Explore the Federal Highway Administration's Open-Source V2X Deployment Resources

A Guide to the Tools and Resources Featured at the 2025 ITS World Congress

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Deploying vehicle-to-everything (V2X) technology may sound complex, but it does not have to be. V2X allows vehicles, traffic signals, and roadside systems to share real-time information, improving road safety and efficiency for everyone. Whether representing a local agency, State department of transportation, or research organization, developers can use this guide to find the tools, resources, and key stages that support successful V2X deployment.

Start With Expert Guidance and Planning Support to Build a Deployment Plan

A successful deployment starts with asking the right questions and getting expert answers. The V2X Interoperability Help Desk is the go-to resource for personalized assistance. Whether defining goals, learning about standards, or planning system architecture, this is where deployers build a solid foundation. To speak with a V2X Interoperability Help Desk expert, email cavsupportservices@dot.gov.

Access and Test Deployment Hardware

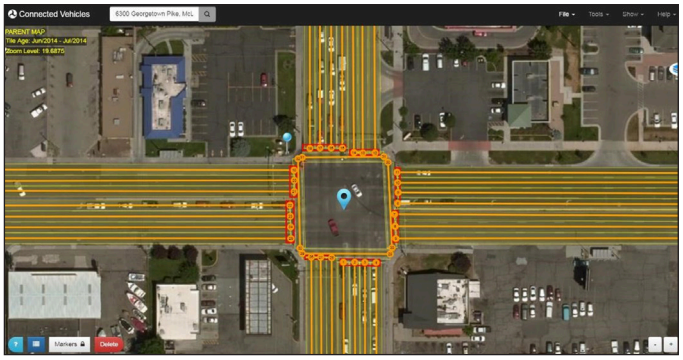
Connected and automated vehicle (CAV) systems rely on radios installed in infrastructure and vehicles to communicate. Through the help desk, the U.S. Department of Transportation's Equipment Loan Program lets researchers borrow and test this hardware in real-world conditions. Deployers will gain hands-on experience, reduce procurement risks, and move faster with technical support. Available equipment includes the following:

- Roadside units.
- Onboard units and applications.
- Connected intersection testing equipment.
- Smart arrow boards and conversion kits.
- Thermal sensors.
- Test laptops and tablets.
- Satellite-based location tracking kits.

To request equipment or get more information, email: cavsupportservices@dot.gov.

Digitally Define Intersections With the MAP Creation Tool

The MAP Creation Tool helps users build standard-compliant MAP messages by providing an interactive map interface, shown in figure 1. These messages define the layout, lanes, signals, and rules of intersections. Connected vehicles rely on this information to safely navigate the roadway. Access the tool at https://webappopen.connectedvcs.com/isd/.[1]



Source: Federal Highway Administration (FHWA).

Figure 1. Image. Intersection definition in the MAP Creation Tool.[2]

Enable Interoperability and Message Management With V2X Hub℠

Once the intersections are mapped, it is time to share the data. As an edge device, V2X Hub translates and routes information such as signal timing and intersection layouts into messages that vehicles can understand.[3] This process ensures that all system components work together effectively.

Test the Setup in a Realistic Environment With CAVe-in-a-Box℠

Before going live, developers can validate their system in a controlled environment using CAVe-in-a-box.[4] This compact, preconfigured test setup (figure 2) replicates a connected intersection. It allows deployers to evaluate functionality, check interoperability, and identify issues early, saving time and reducing risk. Learn more about CAVe-in-a-box through the training series at https://www.youtube.com/playlist?list=PLjP1oRdEKVdRi-pZWidrtko0eeNqQssL4.[5]

Source: FHWA.

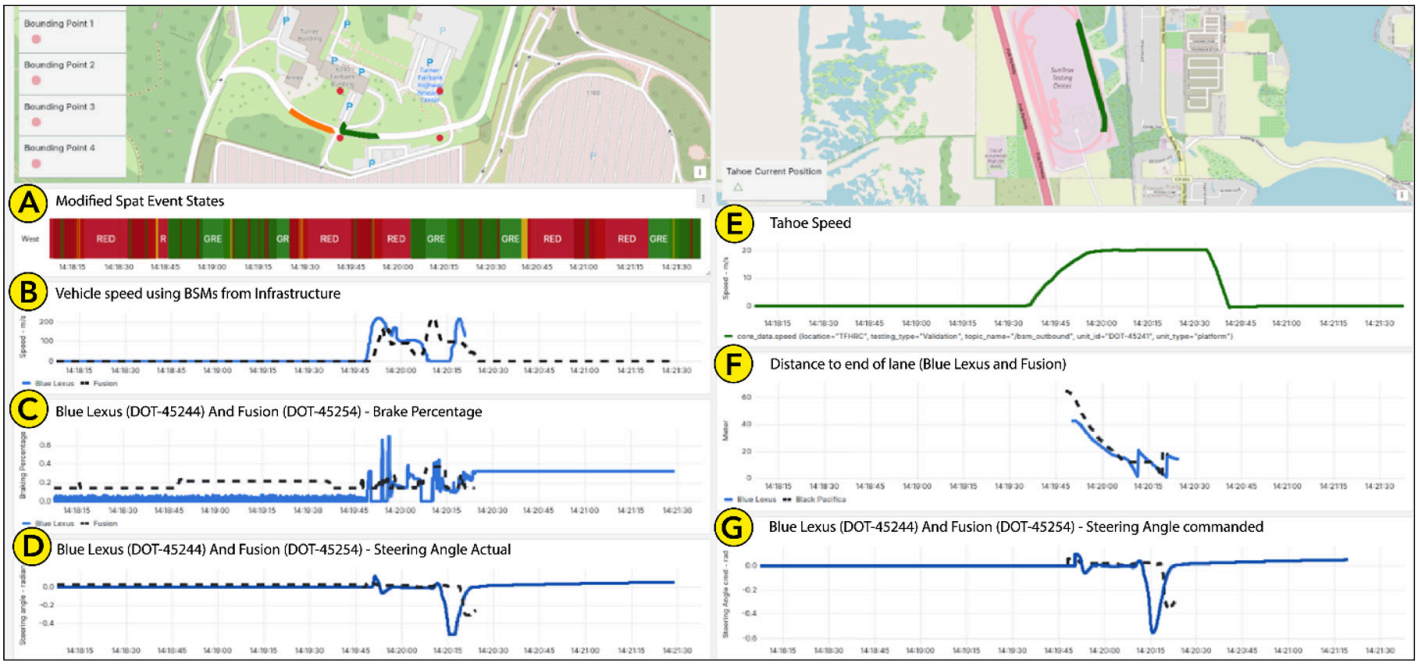
Figure 2. Photo. CAVe-in-a-box.[2]

Validate V2X Scenarios With CDASim℠

CDASim is a cosimulation tool that enables users to test their system in a virtual environment before installing any hardware.[6] Users can simulate scenarios like red light warnings or pedestrian alerts to see how messages are triggered, delivered, and received. This simulation helps to reduce risk, refine performance, and build confidence before field deployment.

Monitor Performance and Optimize With the Intelligent Transportation Systems (ITS) Telematics Tool

Once live, the system must be monitored to ensure it works as intended. Figure 3 shows how the ITS Telematics Tool tracks key metrics like message delivery speed and system health, helping to diagnose issues, measure impact, and adjust as needed.[7] Watch the ITS Telematics Tool in action: https://www.youtube.com/watch?v=kZi15fF5TnA.[8]



Source: FHWA.
BSM = blind spot monitoring; DOT = department of transportation.

Figure 3. Image. ITS Telematics Tool dashboard.[9]

Continue Scaling With Ongoing Support

After deployment, developers are part of a broader movement toward safer, smarter mobility. The V2X Interoperability Help Desk remains a long-term resource to help scale, troubleshoot, or share lessons learned. V2X is an ongoing journey and equips deployers with the tools to lead it.

Take the Next Step on the V2X Deployment Journey

This technology transforms how developers move people and goods, improving safety, reducing congestion, and laying the groundwork for future innovation. With the right tools and support, deploying V2X in the community is not only possible but also achievable. This step-by-step guide helps turn a complex challenge into a straightforward process. Whether deployers are exploring their first pilot or scaling an existing deployment, the technology provides support from the start.

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LET'S WORK TOGETHER TO BUILD SAFER ROADS, SMARTER INTERSECTIONS, AND A CONNECTED FUTURE.

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