

DRISI

CALTRANS DIVISION OF RESEARCH,
INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research

Notes

Research Support

MAY 2024

Project Title:
Connected and Automated
Vehicle (CAV) Infrastructure
Development

Task Number: 3904

Start Date: December 15, 2022

Completion Date: October 31, 2025

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Maintenance, Operation and Enhancement of Cellular Vehicle to Infrastructure (C-V2X) Communication Infrastructure Phase III

California Connected Vehicle Test Bed Maintenance – Phase 3

WHAT IS THE NEED?

U.S. DOT, in the past, has provided financial and technical support to Caltrans for developing the, now defunct, DSRC communication infrastructure on its test-bed site along El Camino Real in Palo Alto. The test-bed is fully operational but needs to be maintained and supported so that it will be useful for other Caltrans projects, as well as for projects to be conducted by a variety of other public and private sector organizations in the region.

Dedicated Short Range Communication (DSRC) at 5.9 GHz (75 MHz Bandwidth) has been rendered obsolete by Federal Communication Commission (FCC) and a new standard has been introduced called Cellular- Vehicle to Everything (CV2X). This new standard has introduced new challenges for the test bed as the existing hardware now needs to be replaced and the new hardware needs to be purchased to replace the existing obsolete hardware. The new hardware also needs to be integrated to the existing traffic controllers which is quite challenging. The test bed provides a unique capability to deliver time-critical, safety-critical messages between the roadside infrastructure and vehicles with high reliability and low latency. This new 30 MHz band has been allocated by Federal Communication Commission (FCC) for Intelligent Transportation System (ITS) use. Caltrans, in conjunction with private and academia, is in the process of developing applications based on connected vehicle technology.

This task is a part of the Connected and Automated Vehicle (CAV) Infrastructure Development project. The primary goal of this project is to develop the hardware and applications and to keep the test bed fully functional so that various applications can be developed in the CAV area. These applications include, but not limited to, Curve Over speed Warning System, Traffic Probe Data



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

Processing, Intersection safety and mobility Applications etc.

WHAT ARE WE DOING?

This task will take care of the following activities.

1. Upgrade the test bed to the new C-V2X standard
2. Regular maintenance of the test bed including special setup requests from various users
3. Support to new users
4. Provide liaison to national network of test beds
5. Increase the awareness among the possible users of the test bed
6. Regular upgrades and enhancement of test-bed capabilities
7. Providing demonstrations to the other states and agencies.

WHAT IS OUR GOAL?

The end goal is to have a fully functional test-bed with complete support to its users.

WHAT IS THE BENEFIT?

This test-bed will provide a platform for software developers who will be developing transportation applications that will help drivers in cutting travel times, saving fuel and drive with augmented safety. Caltrans will be the primary beneficiary as the developed applications will help Caltrans to manage the traffic flows better while reducing the carbon footprint.

WHAT IS THE PROGRESS TO DATE?

January 1, 2024 – March 31, 2024

PATH has received 21 Siemens C-V2X RSUs together with RSU mounting bracket and RSU power supply. The newer version of the RSU has the C-V2X antennas built inside the RSU (see Figure 1). The RSU mounting bracket (see Figure 2) provides two mounting options:

- Option 1 – Mount the RSU directly on a signal mast arm with horizontal mounting (see Figure 3)
- Option 2 – Mount the RSU on a vertical raise from the signal mast arm with vertical mounting (see Figure 4)
- The desired mounting option (horizontal vs. vertical) will be determined on the size and existing load of the mast arm.

PATH has completed the configuration of the new C-V2X RSUs and has received RSU installation materials which are purchased under this project, including the outdoor-rated CAT6 cables, CAT6 connectors, RSU mounting straps, and zip ties.

PATH has completed upgrading SAE J2735 V2X message library software module from version 201603 to the latest version of 202211 and completed upgrading the AB3418 message software module and Traffic Controller Interface (TCI) software module to incorporate the Leading Pedestrian Interval (LPI) information which is transmitted from the traffic signal controller (i.e., the CTSCP). PATH tested a draft CTSCP software that transmits the LPI information to the RSP but found issues in the transmitted data. PATH is working with Caltrans HQ to resolve the issues.

PATH has also been actively involved in ECR V2X Workgroup activities, coordinated between Caltrans HQ Traffic Operations, DRISI, District 4 (D4), and PATH:

- PATH and D4 jointly developed the Network Diagram for moving the operations of the California CV Test Bed from Verizon public domain cellular service to AT&T FirstNet service.
- PATH re-configured the LAN IP addresses of the Roadside Processor (RSP) and RSU to the designated Network Diagram.
- With the approval from D4, PATH started to have the 15 intersections that already have a C-V2X RSU installed to broadcast MAP messages.
- D4 TMC has verified the connection and accessibility from D4 TMC to CV equipment (AT&T FirstNet modem, RSP, RSU, and traffic signal controller) at those 15 intersections.

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PATH has provided technical support to Caltrans District 12 (D12) on their RTCM needs and District 11 (D11) on their needs on installing and testing the MMITSS software with MH Corbin RSP.

PATH has been conducting monthly updating the Ubuntu OS and safety patches to the 16 ECR test-bed intersections that have DSRC RSUs installed.

LEARN MORE

<https://caconnectedvehicletestbed.org/>

IMAGES

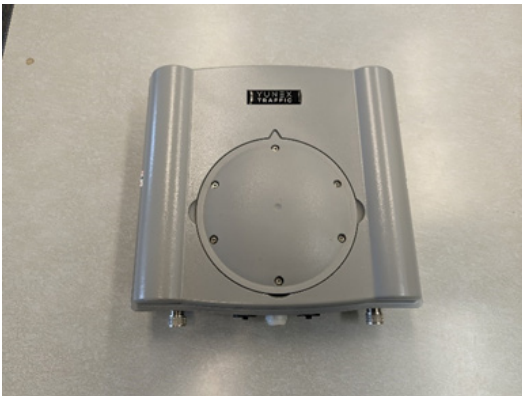


Image 1: RSU Front View

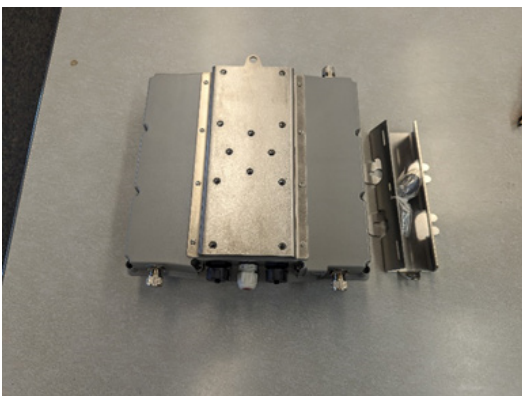


Image 2: RSU Back View with Mounting Bracket



Image 3: RSU Horizontal Mounting