

**Origin Destination (OD) Sensors / Roadside Units
(RSU): US 1, Howard County, Maryland**

**FORM 442: QUESTION 7
PURPOSE OF EXPERIMENT
2021**



Form 422: Question 7 – Purpose of Experiment

Background

Intelligent Transportation Systems (ITS) and connected and automated vehicle (CAV) technologies are rapidly developing in the transportation industry, making it imperative for infrastructure owners and operators (IOOs) to stay up to date with these emerging technologies. In preparation for vehicle-to-infrastructure (V2I), infrastructure to vehicle (I2V), and generally vehicle to everything (V2X) connectivity on our roadways, the Maryland Department of Transportation State Highway Administration (MDOT SHA) is pursuing a variety of CAV initiatives throughout the state, including the deployment of Origin Destination (OD) sensors that can also act as Road Side Units (RSUs) for detection and notification of connected vehicle (CV) communications in the roadway. MDOT SHA is taking the systems engineering approach to prepare for the deployment of wireless communication via Cellular Vehicle to Everything (C-V2X) and Dedicated Short Range Communication (DSRC) for this project for the RSUs.

Goals and Objectives

MDOT SHA's primary objective is to deploy OD sensors (RSUs) at 19 (nineteen) intersections. The roadside unit (RSU) will serve as supporting infrastructure for CV applications, allowing vehicles nearing an intersection to gain situational awareness via a DSRC and C-V2X-compatible onboard units (OBU). The goal of this specific deployment is to promote safety, with the larger ambition of working toward state-wide integration of CV technologies. Deployment of RSUs and other ITS equipment will provide support to many of Maryland's ongoing CAV initiatives.

As connected data becomes more abundant through deployments similar to this one, it may be possible to incorporate this data into traffic management as a whole to provide travelers with a safe and efficient system. MDOT SHA will continue to work to overcome hurdles, encourage private investment, and coordinate with public agencies in the realm of ITS and CAV testing and deployment.

System Boundary

This proposed OD/ RSU project, which will in part serve as a pilot deployment to gauge the effectiveness of ITS messaging systems, will be comprised of users including individuals and systems that interact either directly or indirectly. The direct interaction will be primarily comprised of RSU and OBU. Motorists are identified as indirect users. These are the users that will benefit from the generated broadcasts or notifications but will not interact directly with the OD/ RSU System. They instead interact with a C-V2X or DSRC-compatible OBU with a Human Machine Interface (HMI) that is frequently a tablet or smart phone.

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Deployment Area

This project will deploy OD/ RSUs at nineteen (19) specified locations on I-95, US 1, MD 175, MD 100, MD 295 and MD 108. The locations will have secure backhaul communications capability via fiber and/or wireless to the MDOT SHA network in order to receive Security Credential Management System (SCMS) updates and for administration. The locations are show below in Figure 1.

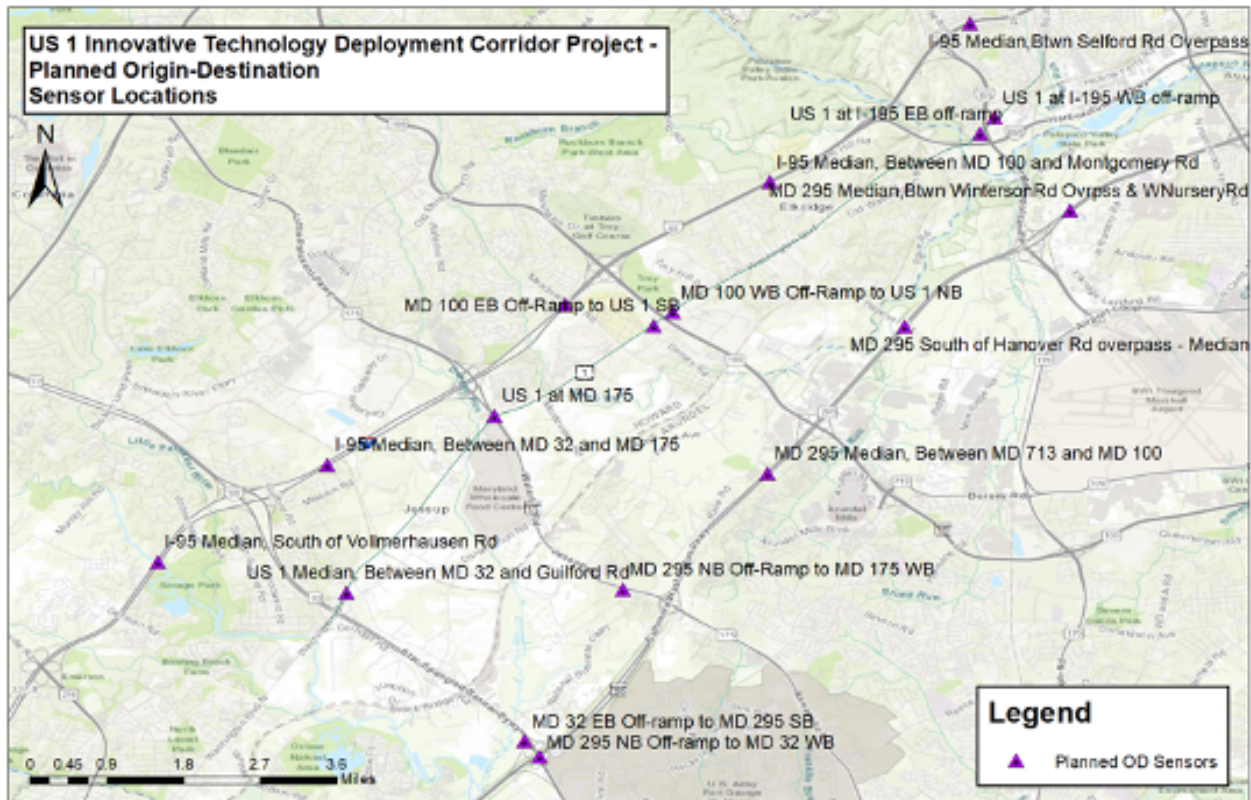


Figure 1: MDOT SHA OD/ RSU Locations

Contribution to Broader Stakeholder Groups

Stakeholders include the agencies and groups responsible for controlling, operating and maintaining the equipment and systems, as well as travelers who will benefit from the CV applications. MDOT SHA is responsible for the installation, integration, operations and maintenance of the system, and will be the main stakeholder; however this program has a reasonable promise of contribution to the development, extension, and expansion or utilization of the radio art for future C-V2X deployments.

The primary requirements for additional stakeholder participation are to conform to CV messaging constructs and valid SCMS credentials. This will allow compliant Original Equipment Manufacturers (OEM) vehicles, agencies, academia and other OBUs to communicate with the project CV infrastructure and receive the Basic Safety Messages (BSMs).

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Use of the OD/ RSUs

Roadside Unit (RSU) are devices that use DSRC or C-V2X wireless communications technologies, depending on manufacturer and project requirements. These devices send messages to, and receive messages from, nearby vehicles using a licensed radio frequency. The RSU operates from a fixed position (like a signalized intersection or pole along a curve), or a portable device (such as a variable message board or work zone mounted trailer). The device includes a processor, multiple radios, firewall/router, Power over Ethernet (PoE)/Network Management Ethernet port, data storage capabilities with configurable radio channels, deployable message-sets and a secure channel broadcast to DSRC or C-V2X equipped vehicles.

For a visual representation of how the OD/ RSU system is to be used, see the following Figure 2, which displays a Use Case/ Messaging Diagram. The diagram depicts the user(s) of the system and displays how they communicate/ interact with the CV ecosystem. For example, the diagram shows that the vehicle communicates via wireless technologies (C-V2X or DSRC) to the RSU that is located on a mast arm at the intersection. The diagram below shows that the pedestrian I2V system will use the detection of a vulnerable user to notify an in-vehicle OBU or similar system.

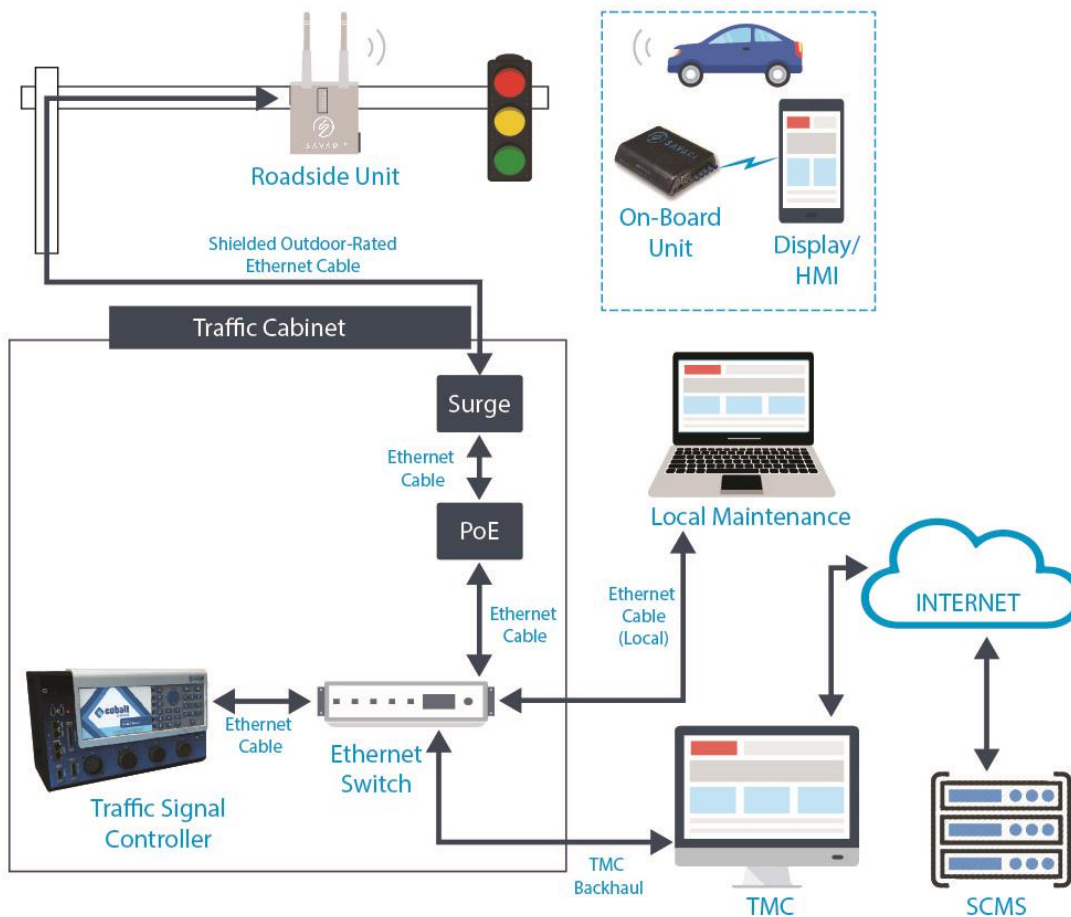


Figure 2: OD/ RSU Diagram

Next Steps

As our roadways advance in connectivity, MDOT SHA will investigate impacts and deploy CV technologies on Maryland's transportation network to increase safety, improve efficiency and enhance mobility for travelers. Following the systems engineering process, testing and verification will occur, followed by system validation. This will involve analysis of data to evaluate performance measures and checks of the system to verify its successful operation.

Coordination will continue between stakeholders described in this document as well as with local and regional state agencies, organizations, and the public. Continued investments will be made in the future of transportation to enhance traffic management and provide a connected, safe infrastructure network.

MDOT SHA will continue to stay at the forefront of emerging technologies in transportation by investigating the impacts of DSRC and CVs and preparing for the predicted deployment of AVs on the roadways. MDOT SHA will be able to leverage lessons learned from the deployment of OD/ RSUs outlined in this Purpose of Experiment document as well as ongoing CAV initiatives throughout the state to prepare for future installments of CAV technologies and V2I, V2V and V2X applications.