Federal Highway Administration (FHWA)
Research and Technology Update Newsletter

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Source: FHWA.

Federal Highway Administration (FHWA) Research and Technology (R&T) Story

FHWA champions R&T innovations to address the critical needs of the Nation's highway system. *The FHWA R&T Story* presents innovations that ensure the safety of vulnerable pedestrians, evaluates concepts for connected and automated vehicles and develops better ways to test for pavement deterioration. These innovations can help renew the highway system, spur economic recovery, reduce inequities, and protect against the impact of future climate scenarios. Please visit the R&T Story web page. (Federal Highway Administration 2021)

FHWA R&T Program Portfolio

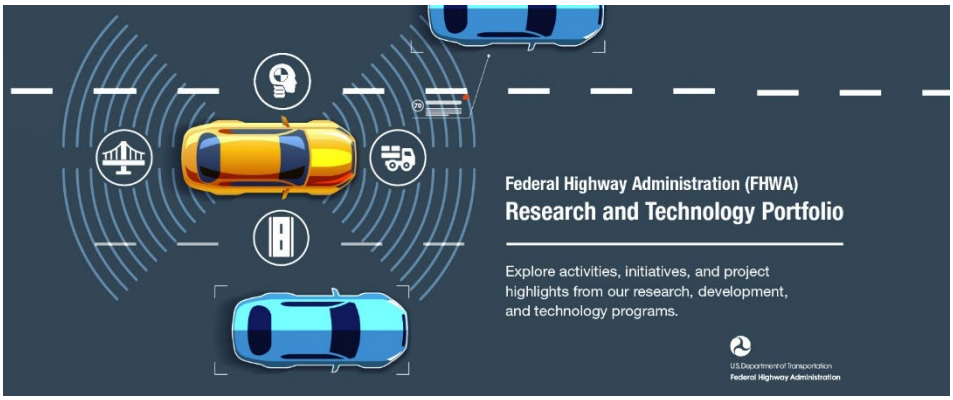
The new FHWA R&T Program Portfolio web pages provide a broad overview of FHWA's research and technology activities, initiatives, and projects. This portfolio is just a glimpse into our research and technologies. The R&T Portfolio covers the entire R&T Program, including agenda setting; research and development; technology testing and evaluation; deployment and evaluation of market-ready technologies and innovations; development of regulations and guidance; and technical assistance. Please visit the R&T Program Portfolio web page. (Federal Highway Administration. n.d.a.)

FHWA Works With the National Science Foundation (NSF) on Research to Assess the Benefits, Risks, and Barriers of Micromobility in Disadvantaged Communities

The FHWA Exploratory Advanced Research program, working with the Office of Human Environment, is supporting a funding supplement to an NSF award entitled Making Micromobility Smarter and Safer (M2S2). The research team from Rutgers University—in cooperation with the New Jersey Department of Transportation, local agencies, and communities—is taking a novel approach to assess the benefits, risks,

U.S. Department of Transportation
Federal Highway Administration

Turner-Fairbank Highway Research Center



Source: FHWA.

Figure 1. Illustration. FHWA Research and Technology Portfolio (Federal Highway Administration. n.d.a.).

and barriers of micromobility in disadvantaged communities, using novel approaches, including instrumented electronic scooters, mobile devices, and roadways.

Federal Data Resource Showcase

During National Library Week, April 3–9, more than 1,000 registrants attended the FHWA Research Library's Federal Data Resource Showcase webinars that explored data resources, their contents, and how to access them. The showcase featured 16 guest speakers from a diverse group of 9 U.S. Federal agencies.

For more information, contact Dawn Vanlandingham at dawn.vanlandingham@dot.gov or 202–493–3198.

Cooperative Driving Automation (CDA) Stakeholder Training

The FHWA Office of Safety and Operations Research and Development provided CARMA℠ tools, training, and technical support to the Florida Department of Transportation (FDOT) and several State universities that are interested in conducting CDA research with the FHWA suite of CARMA open-source tools. FHWA Saxton Transportation Operations Laboratory staff walked through use case exercises with FDOT and university staff to help them understand this emerging technology and in which areas they can focus their internal research to support and enable CDA in the transportation system. The two main topics FDOT requested include pedestrian safety or vulnerable road users and arterial management, which includes work zones, incidents, and weather events.

For more information, contact Dale Thompson at dale.thompson@dot.gov or 202–493–3270.

Traffic Optimization for Signalized Corridors (TOSCo) Project Demonstration

A TOSCo demonstration along Farm-to-Market Road (FM) 1960 in Houston, TX, included four partially automated vehicles traveling together through multiple signalized intersections. Researchers used connected vehicle technologies to decrease energy consumption and emissions by reducing idling, decreasing the number of stops, and reducing unnecessary accelerations and decelerations, which resulted in improved traffic flow through signalized intersections.

TOSCo employs vehicle-to-infrastructure communications as well as data from nearby vehicles using vehicle-to-vehicle communications. The application residing in the vehicle calculates the vehicle's optimal speed to pass through a signalized intersection on a green indication or the most optimal manner to decelerate to a stop and subsequently launch at the start of green.

For more information, contact Govind Vadakpat at g.vadakpat@dot.gov or 202–493–3283.

Source: FHWA.

Figure 2. Traffic Optimization for Signalized Corridors (TOSCo)-enabled cars in a cooperative adaptive cruise control string along Farm-to-Market Road (FM)1960 in Houston, TX.

Testing for Eco-Drive Study

FHWA is collecting data for the Eco-Drive study, also known as Exploring the Effects of Vehicle Automation and Cooperative Messaging on Mixed Fleet Eco-Drive Interactions study. This study is taking place at the Dominion Raceway in Thornburg, VA, and will identify driver acceptance and responses to eco-drive strategies (e.g., using infrastructure information and decelerating to reduce idle time, maintaining speed when approaching a green light) that a lead vehicle uses as it approaches a signalized intersection. This study aims to evaluate interactions between drivers, automated driving systems, and in-vehicle cooperative messages displayed at signalized intersections.

For more information, contact Jesse Eisert at jesse.eisert@dot.gov or 202–493–3284.

FHWA-HRT-21-087, *An Exploration of Pedestrian Safety Through the Integration of HSIS and Emerging Data Sources: Case Study in Charlotte, NC*, Available

The report introduces a proof of concept to spatially integrate Highway Safety Information System (HSIS) data with multijurisdictional and emerging datasets. To pilot the geospatial proof of concept, the project team developed a pedestrian count model to predict pedestrian volumes at locations without pedestrian counts and integrated speed information from probe data to supplement other roadway and contextual transportation data from several agencies. The report can be found here (Hamilton et al. 2021.).

For more information, contact Ana Eigen at ana.eigen@dot.gov or 202–493–3168.

Source: FHWA.

Figure 3. Illustration. The CARMA-Highway Driving Simulator (HDS) integration project.

Highway Driving Simulator—CARMA Integration

The Human Factors Team released the first version of the Turner-Fairbank Highway Research Center (TFHRC) Digital Twin project, the common simulation environment to be used as a common database between the HDS and CARMA Platform℠ tools. The CARMA Everything-in-the-Loop team has begun testing the Digital Twin environment successfully by demonstrating a simulated CARMA vehicle running in the CARMA simulation program around the TFHRC campus roads.

For more information, contact Brian Philips at brian.philips@dot.gov or 202–493–3468.

National Oceanic and Atmospheric Administration (NOAA) and FHWA Cofund Projects

NOAA and FHWA are collaborating and cofunding projects to address infrastructure and environmental considerations holistically, marrying the best coastal science on nature-based solutions for reducing coastal flooding with the best science on minimizing inundated pavement deterioration.

In 2022, FHWA awarded projects that exemplify its priorities of climate change and sustainability, equity and environmental justice, complete streets, economic strength, and safety for all road users. FHWA has notified two of the recipients of their selection for the 2022 Environmental Excellence award:

- Auburn University, University of South Alabama, and University of Wisconsin–Madison are developing an approach that

evaluates road damage from inundation and the effectiveness of nature-based approaches to mitigate inundation impacts in Alabama (National Centers for Coastal Ocean Science 2017a).

- University of New Hampshire, University of South Alabama, and Rockingham (NH) Metropolitan Planning Organization are identifying primary coastal processes that cause pavement deterioration and damage and evaluating nature-based solutions in coastal Alabama, New Hampshire, Massachusetts, and Maine (National Centers for Coastal Ocean Science 2017b).

For more information, contact Amir Golalipour at amir.golalipour@dot.gov or 202–493–3089.

National Highway Institute (NHI) Resilience Courses

NHI has developed the Addressing Climate Resilience in Highway Project Development and Preliminary Design courses to provide knowledge about these concepts and to describe example applications. The courses explore the relationship between engineering inputs and the design process, identify how conditions for those inputs may change in the future, and outline how to conduct a robust assessment of future risks and consequences to guide more effective decisions.

Source: FHWA.

Figure 4. The Human Factors Team testing detection of an articulated child pedestrian dummy.

The prerequisite web-based trainings are posted on the NHI website at the following links:

- *FHWA-NHI-142081: Understanding Past, Current and Future Climate Conditions*
- *FHWA-NHI-142082: Introduction to Temperature and Precipitation Projections*
- *FHWA-NHI-142083: Systems Level Vulnerability Assessments*
- *FHWA-NHI-142084: Adaptation Analysis for Project Decision Making*

For more information, contact Rob Kafalenos at robert.kafalenos@dot.gov or 202–366–2079.

Test Method for Ultra-High Performance Concrete (UHPC) Approved

As the highway community begins to engage UHPC-based solutions to address bridge design, construction, and maintenance challenges, FHWA recognized that there was a need for standardized tests to assess the engineering properties of this new generation of concrete. To address this need, FHWA developed the Standard Method of Test for Uniaxial Response of Ultra-High Performance Concrete. In coordination with the American Association of State Highway and Transportation Officials (AASHTO) Committee on Materials and Pavements, the test method, now given the designation of T 397-22, was refined and successfully balloted by AASHTO in late 2021 (AASHTO Forthcoming).

For more information, contact Ben Graybeal at benjamin.graybeal@dot.gov or 202–493–3122.

Every Day Counts (EDC)-6 UHPC for Bridge Preservation and Repair

FHWA's initiative to encourage the use of innovative UHPC-based bridge preservation and repair solutions is well underway. For departments of transportation beginning to consider this topic area, FHWA has developed an 8-h workshop. The workshop has been delivered 18 times to different audiences around the country, and

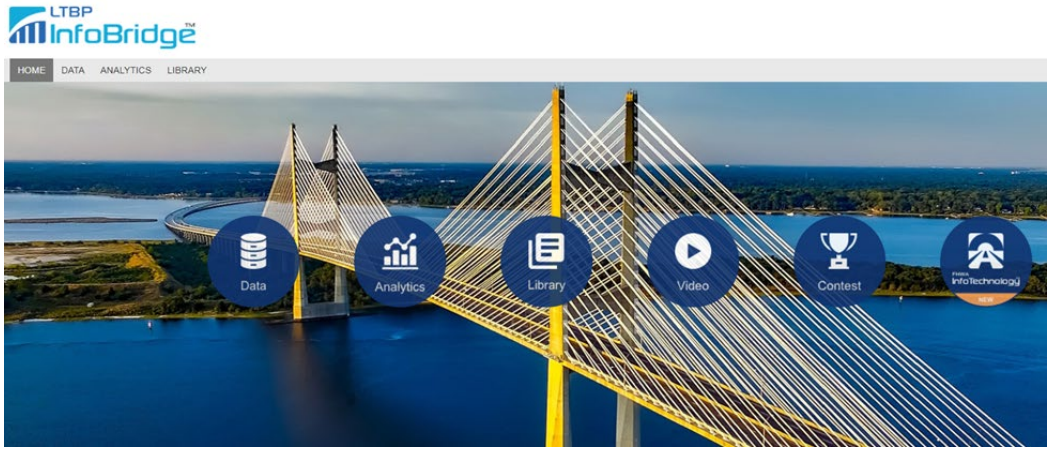
6 more are scheduled for later in 2022. The technical leads on the initiative have also developed design and construction recommendations that will be published soon. A four-part national webinar series is also being planned to raise awareness of these promising solutions within an engaging, compelling format. Finally, agency technical experts have been providing project-specific technical assistance to early adopters across the country as they encounter the types of challenges for which information sharing and expert advice can be quite valuable. To see examples of UHPC deployments, visit the interactive map on the TFHRC website (Federal Highway Administration. n.d.b.).

For more information, contact Zach Haber at zachary.haber@dot.gov or 202–493–3469.

Structural Design with UHPC

FHWA is continuing to support AASHTO's interest in developing structural design guidance for the use of UHPC in primary bridge components. To advance the state of knowledge in the topic area, FHWA embarked on a major experimental research study investigating key structural performance behaviors. The effort is bearing fruit, with these six peer-reviewed journal articles having been published recently. These research findings are key to informing the structural design guidance that the AASHTO Committee on Bridges and Structures is beginning to debate.

- El-Helou, R. G., Z. B. Haber, and B. A. Graybeal. "Mechanical Behavior and Design Properties of Ultra-High-Performance Concrete" (El-Helou, Haber, and Graybeal 2022).
- El-Helou, R. G., and B. A. Graybeal. "Flexural Behavior and Design of Ultrahigh-Performance Concrete Beams" (El-Helou and Graybeal 2022a).
- El-Helou, R. G., and B. A. Graybeal. "Shear Behavior of Ultrahigh-Performance Concrete Pretensioned Bridge Girders" (El-Helou and Graybeal 2022b).
- Mohebbi, A., and B. Graybeal. "Prestress Loss Model for Ultra-High Performance Concrete" (Mohebbi and Graybeal 2022).
- Mohebbi, A., B. Graybeal, and Z. Haber. "Time-Dependent Properties of Ultrahigh-Performance Concrete: Compressive Creep and Shrinkage" (Mohebbi, Graybeal, and Haber 2022).
- Muzenski, S., Z. B. Haber, and B. Graybeal. "Interface Shear Behavior of Ultra-High-Performance Concrete" (Muzenski, Haber, and Graybeal 2022).



Source: FHWA.

Figure 5. Screenshot of FHWA InfoBridge home page (Federal Highway Administration n.d.c.).

For more information, contact Ben Graybeal at benjamin.graybeal@dot.gov or 202–493–3122.

Robotic Utility Mapping and Installation (RUMI) System

FHWA took possession of the RUMI prototype robot that was developed under the Small Business Innovation Research Program as a tool for subsurface utility detection. RUMI autonomously surveys an area and constructs a three-dimensional map, which is displayed in augmented reality to provide real-time situational awareness. The robot is now housed within FHWA's Nondestructive Evaluation Laboratory.

For more information, contact Morgan Kessler at morgan.kessler@dot.gov or 202–493–3187.

Source: FHWA.

Figure 6. Robotic Utility Mapping and Installation (RUMI).

Long-Term Infrastructure Performance Student Data Analysis Contest

The Long-Term Infrastructure Performance Student Data Analysis Contest is now open for the 2022 year. Students are encouraged to use data, information, and tools from Long-Term Pavement Performance InfoPave™ or Long-Term Bridge Performance (LTBP) InfoBridge™ to address specific highway infrastructure challenges. The contest guidelines are on the InfoPave and InfoBridge web portals (Federal Highway Administration. n. d.d. and Federal Highway Administration. n.d.e.). Papers are due by July 29, 2022.

For more information, contact Jean Nehme at jean.nehme@dot.gov or 202–493–3042.

Recent Enhancements to InfoBridge

The most recent version of InfoBridge, released in November 2021, features several usability enhancements, including tools and projects that resulted from LTBP research studies. Highlights of some of the enhancements include an asset valuation tool, a bridge performance transition forecast, a new module on historical changes to concrete shear design, and data collected on experimental bridges. For a complete list of new InfoBridge features and enhancements, visit https://infobridge.fhwa.dot.gov/Page/infobridge_update_notes (Federal Highway Administration n.d.c.).

For more information, contact Jean Nehme at jean.nehme@dot.gov or 202–493–3042.

Forever Open Road (FOR)

FHWA is working with the Forum of European National Highway Research Laboratories (FEHRL) on an update of the Resilient Road element of the FOR Program. FHWA is part of an ad hoc working group. At an April meeting, the FEHRL Research Committee reviewed the draft update and planned a final review and approval for the fall General Assembly meeting. The other two elements of FOR are the Automated Road and the Adaptable Road. The FOR document contextualizes moving research toward implementing new technologies and building opportunities to cooperate on research and pilot deployments with national road administrations or the European Commission. Documents are located at https://www.foreveropenroad.eu/ (Forum of European National Highway Research Laboratories n.d.).

Transportation Pooled Fund (TPF) Excellence Award

FHWA is partnering with the AASHTO Research Advisory Committee to further promote research, innovation, and excellence through a proposed TPF Program Excellence Award. The award would be given biannually to two TPF studies that have significantly advanced national research efforts in the areas of safety, economic growth, equity, climate solutions, or transformation. The TPF Program has existed for more than 45 yr and has enabled public and private entities to combine resources to conduct high-priority research on a wide variety of shared, highway-related problems. By pooling funds and expertise, participants develop innovative solutions at a lower cost while extending the reach and impact of their research. The TPF Excellence Award would help bring additional knowledge, recognition, and support for the excellent collaborative work being done through the TPF Program. The award program is in the early stages of development; additional information, including nomination materials, will be sent out soon.

For more information, contact Tricia Sergeson at patricia.sergeson@dot.gov or 202–493–3166.

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