



U.S. Department of Transportation  
Federal Highway Administration

## TRANSPORTATION OPERATIONS

RESEARCH AND DEVELOPMENT

Turner-Fairbank Highway  
Research Center

SPRING 2015 UPDATE



# FHWA Conducts Field Tests to Evaluate Multimodal Intelligent Traffic Signal Systems Prototype



*Staff from Maricopa County Department of Transportation's REACT Program at the staging area for the MMITSS field test. REACT staff volunteered as drivers for the field tests.*

In support of the evaluation of the U.S. Department of Transportation's (USDOT) Dynamic Mobility Applications (DMA) program, the Federal Highway Administration (FHWA) Office of Operations Research and Development (R&D) oversees the prototype deployment and impacts assessment of the Multimodal Intelligent Traffic Signal Systems (MMITSS). MMITSS is a bundle of applications that seeks "to provide overarching system optimization that accommodates transit and freight signal priority, preemption for emergency vehicles, and pedestrian movements while maximizing overall arterial network performance."<sup>1</sup>

The MMITSS impacts assessment consists largely of a modeling effort, supported by preliminary output data from small-scale field tests. In early March 2015, the FHWA project team completed field testing in Anthem, AZ, one of two MMITSS prototype deployment sites. The site's study corridor extends over 2 miles and includes six signalized intersections.

The field tests comprised two scenarios. In the first, the team assessed the Freight Signal Priority (FSP) application. In the second, the team evaluated a bundled application that included both FSP and transit signal priority. The vehicles sent priority requests to MMITSS using Dedicated Short-Range Communications (DSRC). Probe vehicles equipped with a global positioning system (GPS) also traveled the network to collect data. The objective of the tests was to evaluate the benefits of the priority requests to the freight and transit vehicles in comparison with any negative impacts on travel time and delay for passenger vehicles traveling through the network.

In addition, the team used the MMITSS performance observation system to collect performance measures over the same time period as the evaluations. The performance measures will be compared to the GPS probe vehicle data to evaluate the accuracy of the MMITSS performance observation system.

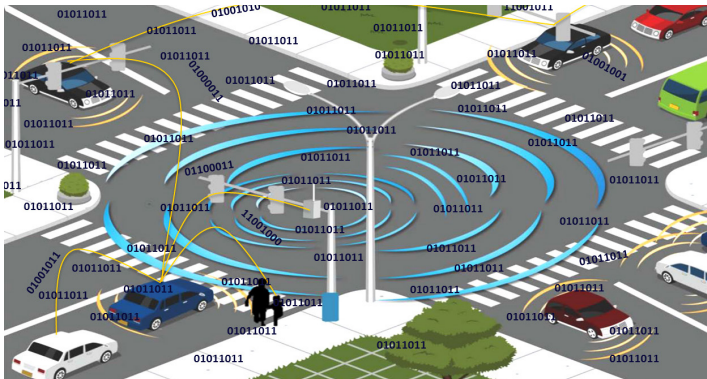
The team collected data from various sources, including county infrastructure system detectors, GoPro cameras, DSRC in-vehicle units, GPS loggers, and over-the-air packet captures. This data will be analyzed as part of the impacts assessment, used for the National DMA Evaluation Project, and shared with the research community through the Research Data Exchange (RDE).

For more information about this project, please contact Ben McKeever ([ben.mckeever@dot.gov](mailto:ben.mckeever@dot.gov)) or Govind Vadakpat ([g.vadakpat@dot.gov](mailto:g.vadakpat@dot.gov)).

<sup>1</sup> U.S. DOT, "Multimodal Intelligent Traffic Safety Systems (MMITSS)," Dynamic Mobility Applications (DMA) Program, Available at: [http://www.its.dot.gov/dma/bundle/mmitss\\_plan.htm](http://www.its.dot.gov/dma/bundle/mmitss_plan.htm).

## FHWA DEVELOPS APPLICATION TO MAKE CONNECTED VEHICLE DATA RESEARCH-FRIENDLY

FHWA has begun work on a data processing application that can be used to increase the value of connected vehicle data by removing errors and translating it into a format that is human-readable. Several projects have been initiated to promote data sharing across the research community to support USDOT's Connected Vehicle program, including the RDE, the open-source application development portal, and the prototype called the Operational Data Exchange.



*Connected vehicle data will create a "data explosion." FHWA's data processing application will help researchers use this data.*

These portals are designed to facilitate access to shared resources by the research community, such as industry professionals, university researchers, and private contractors. Many USDOT-sponsored research projects require that any generated data be shared through one or more of these portals; however, this data is not necessarily formatted for widespread use. For example, DSRC messages are transmitted in packet capture (.pcap) format, which must be cleansed and parsed into a comma-separated value (.csv) file before it can be used to support most applications. The data processing application currently in development will automatically cleanse and parse large batches of .pcap files, eliminating the need for time-consuming and repeated efforts by researchers who are using the same data sets. The application will have a simple interface that allows users to select targeted files and specify their destination into a new folder. It will run in the background to automatically process multiple files.

Upon completion of the application, FHWA will host a Webinar for the stakeholder community to introduce the tool and provide a brief tutorial on how to download and run the open-source application. For more information about this project, please contact Gene McHale ([gene.mchale@dot.gov](mailto:gene.mchale@dot.gov)).

## USDOT SEEKS ACCESSIBLE TRANSPORTATION APPLICATION IDEAS

The mission of USDOT's Accessible Transportation Technologies Research Initiative (ATTRI) is to enhance the mobility of travelers with disabilities through the use of intelligent transportation systems (ITS) and other advanced technologies. On March 3, 2015, the ATTRI team hosted a Webinar to gather input on the needs of travelers with disabilities. Participants included people with disabilities; caregivers; advocates; transportation system managers; Federal, State, and local government officials; academia; and other individuals involved with technology and mobility needs for people with disabilities.

In addition, the USDOT has issued a request for information (RFI) (solicitation number: DTFH6115RI00008) to obtain informed views on opportunities and challenges related to the development, deployment, operation, and use of accessible transportation applications and corresponding infrastructure systems related to ATTRI. The RFI solicitation is available at: <https://www.fbo.gov/index?s=opportunity&mode=form&id=7af5c95dfe01a42925393b80f6aa0206&tab=core&cview=1>. To learn more about ATTRI, contact Mohammed Yousuf ([mohammed.yousuf@dot.gov](mailto:mohammed.yousuf@dot.gov)).

## HCM UPDATE TO INCLUDE ANALYSIS METHODOLOGIES FOR ALTERNATIVE INTERSECTIONS

The FHWA Office of Operations R&D is managing the production of content for the 2015 Highway Capacity Manual (HCM) on analysis methodologies for four types of alternative intersections and interchanges: Diverging Diamond Interchanges; Restricted Crossing U-Turn Intersections; Median U-Turn Intersections; and Displaced Left-Turn Intersections. The HCM content includes new analytical models to estimate the efficiency of these innovative facilities, measured in terms of intersection delays and travel times between intersections. It also includes a chapter with example problems and worksheets to assist software developers in implementing the new computational procedures. At the Transportation Research Board (TRB) Annual Meeting in January 2015, the Highway Capacity Committee voted to make specific adjustments to the draft chapters submitted by FHWA's contractor team in late 2014, with final versions to be submitted in the coming months. For more information, contact Joe Bared ([joe.bared@dot.gov](mailto:joe.bared@dot.gov)).

## RECENT OPERATIONS R&D PUBLICATIONS

### Traffic Performance Analysis of Dynamic Merge Control

Dr. Ximiao Jiang, a National Research Council (NRC) scholar with the FHWA Office of Operations R&D, had his research project, "Traffic Performance Analysis of Dynamic Merge Control using Micro-Simulation," featured in the Autumn-Winter 2014 edition of the NRC Research Associateship Program Newsletter. Dynamic Merge Control (DMC) is a strategy in which traffic signs, dynamic pavement markings, and lane use controls direct traffic to specific general purpose lanes or ramps based on varying demand. For his research, Dr. Jiang simulated DMC, using Vissim, at the merge of the Dulles Toll Road Connector and Interstate 66 in Northern Virginia. Results showed that network travel speed was significantly increased and average delay per vehicles was reduced by approximately 98 percent. To view the full article, visit [http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga\\_153210.pdf](http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_153210.pdf)



## ■ FHWA HOSTS BOTTLENECK IDENTIFICATION AND SOLUTIONS WORKSHOPS

In April 2015, the FHWA Office of Operations R&D is hosting three “Bottleneck Identification and Solutions” workshops to discuss recent FHWA research on precise bottleneck measurement, ranking of bottleneck locations by severity, cost-effective bottleneck mitigation strategies, and modernized “causes of congestion” pie charts. The workshops are taking place in Hanover, MD; Oakland, CA; and Sacramento, CA. A second set of workshops will take place in summer 2015. In addition to the content from the first three workshops, the summer workshops will incorporate new research on innovative bottleneck mitigation strategies that do not require connected or autonomous vehicles. For more information, contact Joe Bared ([joe.bared@dot.gov](mailto:joe.bared@dot.gov)).

## ■ FHWA TO ATTEND AUTOMATED VEHICLE SYMPOSIUM 2015

Mark your calendars for the Automated Vehicles Symposium, scheduled to take place July 21–23, 2015 in Ann Arbor, MI. This event, which is jointly sponsored by the Association for Unmanned Vehicle Systems International (AUVSI) and TRB, will be a multidisciplinary forum designed to advance the deployment of automated vehicles. It will feature high-level presentations by innovators in the field as well as interactive breakout sessions. The FHWA Office of Operations R&D will be leading a 2-day breakout session on early deployment opportunities for connected automated vehicles. To learn more, visit the symposium Web site at <http://www.automatedvehiclessymposium.org/home> or contact Bob Ferlis ([robert.ferlis@dot.gov](mailto:robert.ferlis@dot.gov)).

## ■ FHWA OFFICE OF OPERATIONS R&D LEADS THREE WEBINARS

The FHWA Office of Operations R&D recently led three of seven Webinars that comprised the DMA Program Webinar Series hosted by the ITS Joint Program Office. Held February 9–26, 2015, the Webinars aimed to inform stakeholders about the research efforts, progress, and impacts of DMA research projects. Each Webinar presented an overview of the project; described the products (e.g., prototypes, algorithms, and software), tools, and other resources available from these projects; summarized the testing and impacts assessment results; and included a stakeholder question and answer session.

Approximately half of the 1,000 stakeholders who participated in the series attended the three Webinars, which were offered by the Office of Operations R&D team:

- Research Data Exchange (RDE) and Open Source Application Development Portal (OSADP) Webinar on February 12, 2015 ([Presentation Materials](#) | [Webinar Recording](#)).
- Multi-Modal Intelligent Traffic Signal System (MMITSS) Bundle Webinar on February 23, 2015 ([Presentation Materials](#) | [Webinar Recording](#)).
- Intelligent Network Flow Optimization (INFLO) Bundle Webinar on February 24, 2015 ([Presentation Materials](#) | [Webinar Recording](#)).

Other Webinar topics in the series included Freight Advanced Traveler Information Systems (FRATIS) on February 9; Integrated Dynamic Transit Operations (IDTO) Bundle on February 17; Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) Bundle on February 18; and DMA-Active Transportation and Demand Management (ATDM) Analysis, Modeling, and Simulation (AMS) Testbed Project on February 26. All presentations and recordings from the series are available at <http://www.its.dot.gov/dma/>.

## ■ FHWA HOSTS TRAINING SESSION ON VISSIM

On January 27, 2015, FHWA’s Cory Krause delivered a training session on Vissim, a traffic simulation model, at the Eastern Federal Lands Highway Division’s (EFLHD) Annual Winter Training. The 1-hour session taught new users how to run the software for the first time. Mr. Krause gave a short tutorial on how to create a basic intersection, including signal timing, and run the simulation. He also explained more complex designs, with advice for moving forward with more advanced geometries. Over 100 members attended from EFLHD and other USDOT divisions. For more information or a copy of the training PowerPoint slides, contact Cory Krause ([cory.krause@dot.gov](mailto:cory.krause@dot.gov)).

### WHO HAS VISITED THE SAXTON TRANSPORTATION OPERATIONS LABORATORY?

The following groups visited FHWA’s Saxton Transportation Operations Laboratory at Turner-Fairbank Highway Research Center during winter 2015.

- International Road Federation of the National Committee on Uniform Traffic Control Devices
- New Jersey Institute of Technology Graduate Students
- National Policy Agency of Japan

To arrange a visit of the Saxton Laboratory, contact Randy VanGorder ([randall.vangorder@dot.gov](mailto:randall.vangorder@dot.gov)).

## Dynamic Reversible Left-Lane Control Of Signalized Diamond Interchanges

FHWA’s Cory Krause recently published the paper, “Operational Advantages of Dynamic Reversible Left-Lane Control of Existing Signalized Diamond Interchanges” in the American Society of Civil Engineers’ (ASCE) Journal of Transportation Engineering. The paper, which was co-authored by FHWA’s Joe Bared, Nopadon Kronpraset, and Wei Zhang, studies the advantages of using dynamic reversible lanes for left-turn (DRLT) movements at signalized diamond interchanges. As part of this research project, the optimized traditional diamond interchange performance was compared, in simulation, to the proposed DRLT case. While results showed that the DRLT design was not advantageous for all conditions, it could increase throughput by 28 percent and reduce delays by 60 percent at higher volumes with specific lane configurations. To view the paper, visit [http://dx.doi.org/10.1061/\(ASCE\)TE.1943-5436.0000745](http://dx.doi.org/10.1061/(ASCE)TE.1943-5436.0000745).

## ■ FHWA OPERATIONS RESEARCH SHOWCASED AT THE TRB ANNUAL MEETING

The FHWA Office of Operations R&D had a strong presence at this year's TRB Annual Meeting, held January 11–15, 2015 in Washington, DC. A vehicle from the office's research fleet was displayed in the exhibit hall, and the office hosted a booth where attendees could learn more about ongoing research activities. The booth also featured a video on FHWA's cooperative adaptive cruise control (CACC) project, which can be viewed on FHWA's YouTube page at [https://www.youtube.com/watch?v=D\\_2DPm9v-Lw](https://www.youtube.com/watch?v=D_2DPm9v-Lw).

In addition, FHWA Office of Operations R&D team members participated in numerous committee and subcommittee meetings and presented at the following sessions and workshops: Communication Trends: The Shift to Mobile (Session 148); Freeway Operations (Session 243); Assessing the Transportation Needs of Seniors, Veterans, and People with Disabilities (Session 330); Current Projects and New Developments in Vehicle-Highway Automation Showcase (Session 470); Operational and



*FHWA's Taylor Lochrane at the Office of Operations R&D exhibit hall display at the TRB Annual Meeting, which showcased one of FHWA's connected automation test vehicles.*

Safety Effects of Geometric Designs (Session 472); Traffic Flow Theory: Part 2 (Session 539); Designing Better Turn Lanes (Session 619); Traffic Signal Control in a Connected Vehicle Environment (Session 773); Doctoral Student Research in Transportation Operations and Traffic Control (Workshop 131); and Ignite! Emerging Technologies in Traffic Signal Systems. State of the Art and Predicting the Future (Workshop 175).

Presentations and posters from these sessions will be available on the TRB Annual Meeting Online Web site: <http://amonline.trb.org>.

## ■ NEXT GENERATION TRAFFIC CONTROL SYSTEMS WORKSHOP HELD AT TFHRC

On February 3–4, 2015, FHWA's Office of Operations R&D and the Exploratory Advanced Research (EAR) Program sponsored a Next Generation Traffic Control Systems Workshop at Turner-Fairbank Highway Research Center (TFHRC). The workshop brought together approximately 40 researchers and technology developers from industry, academia, and public agencies to discuss the direction of technological advances in traffic control systems and sensors.

On the first day of the workshop, participants aimed to identify research gaps, barriers, and needs to address in order to improve the utility of infrastructure-based and mobile sensor technology for traffic management, particularly to enable the next generation of adaptive signal control. On the second day, participants discussed how to accelerate the development of tools for future signal control research, such as new traffic signal control algorithms and complex simulation infrastructure.

Participants described the most important takeaways of the workshop as those that dealt with building off of current practices, collecting new kinds of data, using existing data more effectively, and engaging with practitioners. For additional information, please contact Gene McHale ([gene.mchale@dot.gov](mailto:gene.mchale@dot.gov)) or David Kuehn ([david.kuehn@dot.gov](mailto:david.kuehn@dot.gov)).

STAFF UPDATES

### FHWA Rotational Assignment Looks at Planning Needs for Vehicle Automation



Jeremy Raw, a Community Planner from the FHWA Office of Planning, is on rotational assignment at the FHWA Office of Operations R&D from January to March 2015. Mr. Raw manages research projects that aim to deploy improved models and analytic techniques and provide technical assistance related to modeling and data analysis for other FHWA offices, State transportation agencies, and metropolitan planning organizations. As part of his rotational assignment, Mr. Raw will help to develop a research plan to direct FHWA in developing guidance for planning agencies to effectively consider the mobility and energy impacts of near-term vehicle automation deployments.

### FHWA's Mohammed Yousuf Appointed to FCC's Disability Advisory Committee



FHWA's Mohammed Yousuf was appointed to serve as an ex officio member of the Federal Communications Commission's (FCC) Disability Advisory Committee (DAC). The DAC was established to provide a means for stakeholders with interests in accessibility issues to exchange ideas, facilitate the participation of consumers with disabilities in proceedings before the FCC, and assist the FCC in educating the greater disability community and covered entities in disability-related matters. As a member, Mr. Yousuf will represent the viewpoints of FHWA on disability issues and develop recommendations for the full DAC's consideration.

