**Advanced Research**

**NOVEMBER 2024**

**Project Title:**
Connected and Automated Vehicle (CAV) Application Development

**Task Number:** 3614

**Start Date:** January 1, 2019

**Completion Date:** December 31, 2024

**Task Manager:**

Melissa L. Clark
Transportation Engineer (Electrical)
melissa.clark@dot.ca.gov

DRISI provides solutions and knowledge that improves California's transportation system.

# Connected Vehicle - Pooled Fund Study- TPF-5(389)

Research Program to Support the Research, Development, and Deployment of Connected Vehicles.

## WHAT IS THE NEED?

The Connected Vehicle (CV) Pooled Fund Study (PFS) is a research and development program to support state and local transportation infrastructure owner-operators (IOOs) in preparing for the effective deployment and operation of connected vehicle systems infrastructure and applications. The purpose of CV PFS is to establish a multi-phase program to facilitate research, field demonstration, deployment, and evaluation of connected vehicle infrastructure, vehicles, and applications, in order to aid transportation agencies and Original Equipment Manufacturers (OEMs) in justifying and promoting the large-scale use of connected vehicle environments and applications through modeling, development, engineering, and planning activities. Members of the CV PFS are representatives from federal, state, local, and international transportation agencies that contribute funding to the study. Each member has the decision-making authority for the Pooled Fund Study activities, and they are primary stakeholders.

## WHAT ARE WE DOING?

In this project, the focus is on:

- Research, development, and evaluation of connected vehicle applications
- Improved technology transfer to state and local agencies through:
  - Documenting and sharing deployment best practices and guidelines
  - Providing input into emerging standards
  - Identifying additional requirements within the

Connected Vehicle Program to connected vehicle technology by transportation agencies and OEMs

◦ Coordinating with OEMs on infrastructure and vehicle tests, application development, and standards development.

The specific program of projects to be conducted will be developed by participating states in the pooled fund study.

## WHAT IS OUR GOAL?

To provide technology transfer to state, local, and international transportation agencies as well as vehicle Original Equipment Manufacturers (OEMs) in preparing for the deployment of connected vehicle infrastructure and to provide input to the AASHTO Connected and Automated Vehicle working group, USDOT Connected Vehicle Program, and other national initiatives.

To establish a multi-phase program to facilitate research, field demonstration, evaluation, and technology transfer of connected vehicle infrastructure, vehicles, and applications.

To aid transportation agencies and OEMs in justifying and promoting the large-scale use of connected vehicle environments and applications through modeling, development, engineering, and planning activities.

## WHAT IS THE BENEFIT?

Connected Vehicle research can enable drivers, pedestrians, transit riders, and even cyclists to reach a destination quickly, safely, and in a cost-efficient manner. The research will investigate communication with traffic signals, road infrastructure, communication methods, etc. There is potential for a reduction in congestion, safety improvements, and improved traveler services.

## WHAT IS THE PROGRESS TO DATE?

This project is multi-dimensional and a multi-phase program to facilitate the field demonstration and deployment of Connected Transportation Systems infrastructure applications.

There are four active and ongoing projects:

1. Connected Work Zones (CWZ)
2. Connected Intersections Program (CIP)
3. Connected Intersections Message Monitoring System (CIMMS) Requirement and Prototype Development
4. V2X Procurement Specifications Guidance Document

List of projects completed with the support from the pooled fund study.

1. Model Connected Vehicle Data Architecture https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Resources/Model%20CV%20Data%20Architecture%20Report%20_Final.pdf
2. MAP Guidance – Phase 1, 2, 3 https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Resources/MAP%20Guidance%20Document%20-%20Revision%202_06232023.pdf
3. Multi-Modal Intelligent Traffic Signal System (MMITS) https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/(MMITSS)%20Multi%20Modal%20Traffic%20Signal/MMITSS_SEMP_PhaseIIICV%20PFS.pdf
4. Using Third Parties to Deliver Infrastructure-to-Vehicle (I2V) https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/3rd%20Party%20I2V/Task3-4_CVPFS-Consensus_Recommendation-Release_1.0_05.pdf
5. Vehicle-to-Infrastructure (V2I) Queue Advisory/Warning https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/V2I%20Queue%20Warning/612141-00002_CVPFS_QueueWarning_Task5_HLD_Final.pdf
6. Connected Traffic Control System (CTCS): Research Planning and Concept Development https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/CTCS/Task6_CTCS_QLD_ConOps_12-19-2019_Final.pdf
7. Signal Phase and Timing (SPaT) Data Under IntelliDrive
8. Pavement Maintenance Support Applications – IntelliDrive https://engineering.virginia.edu/

sites/default/files/Connected-Vehicle-PFS/Projects/Pavement%20Maintenance%20Applications%20IntelliDrive/99%20Pavement%20Maintenance%20Application%20Intellidrive%20Final%20Report%205-5-11.pdf

9. IntelliDrive Traffic Signal Control Algorithms https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/IntelliDrive%20Traffic%20Signal%20Control%20Algorithms/IntelliDrive%20Signal%20Systems%20-%20TRB%20Poster%202011.pdf

10. Certification Program for Cooperative Transportation Systems https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/Certification%20CTS/Task2-F%20Pooled%20Fund%20Study%20Review%20Presentation.pdf

11. Aftermarket On-Board Equipment for Cooperative Transportation Systems: Enabling Accelerated Installation https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/(OBE)%20Aftermarket/TaskAll-F%20Final%20Summary%20for%20MV121310A.pdf

12. Traffic Management Centers in a Connected Vehicle Environment https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/(TMC)%20Traffic%20Management%20Centers/TMC_ConnectVehicles%20Webinar%202-27-2014_final.pdf

13. Surveying/Mapping Roadways and Intersections for CV Applications – Best Practices https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/Surveying%20Mapping%20Best%20Practices/Mapping%20Final%20Report%20-%20FINAL%2020160915.pdf

14. 5.9 GHz Dedicated Short-Range Communication Vehicle-Based Road and Weather Condition Application https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/(5.9Ghz)%20DSRC%20Weather/Task5%20CVPFS_DSRC_RdWx_Final_Report_v2.0.pdf

15. Basic Infrastructure Message Development

and Standards Support https://engineering.virginia.edu/sites/default/files/Connected-Vehicle-PFS/Projects/Basic%20Infrastructure/26%20BIM-Project-Meeting-2018-12-20_Presentation.pdf

**PROJECT WEBSITES**

Check out the reports in the links provided: https://www.pooledfund.org/Details/Study/642

Connected Vehicle Pooled Fund Study Website: https://engineering.virginia.edu/labs-groups/cvpfs
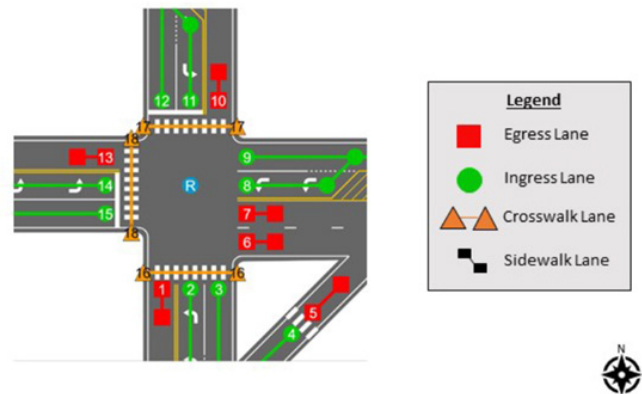
## IMAGES



**Image 1:** Illustration of example lane ID numbering approach from the "Guidance Document for MAP Preparation"
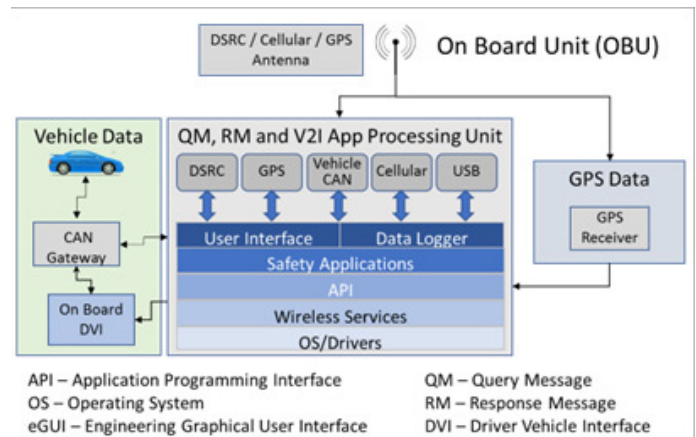


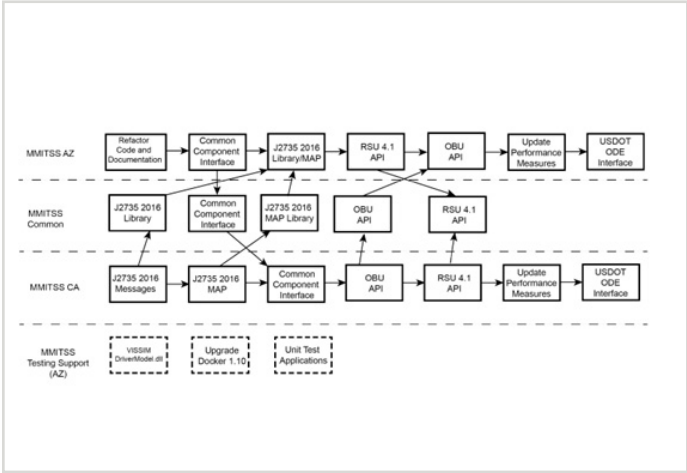**Image 2:** Event-Driven Configurable Messaging (EDCM)-Enabled Vehicle System (Source: CAMP)

**Image 3:** MMITSS Development Plan