FHWA Research and Technology Evaluation Program

The Federal Highway Administration's (FHWA's) Research and Technology (R&T) Evaluation Program seeks to assess and communicate the benefits of the FHWA Research and Technology program to ensure that we are expending public resources efficiently and effectively.

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Goals and Priorities

FHWA conducts research and technology development to meet the transportation challenges of today and tomorrow. FHWA partners with State transportation departments, local agencies, industries, and academia both to conduct research on issues of national significance and to accelerate adoption and deployment of promising research products.

The FHWA R&T Agenda presents the mission and priorities of research and technology activities.[1] The R&T Agenda identifies six high-priority highway challenges: (1) advancing safety toward zero deaths, (2) improving the mobility of people and goods, (3) maintaining infrastructure integrity, (4) enhancing system performance, (5) promoting environmental sustainability, and (6) preparing for the future. The R&T Agenda is intended to catalyze collaboration and accelerate innovation.

FHWA initiated its R&T Evaluation Program to increase transparency, better communicate research benefits, and continually improve R&T efforts in the service of the public good.

Evaluation Activities

In Fiscal Year (FY) 2014, the FHWA R&T Evaluation Program worked with 9 FHWA offices to identify and scope 16 projects for evaluation across all program areas. Formal evaluation began in FY15, and as of the end of FY16, five projects are complete with five more to be completed in FY17. The two lists (see sidebar) show which evaluations have been completed and which remain ongoing.

FHWA developed the R&T Evaluation Program with encouragement from the Transportation Research Board's Research and Technology Coordinating Committee (RTCC). In a September 2016 report, the RTCC communicated its belief that the evaluation program is making "commendable progress" and that the evaluation teams are drawing useful and appropriately cautious interpretations from imperfect data collected in complex situations.[2]

Completed

- Adaptive Signal Control Technologies
- Eco-Logical *
- Geosynthetic Reinforced Soil Integrated Bridge System *
- Gusset Plate
- National Household Travel Survey
- Roadside Revegetation
- Roundabouts

Ongoing

- Agent-Based Simulation Models *
- eNEPA
- High Friction Surface Treatments
- High Recycle Warm Mix Asphalt
- Managing Risk on Rapid Renewal Projects
- Precast Concrete Pavements
- Public-Private Partnership Capacity Building *
- Traffic Incident Management Training *
- Vehicle Operating Costs

* Expected FY17

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Summary of Findings

The seven completed evaluations documented program successes and challenges.

Adaptive Signal Control Technologies (ASCTs) adjust signal timing to alleviate congestion and delay. Findings include the following:

- Adaptive Control Software (ACS) Lite and other FHWA programs increased demand for additional systems and directly influenced 4 out of 16 ASCTs on the market today.
- The Every Day Counts (EDC) Program sped ASCT adoption by agencies at the tipping point. Of surveyed adopters, 48 percent used EDC resources. Only 18 percent of non-adopters used EDC resources.
- FHWA's efforts supported the development of 25 percent of the 200 deployments now in use.
- Expense and complexity of ASCTs along with doubts about performance still pose barriers to adoption.

Recommendations include the following:

- From the beginning of a research program, plan for technology transfer to user products, market acceptance, ease of deployment, and evaluation of the program.
- Share the details of research programs and market products throughout FHWA to improve outreach.

Eco-Logical, developed as part of the second Strategic Highway Research Program (SHRP2), articulates a vision for an infrastructure development process that endorses ecosystem-based mitigation through integrating plans and data across agency and disciplinary boundaries. Findings include the following:

- FHWA funding allowed agencies to pursue previously planned activities sooner, more comprehensively, and with broader stakeholder buy-in.
- Agencies faced challenges working with partners because of differing missions, staff turnover, and varying levels of support for Eco-Logical activities from Federal staff at headquarters and regional offices.
- Eco-Logical led to improved integrated planning between environment, transportation, and land use, and many recipients incorporated Eco-Logical into their long-range transportation planning and project prioritization process.
- Projects typically spanned 2–3 years, and there was little reporting on impacts. Most comments related to impacts were positive.

Left: GRS-IBS. Source: FHWA. Right: Adaptive signal. Source: Photo by Jeremy Brooks / CC BY-NC 2.0

Recommendations include the following:

- Recipient agencies would like FHWA to provide peer exchanges, webinars, and case studies on Eco-Logical.
- FHWA should ensure headquarters and regional staff are aware of program details so that consistent information is provided to stakeholders about the program.
- FHWA should adopt a set of questions to track the yearly progress of recipient agencies and to objectively evaluate progress on the Eco-Logical approach long-term.

Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS) enables the construction of bridges made of closely spaced layers of geosynthetic textile and compacted granular fill material that blend the roadway into the superstructure. Findings include the following:

- FHWA efforts fostered positive attitudes toward GRS-IBS and more market share during 2010–2015 than in 2005–2009.
- Internal disagreements, including between geotechs and hydrologists, led users to receive conflicting information.
- Deployers reported saving money (up to 66 percent) and time. Presence of water and noncompetitive bidding drives costs.
- GRS-IBS possesses several attributes of a disruptive technology, including its value proposition, but growth potential is constrained by priorities and local geography.

Recommendations include the following:

- Make market research part of engineering research to improve pitching upcoming products to stakeholders.
- Improve protocol concerning internal disagreements about FHWA technologies to ensure the public receives a uniform message.

Completed evaluation reports are available on FHWA's R&T website: http://www.fhwa.dot.gov/research/fhwaresearch/agenda/resources.cfm

Gusset Plates join structural components in steel bridges and buildings. After part of the I–35W Bridge in Minneapolis collapsed in 2007, the National Transportation Safety Board (NTSB) investigators sought expertise from FHWA, which launched projects on inspection, quality assurance, and training. Findings include the following:

- FHWA's technical expertise in bridge infrastructure and its prior history of working with NTSB was critical during the bridge investigation.
- FHWA's decision to jointly fund the National Cooperative Highway Research Program (NCHRP) effort accelerated the research, which started less than a year after initial scoping.
- Active engagement of transportation stakeholders by FHWA expedited delivery of new information on gusset plate design and load rating and closing of NTSB recommendations.

Recommendations include the following:

- FHWA should continue to make flexible research funding available for special cases and emergencies.
- FHWA should continue to explore ways to include external input on high-profile research such as the NCHRP panel used for this project.

The National Household Travel Survey (NHTS) provides the only data in the country linking individual personal travel behavior, household demographic and socioeconomic characteristics, vehicle ownership, and vehicle attributes. Findings include the following:

- Half the publications using the 2014 NHTS are in transportation fields with the non-transportation share on the rise. Website data access is also increasing.
- Interviews suggest the survey informs policy and legislative decisions within transportation and other fields.
- NHTS reaches out to its user community through its website, direct contact, and formal events.

Recommendations include the following:

- Conduct the NHTS on a more regular and frequent cycle.
- Institutionalize adequate funding and staffing.
- Conduct more outreach, including with Congressional Policy Staff.

Roadside Revegetation involves establishing or reestablishing appropriate plant material in areas that road construction projects disturb. Revegetation's benefits include soil and slope stabilization, water quality improvement, aesthetic development, carbon sequestration, weed suppression, and wildlife habitat enhancement. Findings include the following:

Left: Gusset plate. Source: FHWA. Right: Roundabout. Source: Photo by Michael Quinn / CC BY 2.0

- End users have adopted the roadside revegetation practices, using the guide as a reference tool to reinforce practices that agency policies already mandated.[3]
- Survey respondents and interviewees report that roadside revegetation has improved erosion protection, sustainability, environmental stewardship, and visitor experience.

Recommendations include the following:

- Reach a wider audience (especially within FHWA Division Offices) and enhance the community of practice.
- Tailor future training courses to personnel without a natural resource background.

Roundabouts attracted international interest as a safety countermeasure in the 1970s. FHWA initiated domestic research of roundabout safety and design in the mid-1990s, later adding training and technical assistance. Findings include the following:

- Early and continued FHWA research increased the quality and availability of domestic roundabout-related safety and performance information.
- FHWA efforts increased awareness and changed attitudes toward the roundabout as a safety countermeasure, contributing to an increase in U.S. deployments.
- The 2,400 roundabouts built in the United States between 1990 and 2014 averted between 38,000 and 53,000 injury crashes with societal cost savings estimated over $9 billion.

Recommendations include the following:

- Invest in data collection on research diffusion and technology adoption during the early years of implementation.
- Learn from this example of internal coordination, which led to a unified message to stakeholders.
- Conduct additional research to understand roundabout costs and develop strategies for cost reduction.

Ongoing Evaluations

Agent-Based Modeling and Simulation Research involves computationally simulating the actions of autonomous individuals to characterize driver and traveler behavior.

eNEPA is an online workspace and collaboration forum for projects requiring an environmental impact statement or an environmental assessment.

High Friction Surface Treatments involve the overlay of calcined bauxite on a base of epoxy along portions of roadways susceptible to vehicle slippage.

High Recycle Warm Mix Asphalt involves the use of recycled materials and asphalt that producers can place on the road at lower temperatures, which may reduce material going to landfills, energy consumption, and emissions.

Managing Risk on Rapid Renewal Projects produced a guide through SHRP2 that provides practical tools and techniques for States to minimize risk and exploit opportunities.

Precast Concrete Pavement is an innovative practice developed through SHRP2 that uses prefabricated concrete panels for roadway maintenance to save construction time.

The Public-Private Partnership Capacity Building Program evaluation focuses on the Public-Private Partnership (P3) Toolkit released in June 2013. The P3 Toolkit is an educational resource containing analytical tools and guidance documents to assist in implementing P3 projects.

Traffic Incident Management Trainings teach a coordinated multidisciplinary process to detect, respond to, and clear traffic incidents as safely and as quickly as possible to restore traffic flow. The trainings are part of SHRP2.

Vehicle Operating Costs calculations are currently based on a 1982 study. More recent developments permit the model to be efficiently and effectively updated.

Above: Traffic Incident Management. Source: Photo by Oregon DOT / CC BY 2.0

Cross-Cutting Recommendations

Across the completed and in-progress evaluations, two particularly notable and actionable recommendations include:

- Improve protocols for research dissemination, including resolving internal disagreements to achieve uniform messaging and external marketing activities with stakeholders. The Roundabouts program demonstrated how to achieve internal coordination and uniform messaging and might serve as a best case to learn from and duplicate in the future.
- Further incorporate evaluation into the research process, including collecting baseline measures and regularly tracking dissemination activities (downloads, webinars, trainings) and deployments.

1 Federal Highway Administration (2017), *Research and Technology Agenda,* Available online at http://www.fhwa.dot.gov/research/fhwaresearch/agenda. Last accessed on 4/17/2017.

2 Transportation Research Board (2016), *Research and Technology Coordinating Committee Report,* The National Academies Press. Available online at http://nap.edu/23588. Last accessed on 10/27/2016.

3 Federal Highway Administration (2007), *Roadside Revegetation: An Integrated Approach to Establishing Native Plants.* Vancouver, WA: Western Federal Lands Highway Division.

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