Battelle Connected Vehicles

DRIVING INNOVATION IN TRANSPORTATION

The future of transportation is here, and Battelle is leading the way. Wireless technology similar to that used every day to stay connected to email and social networks is being employed to improve the safety, mobility and environmental impact of surface transportation to and from your daily destinations.

For over a decade, Battelle has been transforming the transportation landscape through the development, testing and deployment of systems and applications for vehicle-to-vehicle and vehicle-to-infrastructure connectivity.

WHAT ARE THE BENEFITS?

- Reduced crash rates, injuries and deaths
- Traffic, weather and emergency warnings
- Route planning for optimal driving and fuel efficiency
- Traffic pattern and transportation system planning
- Reduced environmental impact
- Detailed data on all aspects of the transportation system that inform planning and decision making.

COMPREHENSIVE, FIELD-READY SOLUTIONS

Battelle offers a unique single-source solution for connected vehicle system integration. Comprehensive in-vehicle, infrastructure, data capture and data processing systems reduce ramp-up time and project complexity.

Battelle's Transportation Message Exchange (TMX) is an open platform that allows for integration of any on-board or roadside units with numerous application packages. It is hardware agnostic and makes for efficient and streamlined integration of new CV technologies:

- In-vehicle hardware that is ready for installation on any vehicle and compatible with existing systems
- Rapidly deployable Dedicated Short Range Communications (DSRC) infrastructure
- Comprehensive suite of deployment-ready applications
- Scalable cloud-based data collection and processing.

THE FUTURE OF TRANSPORTATION

At Battelle, we're always pressing forward. Our innovations in the field of connected transportation technology are part of the next generation of systems to improve safety, mobility and awareness and reduce environmental impacts. As part of the larger movement toward smart industries and systems, Battelle is committed to continuing to advance connected vehicle and related solutions.

BATTELLE

BATTELLE: A PROVEN LEADER

For more than 10 years, Battelle has been trusted as the lead in development and deployment of numerous connected vehicle research, network, and security application development projects with the U.S. Department of Transportation, NHSTA and local authorities. Battelle has been involved in facets of development and deployment for over 60% of the CV applications currently in the field, including:

- **Enhanced Transit Safety Retrofit Package:**
  The successful demonstration of busses retrofit with a suite of general vehicle-to-vehicle safety applications and Battelle-developed, transit-specific safety applications in Ann Arbor, Michigan, and Cleveland, Ohio.

- **Integrated Dynamic Transit Operations (IDTO):**
  Implemented and deployed a Connect and Ride system in Central Ohio and then Central Florida that demonstrated the integration of multiple transportation modes and service offerings to support local commutes, including traditional transit offerings, as well as rideshare and dynamic demand response providers.

- **Device to Everything (D2X) Hub Mobile Device Project:** This cutting-edge project assessed the potential for integrating mobile devices into the connected vehicle environment. The technology was demonstrated at the Turner Fairbank Highway Research Center and evaluated in the field on the campus of the Ohio State University. Project objectives included evaluating the ability of mobile devices to share messages with connected vehicles and roadside devices, developing safety- and mobility-related messages to support travelers using connected mobile devices, assessing the ability to transmit messages from hand-held mobile devices using different alternative communications methods and evaluating methods to coordinate mobile devices sending safety and mobility messages with connected vehicles and roadside devices.

- **Intelligent Network Flow Optimization (INFLO):**
  A Battelle-led prototype project implemented mobile devices supporting DSRC and cellular connections to enable communication of speed harmonization and queue warning information between vehicles and traffic management centers. Demonstrated in controlled environments in Columbus, Ohio and Seattle, Washington.

- **Transit Safety Pedestrian Warning:** This application addresses a real need, protecting the vulnerable road user (VRU)—passengers boarding, alighting or simply dwelling at bus stops—by expanding the awareness of CV-equipped vehicles. Battelle is deploying this application in Cleveland, Ohio to enable infrastructure to warn the VRU of impending safety issues.

- **R.E.S.C.U.M.E.:** Program named for response, emergency staging, communications, uniform management and evacuation piloted in Columbus, Ohio, and Sykesville, Maryland, utilized a dynamic mobility application bundle to demonstrate support for first responders by making incident scene information readily available.

- **Signal Phase and Timing and the Integrated V2I Prototype:** Projects focused on designing and testing the enabling technologies necessary to communicate signal phase and timing information from traffic signal controllers to vehicles in a connected vehicle environment.

- **NYC Connected Vehicle Pilot Deployment Project:**
  In 2016, Battelle was a sub-consultant supporting the NYC Connected Vehicle Pilot Deployment Project. Battelle led the safety management and human use approval plan development and had a major support role in developing the pilot's concept of operations, system requirements, application deployment and comprehensive deployment plans.

THE CYBER SECURITY ADVANTAGE

Paired with Battelle's connected vehicle solutions is extensive automotive cyber security experience spanning penetration testing of embedded systems, wireless networking and communication vulnerability assessments, cellular network infrastructure, secure use and operation of cloud computing resources, mobile device security, analytics and testing, also including Battelle's innovative NEM™ technology for detection and mitigation of anomalies. Our expert team is ready for any challenge.

LET US HELP YOU

Interested in learning more about how Battelle's experience with connected vehicle and intelligent transportation system technologies can work for you? Contact us today at **solutions@battelle.org** or by visiting **www.battelle.org/transportation**.

800.201.2011 | **solutions@battelle.org** | **www.battelle.org**

BATTELLE
It can be done