions about the development of the SCMS Manager approach. • CV PFS members receive brief “easy readable” summaries of how IOOs can prepare to secure the messages broadcast by connected intersections
<i>Develop Guidance Briefings</i>	<ul style="list-style-type: none"> • IOOs can share these briefs with others in their organization to help increase awareness about connected intersections
<i>Develop Overall Connected Intersection Guidance Document</i>	<ul style="list-style-type: none"> • IOOs can use this comprehensive guidance document to support their connected intersection deployments to ensure the data broadcast are standards compliant, accurate, secure, and thoroughly tested

Role of CV PFS Members in This Project

Members should be aware that:

- Testing plans are being finalized and will be resources for all members to use when testing their own intersections.
- Field testing and verification in Ohio, Georgia, and Utah are underway. Members wanting to hear updates and progress may wish to join monthly project webinars.
- Guidance briefing documents are in development now. We want these to be as useful as possible for staff in your agency, and welcome input.
- Development of the overall guidance document will be interactive, with members welcome to participate in guidance review webinar sessions, similar to how the CV PFS MAP Guidance document was created.

Project Schedule at a Glance

Site Testing Support & Assistance:

- Detailed Test Plan completed by January 1, 2022
- Field testing data collection January 2022 – March 2022
- Data analysis and reporting completed by summer 2022

SCMS Involvement:

- SCMS Manager Summary and Security 101 documents available completed!
- Ongoing liaisons with SCMS Manager through May 2022

Develop Guidance Briefings:

- To be completed by March 1, 2022

Develop Overall Guidance Document

- Guidance development initiates in December 2021
- Final Guidance document by fall of 2022