Here is a synopsis of FHWA research that may be relevant for B2V research and implementation.

This information was mostly acquired from a relatively recent wrap-up on various FHWA Research Projects related to Pedestrian and Bicycle Travel found on this page:

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/trb_summaries/2019.cfm

I've called out projects that may be of interest to workshop participants below (and added some links to further descriptions and contact information where it was available). I presented the "SmartCross" and the D2X Hub (**"**Sharing and Using Connected Device Data to Improve Traveler Safety and Traffic Management") at the B2V Safety Workshop on August 14, 2019.

Where these projects lack links or have no contact information, please contact Jeremy Raw (FHWA Office of Planning), 202-366-0986, jeremy.raw@dot.gov for more information.

SmartCross: Traffic Signal Interface on the Smartphone (SBIR Phase IIB)
Recently completed the SmartCross project. This system enables pedestrians to safely navigate busy intersections with the help of a mobile application. This one-of-a-kind system enables the users to request a pedestrian walk phase directly from their smartphone. The app on the smartphone also alerts the user when it is safe to use the crosswalk. The user downloads the application on his/her smartphone from the app store (Android Market or iTunes Store). Once downloaded, the user configures the mode of operation through a first use screen with options of: pedestrian, bike, visually impaired, and wheelchair mode. Based on the user mode, the application varies its feedback mechanism. To use the system, the pedestrian simply approaches the crosswalk with the application running on the smartphone. On reaching the curb, he/she points the device towards the intended direction of travel (the crosswalk he/she wants to use). If the direction pointed aligns with a crosswalk, the user can request a walk phase by pressing the CROSS button on the app. (FHWA Office of Safety)

Pedestrian and Bicycle Crash Analysis Tool (PBCAT): PBCAT is a crash typing software product that analyzes motor vehicle and pedestrian or bicyclist crashes. An update to PBCAT was included in the Highway Safety Information System project. Phase 1 of this update, examined the usability and functionality of PBCAT based on input from current and past PBCAT users, as well as those who had not used PBCAT but had expressed interest in typing crashes. Phase 2, will include the programming work to update PBCAT and release a new version, is currently being considered by FHWA under a new Highway Safety Information System (HSIS) task order that began in December 2018.
See http://www.pedbikeinfo.org/pbcat_us/.

Understanding traffic systems with innovative pedestrian and cyclist detection. Working in partnership with the U.S. DOT's Intelligent Transportation Systems (ITS) Program and the Federal Transit Administration (FTA), FHWA is pursuing research to enable the secure sharing of electronic messages between traffic management systems, ITS devices, transit vehicles and systems, and travelers using connected mobile devices. The goals of research and future efforts include (1) exploit the sharing, integration, and use of data with connected devices (CDs) to proactively manage and control traffic, and (2) improve the safety and mobility of all travelers. The research includes pedestrians and bicyclists as road users.

The **Sharing and Using Connected Device Data to Improve Traveler Safety and Traffic Management** project is exploring the requirements to enable the exchange of electronic messages between roadside devices, traffic management systems transportation service providers, in-vehicle devices, and mobile devices to support the needs of various transportation system users while improving their safety and mobility. This project will identify concepts of operations, use cases and requirements for connected mobile devices using various types of communications available to send and receive data contained within electronic messages with connected (e.g., transit) and automated vehicles, other connected mobile devices, ITS devices, and traffic management systems. This project will identify the technical and other issues to consider in the planning or assessing the feasibility of developing and sustaining the ability to enable an environment that fosters the sharing and use of these electronic messages in early 2020. This project builds upon the proof-of-concept testing and development of the D2X Hub (software platform) that support the sharing and use of electronic messages with connected mobile devices. (Link to Report).

Also be generally aware of the Open Source Application and Data Portal (https://www.itsforge.net) which includes numerous exploratory software tools and data sets (including the D2X Hub) that will be of interest to researchers working on vehicle connectivity and automation.

The **Smart Phone Based Mid-Block Pedestrian Crossing In-Vehicle Warning** Phase II work builds upon the Phase 1 application project funded by the FHWA with FY 2017 funds. The goal of this application is to increase pedestrian safety at mid-block crossings. Using mobile phone-based communication, pedestrians send notifications to drivers within a predefined specified range. The Phase 1 project conducted experimental subject testing of the application on site at the pedestrian mid-block crossing at FHWA's Turner-Fairbank Highway Research Center facility. Given the initial success, the FY 2018 funded Phase 2 project has begun to evaluate pedestrian perceptions of usefulness and application interface design. In 2019, the application will be further refined and evaluated at three diverse mid-block crossings in Northern Virginia. A successful Phase 2 project has the potential to be followed by a FY 2019 funded Phase 3 project to partner with a State or local transportation agency for a broader field test evaluation.

The **Multimodal Alerting Interface with Short-Range Transmissions** **(MAIN-ST)** is a Small Business Innovation Research (SBIR) project awarded to Charles River Analytics (Cambridge, MA) in 2016 (Phase I) and 2017 (Phase II) to develop hardware and software to bring bicycles onto connected vehicle networks and to provide safety information related to possible hazards to the bicyclist. The project developed prototype Dedicated Short Range Communication (DSRC) capability using commercially available hardware, as well as a software hazard detection and notification system that will work with any connected vehicle hardware transport mechanism (potentially including 5G or Bluetooth). The project also developed a virtual reality bicycle simulator and supporting software that has been installed at the Turner-Fairbank Highway Research Center (TFHRC) and that interoperates with the existing driving simulator. Testing of the MAIN-ST system is being conducted through a cooperative research and development agreement (CRADA) with TFHRC, who will continue to conduct research using the bicycle simulator after the completion of the SBIR project (in June 2019). MAIN-ST was submitted to a Technology Readiness Level review in February 2019, to support future commercialization of the research product (the project is at Level 3 – completed prototype and proof of concept, and entering detailed testing). Additional information: https://www.cra.com/work/case-studies/main-st

FHWA's Exploratory Advanced Research (EAR) Program is starting new research projects on Mobile Ad Hoc Networks (MANETs) with one of the projects focused on a rural application. Mobile ad hoc networks are fluid wireless moving networks that can form independently on an ad hoc basis. The network is defined by mobile nodes (smart devices, vehicles, etc.) that receive and transmit data and require no fixed or dedicated infrastructure. This network paradigm lends itself well to fast moving, complex, and dynamic applications (e.g. Transportation System Management and Operations or wayfinding and navigation solutions). Nodes can move cognitively into and out of the network through physical movements or through devices turning on or off, thus redefining the network's characteristics. The network can then reconfigure itself to accommodate these changes. Mobile ad hoc network research and development generally has been for Defense Department and first responder communications system applications. For additional discussion, please refer to the white paper located at https://www.fhwa.dot.gov/publications/research/ear/18027/index.cfm.