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Source: https://www.its.dot.gov/pilots/crosssite_cvp.htm

Three Connected Vehicle Pilots successfully demonstrate cross-site over-the-air interoperability among six participating vendors

To pave the way for a nationwide deployment, a major long-term goal of the Connected Vehicle (CV) Pilot Deployment Program is for the connected vehicle devices and equipment to be interoperable, meaning that they would be able to operate as designed anywhere in the country, regardless of where they were built. The cooperative agreements between the United States Department of Transportation (USDOT) and the CV Pilot Deployment Sites (New York City, Tampa and Wyoming) included a requirement for the CV Pilot sites to perform an activity that showed the devices from the three sites being interoperable. Leveraging a series of technical roundtable meetings, the USDOT and the three CV Pilot sites settled on a definition of interoperability and an approach to conduct a limited test of interoperability. For purposes of the interoperability activity, the USDOT and CV Pilot sites defined interoperability as:



Group shot of the Interoperability Test participants pictured with the logos of the three CV Pilot sites: New York City (left), Tampa (middle) and Wyoming (right).

"A vehicle with an onboard unit (OBU) from one of the three CV Pilot sites is able to interact with OBUs and/or roadside units (RSUs) from the other sites in accordance with the key connected vehicle interfaces and standards."

Over a period of several months, the CV Pilot sites collaborated to harmonize the data elements that would make such interactions possible. The CV Pilot sites next worked with the USDOT and its support contractor to develop a plan to conduct an Interoperability Test that would take place at Turner-Fairbank Highway Research Center (TFHRC) in McLean, Virginia from June 26th-28th, 2018. In addition to testing interoperability among connected vehicle devices from the three sites, the testing also served to identify potential interoperability issues that may require resolution prior to the sites advancing to an operational phase of the CV Pilot Deployment Program later in 2018.



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Planning for the testing event was jointly led by the CV Pilot sites in coordination with TFHRC and USDOT staff. TFHRC and its Saxton Transportation Operations Laboratory (STOL) contractor provided support to the CV Pilot sites as well as the facility and supporting equipment for the testing. This support included installing the same RSU models used by the sites to allow them to replicate their configurations, installing OBUs from the sites in vehicles and providing trained drivers to operate the vehicles during the interoperability test runs. In addition to the USDOT and sites, representatives of the CV Pilots' Independent Evaluation (IE) team were present to observe in support of the broader independent evaluation effort. Six TFHRC-provided vehicles were used for the testing with each vehicle being outfitted with an OBU from one of the CV Pilot site's OBU vendors – Tampa (3), New York City (2) and Wyoming (1). Additionally, the sites each loaded the TFHRC-supplied RSUs with their own software. A test of this nature involving three deployment sites, six device vendors and multiple communications media had never been done before – making the Interoperability Test a truly unique event.



Total data collection path from the test runs.

The purpose of the Interoperability Test was to test: (1) interactions between different sites' OBUs and (2) interactions between selected OBUs and RSUs. Specific objectives are summarized in the table below:

Area	Description
Interactions between different CV Pilot sites' OBU	<ul style="list-style-type: none"> • OBUs from each site should be able to receive SAE J2735 Basic Safety Messages (BSMs) transmitted by each of the other site's OBUs over-the-air, authenticate them, parse them and process them in accordance with SAE J2945/1. • The Forward Collision Warning (FCW) application – an application all three sites are utilizing in their Pilots – hosted by OBU-equipped vehicles from each site should be able to interact with equipped lead vehicles from each of the other sites in an open-sky environment, and demonstrate a response (e.g., alert). Additionally, the Electronic Emergency Brake Light (EEBL) and Intersection Movement Assist (IMA) applications on OBUs from Tampa and New York City should be able to interact with equipped vehicles from the other site in an open-sky environment.
Interactions between selected OBUs and RSUs	<ul style="list-style-type: none"> • OBUs from New York City and Tampa should be able to receive and parse SAE J2735 Signal Phase and Timing (SPaT) and MAP messages sent by RSUs. (Note: Wyoming's Pilot does not involve intersections so Wyoming did not participate in the RSU testing).



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The capabilities listed in the table above were demonstrated in staged scenarios on TFHRC's closed road course. In total, 102 interoperability test runs were conducted for four test cases – FCW, IMA, EEBL and reception of SPaT/MAP messages. Data was downloaded off of the OBUs immediately following each test run, with nearly 5 GB worth of data being generated over the test period. This data will be uploaded to the USDOT's Secure Data Commons (SDC) for further analysis to help identify lessons learned that can be gleaned for future testing.



A Tampa vehicle (white) receives an IMA alert while trying to enter an intersection when a New York City vehicle (black) with the right-of-way passes through.

Overall, the three-day testing event was a major success that went above and beyond the event's original testing objectives, with time allotted on the last day for some impromptu tests by the sites. Results of the testing indicated successful transfer of messages between the six vehicles fit with devices from five different OBU vendors. Out of the five vendors, four utilized a live-running log of sanitized BSMs from the Wyoming Pilot is currently available on the ITS Public Data Hub. Data from the New York City and Tampa Pilots is expected to be available later this year. DSRC and one used both DSRC and SiriusXM Radio. Additionally, equipment from New York City and Tampa's vendors demonstrated the successful transfer of messages between the site-configured RSUs and the sites' OBUs. The event was lauded by many for being well-planned, well-organized, and well-executed, with some attendees reporting that it was the most successful connected vehicle testing event they had ever participated in. The Interoperability Test was a watershed moment for connected vehicle technology, and an important milestone in the maturation of these technologies for operational deployment.

A Final Test Report documenting the results of the Interoperability Test is expected to be made available in Fall 2018.

A live-running log of sanitized BSMs from the Wyoming Pilot is currently available on the [ITS Public Data Hub](#). Data from the New York City and Tampa Pilots is expected to be available later this year.