

Strategic Objective 3.3—Improve System Efficiency

Improve the efficiency of the Nation's transportation system through transportation-related research, knowledge sharing, and technology transfer.

PERFORMANCE OVERVIEW

Transportation research has little value if its technological outcomes are not transferred to those that might apply them. DOT will facilitate the exchange of knowledge and technologies by streamlining processes for partnership agreements and increasing awareness of commercialization and technology transfer opportunities. DOT will also pursue additional innovations through international dialogues such as the International Transportation Forum, cooperation agreements with global partners, and international research initiatives.

DOT Operating Administrations: Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Railroad Administration (FRA), and Office of the Secretary (OST).

Highways Research and Development (FHWA)

Overview

Through Highway Research, Technology and Education (RT&E) programs, FHWA conducts and coordinates research and development to generate innovative solutions to highway and transport challenges. The Agency also undertakes significant technology deployment to accelerate the use of more effective decision-making information and cutting-edge practices and tools that allows our country to make the best investments in the Nation's transportation system.

Three components of the RT&E program are necessary to cover all phases in the innovation life cycle.

- The R&D program encompasses advanced and applied research, by exploring new areas of research as well as developing and testing new products and services that can provides short-term benefits for the Nation's transportation system.
- Once a new product or technology has gone through initial testing and evaluation and is proven to provide value, the Technology and Innovation Deployment Program (TIDP) supports its implementation through the delivery and deployment phase, which includes further refined testing and evaluation, market research, and marketing and communication to the wider community.
- The third component is the Training and Education (T&E) Program, which supports training the current and future transportation workforce. This program is discussed in more detail under the Dynamic Workforce strategic objective.

Progress Update

In 2009, FHWA launched Every Day Counts (EDC) in cooperation with AASHTO to speed up the delivery of highway projects and to address the challenges presented by limited budgets. EDC is a State-based model to identify and rapidly deploy proven but underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce congestion and improve environmental sustainability. Through the EDC model, FHWA works with State and local transportation agencies and industry stakeholders to identify a new collection of innovations to champion every two years. Innovations are selected collaboratively by stakeholders, taking into consideration market readiness, impacts, benefits and ease of adoption of the innovation. After selecting the EDC technologies for deployment, transportation leaders from across the country gather at regional summits to discuss the innovations and commit to finding opportunities to implement the solutions that best fit the needs of their state highway programs.

Information gathered at the summits is brought back to State Transportation Innovation Councils (STICs), which bring together public and private transportation stakeholders to evaluate innovations and spearhead their deployment in each State. EDC's collaborative, State-based approach to deploying innovation enables states to be in the driver's seat and decide which innovations will work best for them and their customers. Working through STICs or similar groups, States can consider innovations FHWA recommends, along with technologies and practices from sources such the AASHTO Innovation Initiative and the second Strategic Highway Research Program, and adopt those that add value to their highway programs. Currently, 46 States, D.C., and Puerto Rico have established STICs. With a STIC in nearly every

State, there is a national network to exchange best practices for widespread use of innovation across the Nation.

Every state transportation agency has used eight or more of the 32 innovations promoted under the initiative, and some have adopted more than 20. Several of those innovations are now mainstream practices in many states. The initiative has also fostered a transportation workforce that is adept at putting innovation to work to address transportation challenges. Provisions for continuation of the EDC initiative included in the FAST Act serve as recognition of the overall success and impact the initiative has made. The following highlights provide a glimpse of innovation deployment by State and local transportation agencies along with the resulting benefits:

- Since October 2010, more than 2,500 replacement bridges have been designed and constructed using accelerated bridge construction technologies. For example, the Nevada DOT replaced two bridges using slide-in bridge construction, which saved an estimated \$12.7 million in time and fuel costs for commuters. The Rhode Island DOT replaced a 57-year old bridge using prefabricated superstructure, substructure and foundation systems. This allowed the contractor to replace the bridge in 33 days instead of the six months required for traditional methods, saving road users about \$2 million.
- During EDC, Division Offices and State DOTs have initiated, revised, or expanded over 250 programmatic agreements to establish a streamlined process for handling routine environmental requirements. All 50 States, Washington, DC and Puerto Rico have programmatic agreements in place with 37 States having two or more. For example, the Oregon Endangered Species Act programmatic agreement with National Marine Fisheries Service resulted in a reduction in the review time by 85 percent, from 170 days to 30 days per biological assessment.
- From 2009 to 2013, warm-mix asphalt use increased from about five to 30 percent of the total asphalt produced, resulting in savings of over \$600 million in fuel use during production. In total, 47 State DOTs and all Federal Lands Highway Divisions have a specification and/or contractual language allowing warm-mix asphalt on Federal-Aid or Federal Lands projects.
- Prior to EDC, approximately 12 agencies were using Adaptive Signal Control Technology, or ASCT, to adjust the timing of traffic lights to accommodate changing traffic patterns and ease traffic congestion. Now, over 100 agencies are implementing this technology.

FHWA launched an Incentive Program that offers technical assistance and funds, of up to \$100,000 per STIC per year, to support the costs of standardizing innovative practices in a State transportation agency or other public STIC stakeholder. In FY 2015, a total of \$4.2 Million was awarded to 44 STICs and a FLH TIC to fund a variety of projects. For example, the Vermont Transportation Agency is using STIC Incentive funds to develop a design-build guidance document, the Utah DOT is developing a 3D utility database, and the North Carolina DOT is developing a local public agency certification program.

FHWA also launched the Accelerated Innovation Deployment (AID) Demonstration Program in 2014. The AID Demonstration Program provides incentive funding to offset risk of using an innovation on a project. Under this program, funds are available to implement an innovation in

any aspect of highway transportation including planning, financing, operation, structures, materials, pavements, environment, and construction on any project eligible for assistance. The funding award is for the full cost of the innovation on a project up to \$1 million. A total of \$45 million was allocated to fund the program and, 45 awards have been issued totaling \$33.8 million since the program was started.

The Strategic Highway Research Program 2 (SHRP2) complements the EDC and STIC initiatives. In coordination with AASHTO, FHWA is encouraging transportation agencies to field test the results of more than 100 research projects, referred to as SHRP2 Solutions, to determine if they will ultimately be adopted as standard business processes and practices. FHWA's Implementation Assistance Program (IAP) offers financial and technical assistance to eligible State DOTs, MPOs, local transportation entities and others to help offset the costs and risks of early adoption of innovation. Below are some highlights of FHWA's achievements with SHRP2 implementation.

- The first six rounds of the IAP put more than 40 SHRP2 solutions to work on 350 projects in all 50 States, the District of Columbia, and Puerto Rico. In addition to State DOTs, MPOs, and local agencies, IAP participants include Tribal agencies, regional councils of governments, tolling authorities and FHWA Federal Lands Divisions.
- FHWA and AASHTO have instituted a programmatic process to evaluate the success of SHRP2 solutions based on outcome, output, and impact metrics. Baseline data have been gathered for many of the SHRP2 products under implementation and will be collected via various methods for products not yet implemented or for which no data were originally gathered.
- FHWA and AASHTO have a broad audience for marketing, communications, and education about SHRP2 solutions, reaching out to State DOTs, MPOs, and regional, local and Tribal organizations. Information about SHRP2 is widely disseminated through ongoing outreach to transportation agencies and other practitioners, both directly and through numerous national associations and organizations. In July 2015, FHWA announced the selection of 10 universities that are receiving cooperative agreements under the SHRP2 Education Connection initiative to incorporate SHRP2 solutions into their existing coursework in a variety of disciplines.
- Internationally, FHWA shares SHRP2 updates with the Forum of European Highway Research Labs, or FEHRL, and there has been interest in including SHRP2 products in the European Road Authority's innovation and technology program. Additionally, the Australian Road Research Board, or ARRB, is currently reviewing selected SHRP2 Solutions for implementation by road agencies in Australasia.

Information Gaps

In order to better assist our most important partners, the State Departments of Transportation (DOTs), FHWA launched the Top Three initiative to solicit input from State DOTs regarding their top three challenges that could potentially be solved or improved through research and technology solutions. Through this initiative, FHWA's RT&E program is increasing support to the States, ensuring that their most important concerns are taken into consideration when setting an agenda for the FHWA RT&E Programs. The input received from the States was analyzed and the potential additions to FHWA's research roadmaps are being identified.

FHWA is developing a performance and evaluation system for its RT&E program to assess and communicate its value and effectiveness and to ensure that stakeholders and Congress understand their return on investment of Federal funds. Reports for the first set of programs and projects were completed and are undergoing final review. Simultaneously, data collection has begun for a second wave of project evaluations.

Key Strategies

R&D program supports research in a variety of mission-critical area and ultimately provides transportation policymakers with information and data that allows them to make more informed decisions. The R&D program includes FHWA's advanced and applied research, and facilitates national and international coordination and collaboration to leverage knowledge and develop solutions to address current and emerging highway transportation needs. The R&D program is closely coordinated with, but does not duplicate, research and development conducted through the University Transportation Center Program, the Intelligent Transportation System Program, the pooled fund National Cooperative Highway Research Program, and State-based research and technology initiatives.

The TIDP undertakes final analyses, pilots, demonstrations, marketing, communications, and promotional activities that will accelerate the adoption of a product or service by the States and other governmental entities. As described earlier, FHWA administers the EDC initiative, STIC Incentive Program, AID Demonstration Program, and SHRP2 under the TIDP established under MAP-21 and continued under the FAST Act

FHWA is an active participant in the Small Business Innovation Research (SBIR) Program, in which more than 2.5 percent of all extramural research funds are contracted to small businesses to develop products to support the highway transportation industry. For example, a small business developed a new stereovision-based approach for detecting pedestrians at intersections. Based on a concept borrowed from military tracking, the company used a new light-emitting diode stereo camera and advanced pedestrian-detection algorithms to distinguish pedestrians and vehicles on the roadways. FHWA and the FTA are collaborating on a follow-up project to research whether the information from the project can be used in connected-vehicle research to greatly reduce pedestrian fatalities. Another SBIR project developed a smartphone application that alerts pedestrians before crossing the street. Sending signals between the pedestrian's phone and the traffic signal box, the application becomes a warning sign to notify when it's safe for the pedestrian to step into the crosswalk.

FHWA is also actively pursuing Cooperative Research and Development Agreements (CRADA), to enhance innovation and the acceptance of new ideas. Examples of recent CRADAs, which are established with privately-owned firms, include an agreement to examine the use of laser shearography in evaluating asphalt binders, asphalt mixtures and pavements; and an agreement to test the production of durable, sustainable, cost-effective, hydration-free construction material.

Next Steps

FHWA will continue to promote the use of innovative products and services by:

- Developing and evaluating more durable and sustainable pavements, such as Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles mixes;

- Studying and evaluating the benefits of deploying low-cost highway safety countermeasures, such as offset improvements for left-turn lanes, increased retro reflectivity at stop signs, and lane and shoulder width combination on rural, two-lane, undivided roads;
- Continuing EDC implementation efforts in 2016 to deploy 11 innovations;
- Promoting the use of a STIC at the State level and provide funding incentive support through the STIC Incentive and AID Demonstration programs;
- Soliciting ideas for EDC-4, making selections with stakeholders, preparing for launch of EDC-4, and ultimately supporting deployment efforts of the selected innovations in 2017-2018.
- Working with its partners to implement SHRP2 solutions and evaluate the success of the products themselves and the deployment methods. The selections for round 6 were announced this past year and round 7 will launch in April 2016.
- Continuing to use T&E Program funds to support the delivery of a wide variety of services and products, such as instruction in the latest technologies and best practices in highway construction through the National Highway Institute; technology transfer centers in all 50 states, Puerto Rico, and regional centers serving Native American Tribal governments; freight planning capacity building in transportation planning; and strategic programs and activities in the areas of environment, surface transportation safety, rural safety, and project finance; and
- Advancing the objectives of the Long-Term Pavement Performance program (LTPP) and the Long-Term Bridge Performance program (LTBP).

Goal Leaders

Michael Trentacoste, Associate Administrator for Research, Development and Technology, Federal Highway Administration

Tom Harman, Director, Center for Accelerating Innovation, Federal Highway Administration

Amy Lucero, Director of Technical Services, Federal Highway Administration

Railroad Research and Development (FRA)

Overview

FRA's Research and Development (R&D) program enables the safe, reliable, and efficient movement of people and goods through basic and applied research and development of innovations and solutions. It does so by providing the scientific and engineering basis for safety rulemaking and enforcement. FRA also collaborates with the railroad industry to develop and implement new technologies and practices that improve overall system safety. R&D produces long-term benefits. The work that began 5 to 10 years ago contributes to today's safety record.

Progress Update

Recent examples of successful rail safety R&D include crashworthiness research that led to improved passenger rail car safety; analysis of vehicle-track interaction that led to revised track

safety and vehicle qualification standards; development of a freight train braking algorithm that enables achievement of positive train control safety benefits without adversely affecting operations; and safety culture pilot programs that have reduced the number of human factors caused accidents and incidents.

Key Strategies

FRA R&D will continue to focus on the most pressing safety challenges. For example, R&D FRA full-scale testing and computer modeling will lead to improvements in the crashworthiness of passenger equipment and training and software development will support passenger and commuter railroads' safety culture programs. In addition, FRA's R&D program is developing new technologies for highway-rail grade crossing protection and train to vehicle communication to reduce the number of incidents. Regarding the safe transportation of energy products, FRA focus areas include tank car and rail integrity and developing the scientific and engineering foundation to continue revamping of FRA's track safety regulations.

Goal Leader

Dr. John Tunna, Director, Research, Development, and Technology Program, Federal Railroad Administration