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Autumn 2024

e-Construction Pilot Project in Lincoln, Nebraska

Also in this Issue:

Moving Goods from Farm to
Market Facing Data Challenges

Pilot Program Creating Skilled
Transportation Workers

Tapping Global Best Practices to
Better U.S. Transportation System



U.S. Department
of Transportation

**Federal Highway
Administration**

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Autumn 2024 | Vol. 88, No. 3

FEATURES

8 Standardizing e-Construction: A Pilot Project in Lincoln, Nebraska

Achieving Project Efficiencies
Through Technology

by *Lonnie Burklund* and *Marc Rosso*

14 Celebrating Innovation and Collaboration: Debut of the TPF Excellence Awards

Showcasing groundbreaking research and
innovation, the inaugural TPF Excellence Awards
honors the outstanding achievements made
by partners across the transportation sector.

by *Tricia Sergeson*, *Zachary T. Bergeron*,
and *Michael York*

20 From Farm to Market: The Data Challenges of Rural Roads

Using data and effective practices to
identify and analyze the role of rural roads
in safe and efficient goods movement.

by *Birat Pandey* and *Amber Reimnitz*

26 Accelerating U.S. Innovation: Bringing Global Innovations to U.S. Highways

How the Federal Highway Administration
transfers applicable technologies and
best practices from overseas.

by *Hana Maier*

34 Reentry Workforce Training Pilot Programs for Incarcerated Individuals

New initiatives offering employment, life
skills training, and supportive services
while creating a pipeline of skilled workers
for the transportation industry.

by *Andrea Kirk*

DEPARTMENTS

Guest Editorial	2
What's New	4
Innovation Corner	6
Along the Road	38
Training Update	43



ABOVE: A handful of States across the Nation have laws that formalize the designation and funding for roads that connect farms to markets.

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COVERS: The use of e-Construction methods and best practices is providing Lincoln, NE, with next-level processes, efficiency, and collaboration on its projects.

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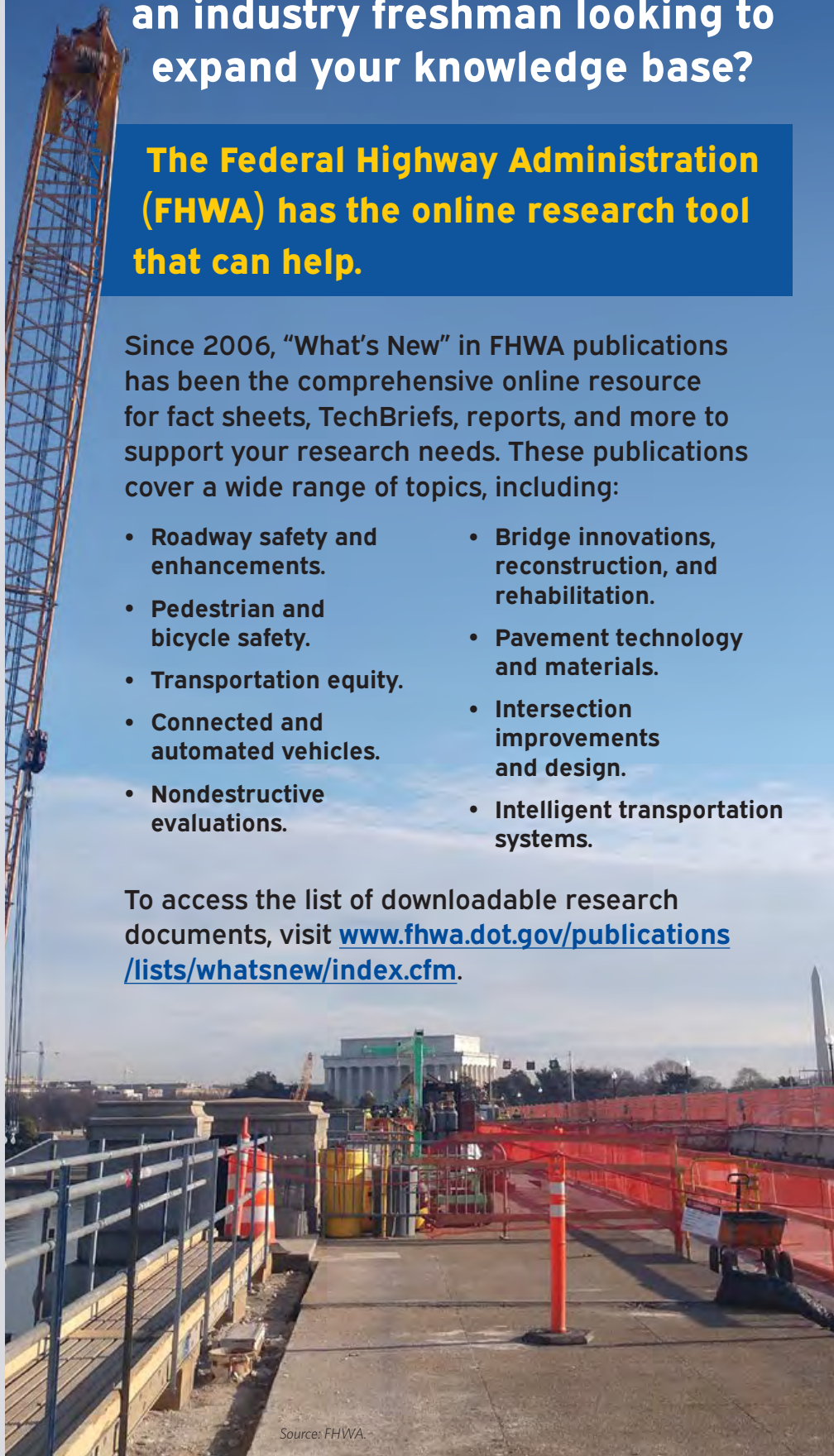
Are you a longtime transportation professional conducting new research on a particular topic? Or an industry freshman looking to expand your knowledge base?

The Federal Highway Administration (FHWA) has the online research tool that can help.

Since 2006, "What's New" in FHWA publications has been the comprehensive online resource for fact sheets, TechBriefs, reports, and more to support your research needs. These publications cover a wide range of topics, including:

- Roadway safety and enhancements.
- Pedestrian and bicycle safety.
- Transportation equity.
- Connected and automated vehicles.
- Nondestructive evaluations.
- Bridge innovations, reconstruction, and rehabilitation.
- Pavement technology and materials.
- Intersection improvements and design.
- Intelligent transportation systems.

To access the list of downloadable research documents, visit www.fhwa.dot.gov/publications/lists/whatsnew/index.cfm.



Source: FHWA



Enhancing the Road Transportation System Through Global Collaboration

Through technical assistance and distribution of funds to State and local governments, the Federal Highway Administration is responsible for ensuring that America's roads and highways continue to be among the safest and most advanced in the world. FHWA's Office of International Programs (HPIP) supports this responsibility by providing the U.S. highway community with access to global best practices and technical innovations that help to advance our transportation system.

The HPIP employs the following four main mechanisms that work together and cross-pollinate—with developments in one area sometimes leading to opportunities in others:

(1) Global Benchmarking Program (GBP); (2) Multinational Relations Programs; (3) Binational Relations Programs; and (4) the International Visitors Program (IVP).

The GBP is a tool used by FHWA to identify, evaluate, document, and implement proven foreign innovations that have the potential to significantly improve highway transportation in the United States. This process is accomplished through focused study missions that connect FHWA and U.S. subject matter experts with transportation advances and counterparts abroad. In this issue of *PUBLIC ROADS*, you will read about GBP's proven track record of advancing innovation through the implementation of study findings and recommendations in the U.S. context in "Accelerating U.S. Innovation: Leveraging Global Best Practices/Bringing Global Innovations to U.S. Highways."

The Multinational Relations Program, which features U.S. participation in international organizations, is also a cost-effective mechanism to exchange technologies and best practices with foreign counterparts. For example, FHWA is the lead organization representing the United States within the World Road Association known globally as PIARC (Permanent International Association of Road Congresses). PIARC brings together road administrations from more than 120 countries to exchange information on innovative road practices. FHWA is also actively engaged in the Forum of European National Highway Research Laboratories. Led by our colleagues at the Turner-Fairbank Highway Research Center, this collaboration enhances innovation through coordination of emerging research with European national highway laboratories. Most recently, FHWA has become a participating member of the International Federation for Structural Concrete facilitating

continued international collaboration to advance technologies and practices that improve the resiliency of concrete bridges.

Another mechanism used by FHWA to facilitate international knowledge exchange and transfer is the Binational Relations Program, which develops and leverages government-to-government relationships with countries around the world. For example, a joint U.S.–Japanese relationship that began more than 50 years ago provides an ongoing framework for collaboration and knowledge exchange. The value and trust developed through this relationship enabled FHWA to send a team to survey bridge and geotechnical asset damage from the earthquake that struck the Noto Peninsula in Japan on January 1, 2024. Subject matter experts from FHWA observed the damage firsthand and collected valuable information on the performance of assets in the earthquake and the effectiveness of previous retrofits and repairs (among other data) that will directly impact U.S. efforts to mitigate against seismic events.

FHWA also recently initiated a technology transfer reengagement effort in Africa, focusing on subjects identified by African countries, such as road safety, electric vehicles, and innovative materials, all of which align with FHWA's priorities. In support of this reengagement, FHWA staff participated in the 9th Africa Regional Transportation Technology Transfer Conference in May 2024. FHWA presented the U.S. perspective on sustainable road infrastructure management and road safety and exchanged ideas and best practices with several countries from southern Africa.

Finally, HPIP's IVP facilitates sharing road-related information between FHWA staff and their foreign counterparts through topic-specific meetings, as well as study tours with FHWA program offices, State departments of transportation, local transportation agencies, and other stakeholders.

Through its mission of sharing and exchanging technology and information with other countries, HPIP contributes to the mission of ensuring the United States has a world-class transportation system.

Leslie J. Wright

Leslie J. Wright
Director, Office of International Programs
Federal Highway Administration

TOP LEFT:
Through FHWA programs, innovations and best practices from around the world support advancements towards a world-class transportation system in the United States.
© Digital-Dreamscape / AdobeStock.com.

TOP RIGHT:
Source: FHWA.

You're Invited to Visit

FHWA's Turner-Fairbank Highway Research Center

The TFHRC virtual tour provides a 360° experience that includes details of the equipment, research, and history of the cutting-edge facility.



This virtual tour is more than a self-guided stroll through the building—it is highly informative with various touchpoints that describe the equipment you would hear about on an in-person tour.

There is an interactive STEM Activities Center, where anyone can try out science, technology, engineering, and math exercises that represent the kind of research conducted at TFHRC. Visit the grounds at the entrance for a view of the Oklahoma City Memorial Grove and the time capsule that is scheduled to be opened in 2093.

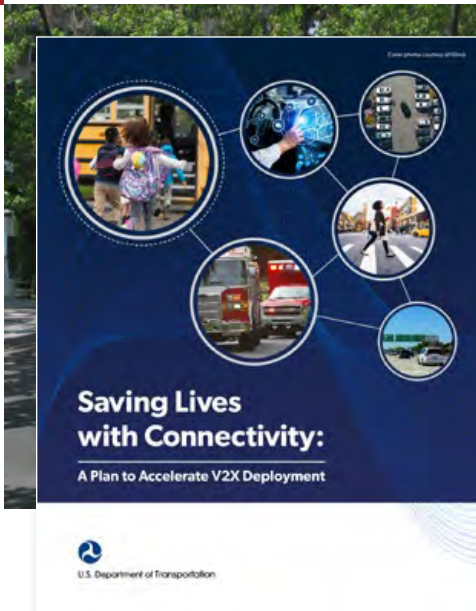
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any time. Our doors
are always open!**

<https://highways.dot.gov/research/tfhrc/VirtualTour/home>



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SAVING LIVES WITH CONNECTIVITY: USDOT's Plan to Accelerate V2X Deployment

by **BRIAN CRONIN**

The momentum behind vehicle-to-everything (V2X) technology is growing, and for good reason: it is a powerful tool for reducing deaths and serious injuries on the Nation's roadways. V2X technology enables vehicles to communicate with each other, with other road users such as pedestrians and cyclists, and with roadside infrastructure like traffic signals and work zones. This wireless communication has various applications to enhance safety and efficiency.

For nearly 30 years, the U.S. Department of Transportation has played a leading role in advancing V2X deployment by working with State and local governments as well as auto manufacturers to help deploy the game-changing technology. This summer, USDOT unveiled the final National V2X Deployment Plan, which sets the vision, goals, and milestones for V2X deployment for the next 12 years.

"Excitement is building around V2X," said Intelligent Transportation Systems Joint Program Office (ITS JPO) Managing Director Egan Smith. "As deployments become more widespread, we are going to see the safety benefits multiply."

While USDOT leadership is important, achieving a national, interoperable V2X ecosystem requires action from public agencies and the private sector. The National V2X Deployment Plan issues a call to action for these stakeholder groups. It also establishes short-, medium-, and long-term milestones and targets. For example, the plan specifies the actions needed to achieve 12 interoperable V2X deployments by 2028, 25 by 2031, and 50 by 2036, with the goal of an observable impact on safety.

"Interoperability is the key," said Govind Vadakpat, the ITS JPO program manager for smart infrastructure. "Vehicles, devices, and infrastructure all must be able to communicate with each other seamlessly across jurisdictional boundaries for V2X to reach its full potential to save lives on our Nation's roadways."

The Federal Highway Administration has taken many notable actions to advance interoperability, including providing technical assistance and resources to V2X deployers, working to resolve regulatory uncertainty, establishing a V2X peer group to share best practices and lessons learned, identifying proven

V2X applications, and investing in research, development, and deployment of V2X technology.

In the months following the release of the draft deployment plan, USDOT received more than 800 comments from stakeholders including public agencies, service providers, professional associations, and the automotive industry. Many respondents expressed enthusiasm for the plan and support for the plan's key features.

The National V2X Deployment Plan represents a major step toward enabling a safe, efficient, equitable, and sustainable transportation system through the national, widespread deployment of interoperable V2X technologies. Realizing the plan's ambitious goals will require commitment and investment not only from FHWA but also from across the stakeholder community.

To learn more about the National V2X Deployment Plan, visit https://www.its.dot.gov/research_areas/emerging_tech/html/ITS_V2X_CommunicationSummit.htm.

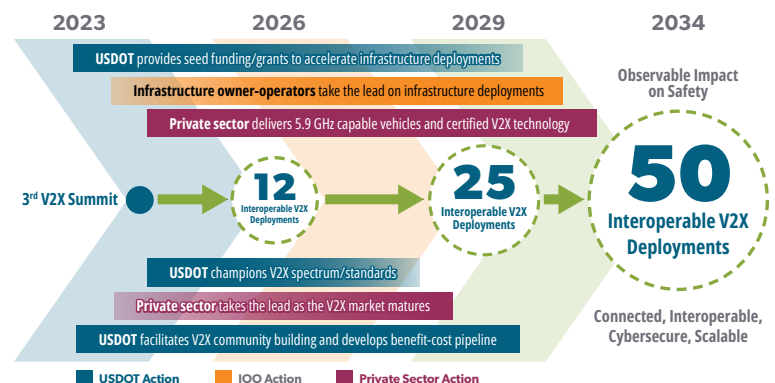
To learn more about USDOT's V2X deployment resources, visit the Smart Community Resource Center at <https://www.its.dot.gov/scrc/>.

TOP LEFT: The National V2X Deployment Plan.

TOP RIGHT: Advances in V2X technology create new opportunities to support and protect all road users.

RIGHT: The National V2X Deployment Plan establishes short-, medium-, and long-term goals that will require action from across the stakeholder community. Source for all images: USDOT.

BRIAN CRONIN is the director of the ITS JPO, with more than 25 years of experience providing technical and strategic leadership at USDOT. He holds a master's degree in civil engineering from Texas A&M University and a bachelor's degree in civil engineering from Virginia Tech.



The FHWA Research Associateship Program Addresses Priority Transportation Needs

by ERIC R. BROWN

The Federal Highway Administration conducts advanced research across many disciplines and topics to fulfill its mission of delivering a world-class transportation system that advances safe, efficient, equitable, and sustainable mobility choices for everyone while strengthening the Nation's economy. To augment its in-house staff expertise, FHWA participates in the National Research Council Research Associateship Program (RAP), administered by the National Academies of Sciences, Engineering, and Medicine (NASEM). Through RAP, research advisors at the Turner-Fairbank Highway Research Center in McLean, VA, (TFHRC) and FHWA headquarters in Washington, DC, supervise postdoctoral research associates on a short-term basis (usually 1 to 3 years) to apply cutting-edge tools and techniques to priority research focus areas, including highway safety; motorist behavior; high-performance construction materials; and infrastructure resilience, assessment, and performance. Examples of tools and techniques research associates use to conduct advanced research are artificial intelligence combined with computer science (such as machine learning and computer vision), data science, and physical and numerical testing.

An article in the Summer 2021 issue of PUBLIC ROADS described how RAP has become a program for developing FHWA's workforce (<https://highways.dot.gov/public-roads/summer-2021/former-research-associates-find-success>). The following four former RAP research associates identified in that article continue to excel as FHWA staff at TFHRC:

- Dr. David Mensching, a RAP research associate in the TFHRC Asphalt Binder and Mixtures Laboratory from 2015 to 2016, was recently promoted to team leader of the Infrastructure Materials Team.
- Dr. Rafic Helou, a RAP research associate from 2016 to 2019 in the TFHRC Structures Laboratory, was hired by FHWA as research structural engineer in 2023.
- Dr. Pavle Bujanovic, a RAP research associate for one year starting in 2018, continues to serve on TFHRC's Transportation Enabling Technologies Team. His work focuses on cooperative driving automation.
- Dr. Jose F. Munoz Campos, a 2010 to 2013 RAP research associate, was hired by FHWA in 2023 as a research chemist at the TFHRC Chemistry Laboratory, specializing in concrete and asphalt binders.

"I transitioned from my postdoctoral position to permanent employment at FHWA to pursue my passion for conducting research with direct field applications. This move allowed me to contribute to impactful projects that enhance the durability of concrete infrastructure, aligning my work with tangible outcomes and public benefit," says Dr. Campos.

Since 2021, research advisors have posted multiple new opportunities to the RAP website for research associates in leading-edge research fields, including:

- Data Mining and Analysis Tools and Methodologies for Traffic Modeling and Simulation.
- Ultra-High Performance Concrete: Materials and Structures from Research to Deployment.
- Advanced Data-Driven Crash Analysis Reflecting Advanced Driver-Assistance System (ADAS) for Safe System Approach.
- Applied Engineering Research to Advance the State-of-the-Art in Highway Transportation Geotechnics.
- Use of Strategic Highway Research Program (SHRP2) Naturalistic Driving Study (NDS) Data and Roadway Information Dataset (RID) in Highway Safety and Operations Analytics.

The NASEM RAP website provides these research opportunities and many others, and procedural information for current and prospective research associates, advisors, and sponsors: <https://www.nationalacademies.org/our-work/rap/nrc-research-associateship-programs>. Interested RAP applicants may directly view current FHWA research opportunities at: <https://ra.nas.edu/RAPLab10/Opportunity/Opportunities.aspx?LabCode=27>.

RAP steadfastly supports national and agency research priorities and strategic goals while strengthening the FHWA workforce. RAP complements a suite of additional FHWA programs that target and support transportation students and professionals from across the career continuum who have an interest in public service. This holistic approach to engagement, recruitment, and development helps empower FHWA to be a Federal agency of excellence.

ERIC R. BROWN is the program coordinator for the Exploratory Advanced Research Team within TFHRC's Office of Corporate Research, Technology, and Innovation Management. He holds a Ph.D. in civil engineering from Pennsylvania State University.

For more information about RAP, visit: <https://highways.dot.gov/research/research-programs/exploratory-advanced-research/nrc-research-associates-help-ear-program-solve-transportation-issues> or contact Eric Brown, 202-493-3420, eric.r.brown@dot.gov.

To join the email distribution list and stay connected with information about RAP, visit: https://public.govdelivery.com/accounts/USDOTFHWA/subscriber/new?topic_id=USDOTFHWA_221.



Dr. Campos uses a scanning electron microscope to examine a concrete core from a bridge.
Source: FHWA.

Build a Better Mousetrap National Competition Highlights the Role Innovative Solutions Play In Transforming Transportation

by **TRINETTE BALLARD**

For the 2024 Build a Better Mousetrap (BABM) national competition, the Federal Highway Administration received 46 nominations from 19 States. The submissions highlight the important role innovative solutions play when it comes to transforming transportation. The purpose of the annual competition is to show how local government agencies are using innovation to improve their programs by saving time and money on projects, increasing safety, and enhancing quality of life for communities.

Most of this year's nominees involved ideas that began with frontline workers who saw the need for a better way to do their jobs. The nominees tackled challenges ranging from poor access to clean water on job sites and slip and fall hazards when accessing equipment to weeds in asphalt crevices and dim lighting when working on truck engines. "No innovation is too small or too great for Build a Better Mousetrap," says Jeff Zaharewicz, acting director for the FHWA Local Aid Support team who manages the annual competition. "We are always excited to see the level of ingenuity and practical skills necessary for solving problems and improving service to our communities. Although transformational technology holds the keys to the future in transportation, the need for homegrown solutions is something that may never go away!"

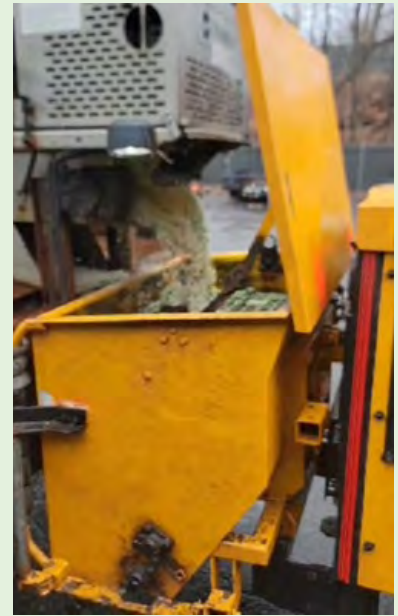
FHWA's goal for BABM is to not only encourage the use of innovative solutions in transportation but to also encourage collaboration among local government agencies. "Our cities and towns benefit when these things are happening to support our roadway systems. Working with and learning from each other is another hallmark of this program," says Zaharewicz.

FHWA's Local Aid Support team selected four national winners in the categories of Bold Steps, Innovative Project, Pioneer, and Smart Transformation. They were announced this summer during the 2024 National Local and Tribal Technical Assistance Program Association's Annual Conference.

Pioneer Award Winner:

Town of East Hartford, CT

The Pioneer Award recognizes a product or tool that is among the first to solve a maintenance problem. The 2024 winner is the Town of East Hartford, CT. Their innovation, the "Trackless Automated Loader," provided a safer and more timely way to clear many miles of sidewalks during winter operations by refurbishing an old sander into an automated chute that can quickly dispense sand mixture materials. The process helps crews clear the sidewalks faster, with less wasted material and improved safety for the workers. The innovation was built in-house following a brainstorming session and with used materials—making them a BABM winner.



The Pioneer Award-winning innovation called the Trackless Automated Loader.

© 2024 Town of East Hartford, CT.

Innovative Project Award Winner:

City of Moreno Valley, CA



The Innovative Project Award recognizes any solution that addresses any or all phases of a project that is locally relevant and creative in thinking. The 2024 winner in this category is the City of Moreno Valley, CA. Their innovation, known as "Slow and Safe, Save a Life," involves the use of modified speed cushions to address high speeds and increased traffic volumes through residential communities and school zones without impacting emergency response. Video monitoring and data are showing success with this innovation making them a BABM winner.

The Innovative Project Award-winning innovation is the modified speed cushion.

© 2024 City of Moreno Valley, CA.

SMART Transformation Award Winner:

McKenzie County Highway Department, ND

The Smart Transformation Award recognizes significant changes to an activity or process that is specific, measurable, achievable, realistic, and time-bound in nature that results in improved efficiencies. The 2024 winner is the McKenzie County Highway Department in North Dakota. Their innovation, the “Fifth-Wheel Quick Attach Sander,” addressed challenges associated with their fleet of vehicles only being used seasonally. The dump trucks were mainly used in the winter and semi-tractors were only used in the summer. The local agency developed the sander attachment to help maximize the use of the semi-tractors throughout the entire year. The attachment allows the use of semi-tractors during the winter months to add to the number of dump trucks needed for applying salt and sand on icy roads. The county is saving money and time with this innovation, making it a 2024 BABM winner.

The SMART Transformation Award-winning innovation called the Fifth-Wheel Quick Attach Sander.

© 2024 McKenzie County, ND.



Bold Steps Award Winner:

West Lafayette Street and Sanitation Department, IN



The Bold Steps Award-winning innovation called the “Leaf Vac Unit” from West Lafayette, IN.

© 2024 West Lafayette, IN.

The Bold Steps Award recognizes projects or processes showing a breakthrough solution with a demonstrated high reward. The 2024 winner is the West Lafayette Street and Sanitation Department in West Lafayette, IN. Their innovation, the “Street Sweeper Conversion to Leaf Vac Unit,” solved workforce safety and operational efficiency challenges for leaf pickup service, which is very important to this community. Development of this innovation involved repurposing used street sweepers into a leaf vac system that required less workers to operate and improved the time it took to complete the job. The innovation was developed in-house with used equipment, keeping expenses at a minimum, and making this innovation a BABM winner.

For more information about the BABM 2024 winners and nominations, visit <https://www.fhwa.dot.gov/clas/babm/>.

TRINETTE BALLARD is a program manager in the FHWA Center for Local Aid Support. She has been with FHWA for 17 years.

STANDARDIZING e-CONSTRUCTION:

A Pilot Project in Lincoln, Nebraska

Achieving
Project
Efficiencies
Through
Technology

After the fiber-optic communication system conduits were installed, personnel tracked and located all assets in the field, updating the data easily and in near realtime to accurately reflect the exact coordinates.

© 2024 Brad Wilken /
JEO Consulting Group.

by **LONNIE BURKLUND** and **MARC ROSSO**

While construction is a well-known term, the concept of e-Construction may be less familiar. According to the Federal Highway Administration website (<https://www.fhwa.dot.gov/construction/econstruction/>), e-Construction is defined as the collection, review, approval, and distribution of highway construction contract documents in a paperless environment and involves the electronic capture and submission of construction documentation via mobile devices. Additionally, e-Construction allows for automated, digital document review and approval, incorporating electronic stakeholder signatures, all while providing workflow management that is accessible across all platforms. This process provides optimized collaboration, efficiency, and productivity.

During most infrastructure projects, the construction project manager and field inspectors rely on traditional techniques that use measuring wheels, logbooks, clipboards, and hard-copy plans to locate, track, and measure constructed assets. Often, these details must be manually transferred into various electronic formats for the creation of final documents, including as-built plans, record drawings, quantity summaries, and payment processing. This process has proven to be time-consuming, as staff meticulously inputs information into construction management systems. Information is commonly redrawn in computer-aided design (CAD) platforms based on hard-copy field notes or inputted into a final geographic information system (GIS) for recordkeeping and asset management. In fact, the process can take weeks, months, or even years. The delay caused by using manual methods of data management can result in subsequent stakeholders, offices, and projects being unaware of precise asset locations, which could lead to an increased risk of damage to newly installed infrastructure.

This is where e-Construction's advantages truly shine. Data are seamlessly transferred from the field into electronic and digital platforms and asset management systems such as GIS, granting stakeholders nearly instant access to newly constructed infrastructure details. With information recorded promptly, organizations experience significant time savings by eliminating manual data entry on paper. Moreover, swift recording safeguards infrastructure from inadvertent damage during other projects because the infrastructure is known to be installed for one-call locating. This feature is due to the newly constructed asset information (and location) being known and available in electronic or digital format for use as basemapping and/or also being available in the utility locate system during subsequent construction activities.

Pilot Project Overview

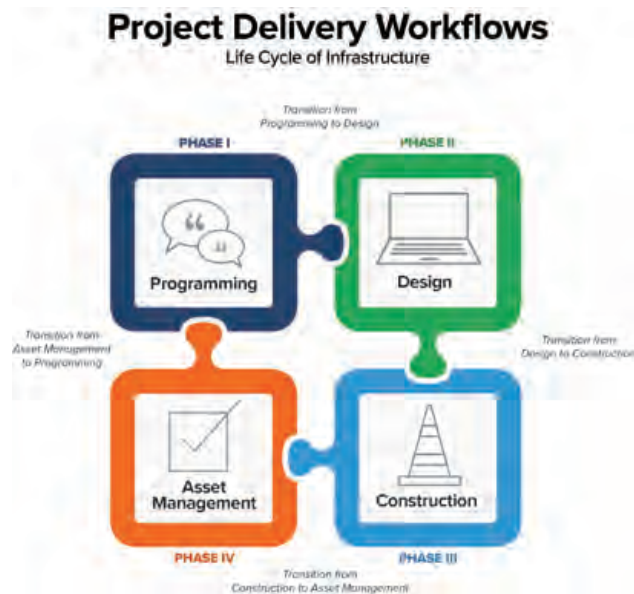
Serving the city of Lincoln, NE, the Lincoln Transportation and Utilities (LTU) Department manages all phases of public infrastructure—from initial planning and design to construction and ongoing operations and maintenance.

LTU was awarded a grant from the State Transportation Innovation Council Technology and Innovation Deployment Program to conduct a pilot project to explore modernizing construction administration and asset management activities with e-Construction techniques.



Project Theme

During initial conversations with key stakeholders, a theme emerged: Plan It, Design It, Build It, Measure It, Pay for It, Record It, and Maintain It. This expression represented the staged tasks inherent to any project. This project focused on the phases required once final plans were approved: Build It, Measure It, Pay for It, and Record It.



The life cycle of a project has many steps and transitions. This model outlines the process from programming to asset management.

© 2024 Janine Jones / JEO Consulting Group.

Before the project could move forward, the project team set out to discover how the theme was currently being implemented in the field. They evaluated the existing workflow for construction observation, inspection, and administration to understand how information is collected and to determine the various stakeholders involved in tracking and measuring assets. From there, the team developed operational scenarios and workflows that would use mobile data collection equipment for infrastructure documentation, ultimately improving the quality and efficiency of developing as-built plans and record drawings. Next, the project team evaluated mobile data collection equipment and associated GIS applications to determine options for collecting precise and timely data. The pilot project was then executed during the construction of multiple linear infrastructure projects. As a final deliverable, the project team developed a comprehensive final report that outlined project details, lessons learned, and recommended next steps.

Client's Historical Construction Process Evaluation and Challenges

The project team held a kick-off meeting and initial workshop with stakeholders from various technical and professional backgrounds, including LTU's Project Delivery Division staff. The team evaluated current conditions, primarily focused on fieldwork components and construction project administration that delivered infrastructure in the public right-of-way (ROW).

This preliminary assessment identified that construction project managers and field inspection staff located, tracked, and measured constructed project assets using traditional manual field methods and hard-copy and paper engineering drawing sets. Daily construction progress was tallied in manual logbooks. As projects were completed, hard-copy field notes were provided to office staff who updated electronic CAD files. These electronic records were ultimately converted into the city's long-term digital asset management GIS platform for final retention and management. These GIS database and linework files are used as the primary records for subsequent utility location and for protection of all infrastructure assets in the ROW.

This process of converting hard-copy field notes for installed infrastructure into GIS-based assets for management is a time-consuming and potentially error prone process—spanning weeks, months, or years, depending on project complexity and staffing capacity. This lengthy process leaves assets vulnerable to damage in the field. It can also pose subsequent design challenges for new projects or other scheduled maintenance and operations in the ROW.

After assessing existing procedures and gathering input from stakeholders, the project team pinpointed areas for improvement, focusing particularly on expediting the transfer of data from construction field notes to final asset management files (via GIS). In alignment with project goals and objectives, the team considered the following high-level goals:

- Modernizing asset location and tracking activities during construction, using mobile data collection devices tied to the city's GIS platform.
- Expediting the completion of as-built plans when projects are constructed.
- Implementing, in the future, a field data collection process that would allow for faster development of installed quantity summaries and issuing of draft pay estimates and approvals for contractors.

Client's Stakeholder Engagement

Given the extensive network of how assets are located, tracked, and maintained, input from diverse stakeholders was essential. Lead stakeholders encompassed various LTU groups that support delivery of work within the public ROW. Additionally, the general public was recognized as a secondary stakeholder that would reap benefits once the primary stakeholder's needs were addressed.

"Being involved in this pilot project, and specifically all the discussions amongst a diverse group of stakeholders, helped me see the big picture in the overall delivery of projects," says Chuck Seufferer, construction manager, JEO Consulting Group, Inc., who was a lead field construction manager during pilot project testing.

Diving deeper, lead stakeholders identified opportunities to provide needed improvements for the following areas:

- Accurate data collection for downstream operational and maintenance activities.
- A wide array of data collected during construction activities, such as installation date, weather conditions at installation, contractor information, and other asset-specific characteristics.

- Timely recording of asset locations to protect them from subsequent damage due to future infrastructure installation in the ROW.
- Data collection devices that would integrate seamlessly with the existing GIS database.
- Prompt documentation of contractor work to ensure timely payments.
- Accuracy of data to respond to requests for both internal records and various outside partners.

These identified needs served as the foundation for the project goals. A key component of accomplishing these goals was the use of GPS-enabled mobile data collection devices that would connect to the city's existing GIS database. These devices would allow for the use of electronic and digital files to modify design features in the field during construction administration and inspection, the ability to quickly and easily record the construction of new assets as work is conducted, and the ability to load pertinent information directly into the asset management system to expedite advancing toward digital as-builts with direct-to-file updates.

Data Collection Benefits

- Data are loaded into the database during construction or maintenance activities, creating a consistent record collection process and improving the accuracy and reliability of each asset's data.
- Unique data are identified and collected per asset type, with all details available through a searchable process.
- Assets are located during construction, and identified information is loaded directly into the asset management system, expediting updates of records.

Pilot Project Testing

During project meetings, the team confirmed that the pilot would focus on linear utility construction projects (e.g., conduit systems and water main installations) to allow for a simple, initial, point-to-point framework. Sample operational scenarios were discussed with stakeholders to develop the user interface and process for field staff to use during the effort, as well as potential future projects.

New Construction Scenario

In this scenario, a fiber-optic communications system conduit could be deployed and made available for third-party Internet service providers to install fiber cable. After construction begins, LTU could conduct typical construction observation activities but also follow construction crews with GPS-enabled mobile data collection equipment and asset tags (loaded with information) to attach to newly constructed conduit system pull boxes. Locations and characteristic information could be collected and loaded into the GIS database, allowing the original design file drawings to be updated quickly. Also, the GIS shape files of the conduit system and pull-box infrastructure could be instantly loaded into the city's enterprise GIS platform, allowing the production of digital



This pilot project introduced a fresh workflow approach for infrastructure projects, leveraging in-field mobile data collection that records assets in near realtime, saving both time and money.

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as-builts, design file sharing to private entities, and information sharing into Nebraska811, the State's "call before you dig" utilities locator service.

Asset Maintenance Scenario

In this scenario, as assets are scheduled for maintenance and/or replacement through an established management process, the asset database could be queried, and an item could be located with all component characteristics and history embedded. This information would allow for an accurate cost estimate for maintenance or replacement. Both the detailed as-built plans and the record GIS shape files could be immediately available for maintenance, operations, and necessary design activities.

Field Permit Issued for ROW Occupation Scenario

In this scenario, when a major water main project is planned to occupy the ROW near existing assets, data could be queried and compared to the proposed work to determine whether assets need to be relocated to avoid conflicts. As work is completed, information could be updated with GPS-enabled mobile data collection equipment, and the asset tags could be loaded with the updated information and data. These new records could be saved into the system for future use and tracking as needed.

While considering which projects to implement for this pilot project, the team assessed the hardware and applications critical for mobile data collection. Collaborating with the city of Lincoln Information Services (IS) staff—experts knowledgeable in internal GIS operations—the team tested two industry-standard field units:

- The Trimble® DA2 global navigation satellite system (GNSS) receiver with Catalyst™ positioning service offers units known for precision, accuracy, durability, and seamless integration with GIS platforms.
- The Eos Positioning Systems Arrow Gold® GNSS receiver offers precision, battery longevity, and portability, with Bluetooth® connectivity on smartphones and tablets.

Although both brands demonstrated feasibility in helping achieve the e-Construction objectives, the city IS department opted for the Trimble units because other city divisions are currently using them.

Once the units were selected, the project team collaborated with the city IS and Construction Services staff to develop user-friendly, tailored menu options. These options featured easily navigable drop-down lists and typical pay items, ensuring easy accessibility during field data collection activities. Various link attribute examples for conduit sizes, conduit bundle count, and water main pipe sizes were integrated into the menus. Furthermore, the menu options included several node-type items, covering diverse pull-box types, water valves, fittings, and hydrants. The team also developed GIS applications for the collection of these in-field asset characteristics (e.g., pull-box size, power pedestal, type of valves).

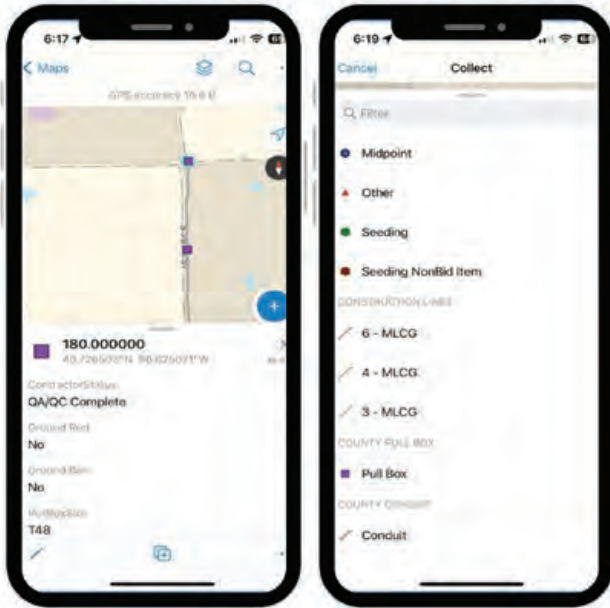
"This project has allowed us to train our Construction Services staff on modern field data collection activities and gain good familiarity with GPS-enabled mobile devices," says Nate Cole, GIS system supervisor within LTU's Technology Services division.



Linear construction projects, including this fiber-optic conduit system, were undertaken as part of the pilot project.

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PILOT PROJECT PHONE INTERFACE



Tailored, user-friendly menu options were designed for in-field use, making it simple for staff to record updates.

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In the field, mobile tablets and smartphones were used to develop the menus and options for presenting maps and dropdown pay items. These variations underwent testing from field staff to gather insights on user-friendliness, functionality, and the ability to modify preloaded design line work versus adding new stand-alone pay items in the field. Furthermore, discussions with the project team centered on future

enhancements, such as delineating fenced areas and measuring and locating points along a horizontal shape, which can enable tracking and summarization of more complex project types.

The team conducted field-testing activities, affording diverse city staff and the project team an opportunity to apply the equipment and applications to fieldwork. These activities consisted of the following elements:

- **Equipment:** The GPS-enabled devices, software, and affiliated equipment were configured according to the requirements to promptly relay data to the city GIS servers, facilitating the display and monitoring of information in near realtime.
- **Training:** Field personnel were trained in the operation and use of the equipment. Data collection activities—including asset location, measurement, and tracking—were carried out, and the collected field data were seamlessly synchronized with the city GIS platform.
- **Processes:** As one example, the pilot project involved performing construction administration services during the installation of fiber-optic communication system conduits. The design was converted into relevant shape files and then imported into the city's GIS platform. During field testing, staff successfully tracked and located all pull boxes and conduits. Adjustments to pull-box locations were made during construction, with an additional pull box included compared to the original plan. Project team members were able to “adjust” the authoritative data in the field application to reflect the actual coordinates of the constructed assets. These line work and shape files were immediately accessible in the city GIS platform to depict the as-built location. Subsequently, the elements were available for conversion back into CAD, facilitating the production of updated digital, as-built drawings and final records for the typical plan set (PDF files).

This process and workflow were employed in ongoing pilot testing of additional conduit systems and water main projects. This example was showcased during a demonstration to LTU and exemplifies the future capability where GIS files representing location and property and the subsequent as-built plans could be finalized in a short time frame, possibly even within hours of construction completion. The team conducted further testing on multiple other projects, including major broadband conduit system deployments on the fringes of Lincoln and Lancaster counties in Nebraska, and large-scale collection of water main assets across the city of Lincoln.

During the project, personnel gained proficiency in using mobile data collection devices and electronic and digital workflows, thus diminishing dependence on hard-copy records and manual measurement methods. Lessons learned are being continually tracked. These lessons include the ongoing necessity to refine user-friendly data collection interfaces (menus) on tablets and smartphones for field staff as well as strategies for gathering data involving new elements in the field, as opposed to existing GIS design layers exported from CAD.

Pilot Project Outcomes

Drawing on current project work, the team identified numerous improved efficiencies. Several instances of e-Construction were tested, validating the capabilities of field data collection and the seamless integration of engineering design files and GIS platform data, thus facilitating streamlined



During field testing, staff successfully tracked and located all installed conduits. Project team members were able to “adjust” the design data in the field application to reflect the actual installed coordinates of the constructed assets.

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processes. The ability to progress from project design to field data collection and, ultimately, generate final authoritative GIS files and as-built plans with a quick turnaround was effectively demonstrated to stakeholders.

Furthermore, the GPS-enabled mobile data collection devices demonstrated accuracy within 2 cm (0.79 inches) in any direction in locating and measuring assets. Leveraging real-time kinematic and GNSS technologies ensured dependable positioning data. The transfer of collected field data to the GIS platform effectively mitigated data disparities and redundancies, enhancing the precision and reliability of as-built engineering plans and record drawings. This outcome diminished the likelihood of conflicts and errors during subsequent maintenance or infrastructure modifications.

The testing phase demonstrated the efficacy of precise, near real-time data collection through GPS-enabled mobile devices. Successful trials of hardware and applications revealed the flexibility for modifying design elements directly on handheld devices when field changes were made. Field personnel were also able to input new assets into the system as they were constructed.

Overall, the equipment and software applications were found to be user-friendly. Field personnel noted the ease of most operations and intuitive interfaces, facilitating efficient data collection and navigation.

Finally, the ability for near real-time data collection and integration facilitated effective communication among field personnel, design teams, and project managers, guaranteeing the inclusion of precise, as-built information into the record drawings. “We’re looking forward to continuing to realize efficiencies and increased accuracy in measuring quantities and summarizing field notes,” says Randy Saathoff, construction project manager within LTU’s Project Delivery division.

Next Phase of Pilot Program

LTU is seeking additional testing on more complex, nonlinear infrastructure projects. In this subsequent phase, LTU looks to evaluate software providers capable of integrating construction data and financial summaries to generate contractor payments, daily logs, and progress reports. This evaluation aims to enable LTU to fully leverage integration within its construction and financial management software systems.

Lessons learned from the pilot project will be integrated into subsequent testing phases, including continuous training for field personnel. While training and support allowed personnel to proficiently operate the field equipment, ongoing training and technical assistance are needed to address challenges that may arise during the continued implementation, leading to maximized use of the equipment.

Moreover, while most staff and project team members found mobile data collection equipment and automated tools beneficial, some faced challenges adjusting to these methods. This finding underscores the importance of ongoing training to foster wider acceptance and use of modern tools. Ensuring continued emphasis on tool adoption will be imperative in the upcoming phase to promote broader acceptance and utilization.

Lastly, during testing, the team observed that modifying design features, such as line work and elements, on a mobile device posed challenges for some field staff. Contrary to project assumptions, most users expressed a preference for adding new elements directly into the collector applications rather than attempting to modify existing design files in the field. This



Pilot project testing also included GIS location of components related to water main installation projects.

© 2024 Chuck Seufferer / JEO Consulting Group.

preference is likely influenced by factors such as the size of tablets and phones, sun glare, and field conditions.

Conclusion

The successful completion of this pilot project produced significant initial results and sparked discussions among a variety of stakeholders, including managers, engineers, GIS and design technicians, field inspectors, and information technology professionals. Continued implementation, testing, and training will play a key role in ensuring streamlined infrastructure project delivery, enhancing the accuracy of as-built documentation, and securing long-term benefits.

“Because of this effort, we’re continuing to double down on our technology development for field service applications and infrastructure asset management,” says Travis Klasna, JEO Consulting Group’s director of technology.

As the pilot project proved, the project’s theme—“Plan It, Design It, Build It, Measure It, Pay for It, Record It, and Maintain It”—was exemplified while achieving efficiencies, reducing redundancies, and facilitating near real-time data processing. Additional testing is on track to continue to enhance the process.

LONNIE BURKLUND, PE, PTOE, leads the Traffic and Technology Department at JEO Consulting Group, in Lincoln, NE. He earned a B.S. in civil engineering from the University of Nebraska.

MARC ROSSO, PE, is a senior construction engineer for the city of Lincoln Transportation and Utilities in Lincoln, NE. He holds a B.S. in civil engineering from the University of Colorado.

For more information, see lincoln.ne.gov, then search for SLIC, or contact Lonnie Burkland (402-435-3080, lburklund@jeo.com), Marc Rosso (402-441-7711, mrosso@lincoln.ne.gov), or Bryan Cawley, Construction and Maintenance Engineer at the FHWA Resource Center, Office of Innovation Implementation (307-631-7424, bryan.cawley@dot.gov).

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CELEBRATING INNOVATION AND COLLABORATION:

Debut of the TPF Excellence Awards



Showcasing groundbreaking research and innovation, the inaugural TPF Excellence Awards honors the outstanding achievements made by partners across the transportation sector.

by **TRICIA SERGESON, ZACHARY T. BERGERON, and MICHAEL YORK**

It's an exciting time of opportunity and change in the transportation industry, with strong partnerships contributing to great research. Every day, researchers and transportation practitioners are working tirelessly to improve the safety, efficiency, and sustainability of our roads and transportation infrastructure. Recognizing the importance of these efforts, the Transportation Pooled Fund (TPF) Excellence Awards highlight exceptional projects that demonstrate the success of meaningful collaboration and partnership. These projects illustrate how partners are coming together to solve common challenges and shape the future of transportation.

The TPF Excellence Awards

The TPF Excellence Awards reflect a joint Federal Highway Administration and American Association of State Highway and Transportation Officials (AASHTO) effort to showcase the incredible achievements made by partners through the TPF Program (<https://www.pooledfund.org/>). Since its establishment in 1977, the TPF Program has advanced collaboration, innovation, and efficiency in transportation research. By pooling funds and expertise, agencies can develop innovative solutions more efficiently and cost effectively than conducting the research alone.

The biennial TPF Excellence Awards' debut showcases TPF studies that have significantly advanced safety, economic growth, equity, climate solutions, and/or transformation through meaningful collaboration and partnership in transportation research.

"The TPF Excellence Awards underscore the critical importance of collaborative research in advancing our transportation network. By recognizing exceptional research efforts from across the Nation, we celebrate innovative solutions that enhance safety, efficiency, and sustainability. These awards highlight the power of shared expertise in addressing the challenges and opportunities within the transportation sector."

Kelly Regal, Ph.D.
Associate Administrator for Research,
Development, and Technology
Director, Turner-Fairbank Highway Research Center

The development of the TPF Excellence Awards would not have been possible without the dedication, insight, and expertise of the working group comprising State departments

ABOVE: The TPF Excellence Awards recognizes innovations and best practices that are making a difference across the Nation.

Image credits:
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note on page 18.

2024 TPF Excellence Awards Nominations

- **TPF-5(099)** Evaluation of Low-Cost Safety Improvement
<https://pooledfund.org/Details/Study/332>
- **TPF-5(193)** Midwest Pooled Fund Program
<https://www.pooledfund.org/Details/Study/653>
- **TPF-5(241)** Western States Rural Transportation Consortium (WSTRC) <https://www.pooledfund.org/Details/Study/724>
- **TPF-5(372)** Building Information Modeling (BIM) for Bridges and Structures <https://www.pooledfund.org/Details/Study/624>
- **TPF-5(353)** Clear Roads Winter Maintenance Research
<https://www.pooledfund.org/Details/Study/706>
- **TPF-5(368)** Performing Engineered Concrete Paving Mixtures
<https://www.pooledfund.org/Details/Study/620>
- **TPF-5(358)** Wildlife Vehicle Collision Reduction and Habitat Connectivity <https://www.pooledfund.org/details/study/610>
- **TPF-5(432)** Bridge Element Deterioration for Midwest States
<https://www.pooledfund.org/Details/Study/655>
- **TPF-5(253)** Member-level Redundancy in Built-up Steel Members
<https://www.pooledfund.org/details/study/482>
- **TPF-5(362)** Improvements to the Infrastructure Carbon Estimator
<https://www.pooledfund.org/details/study/614>
- **TPF-5(385)** Pavement Structural Evaluation with Traffic Speed Deflection Devices (TSDDs)
<https://www.pooledfund.org/details/study/637>

2024 Nomination Overview



TPF
Excellence
Awards

of transportation (DOT) and FHWA staff. Their invaluable contributions and thoughtful feedback were instrumental in shaping the vision, evaluation criteria, and selection process for these awards.

The TPF Excellence Awards recognize two TPF studies each cycle, including at least one State DOT-led study. Nominations for each award cycle are collected in odd-numbered years and winners are announced in even-numbered years.

The 2024 call for nominations included many competitive research studies from partners spanning across the United States and other parts of the world. These nominations featured the exceptional TPF research work done, ranging from low-cost safety innovations to transformational intelligent infrastructure system solutions.

After careful consideration by a diverse panel of judges, the 2024 winners are Clear Roads Winter Maintenance Research (Clear Roads; TPF-5(353)) and Member-level Redundancy in Built-up Steel Members (TPF-5(253)). Let's dive into the great work they have done to strengthen the Nation's transportation network.



Clear Roads

The Clear Roads TPF study (<https://www.clearroads.org/>) is a great example of the core values of the TPF Program. This TPF study brought together transportation professionals and researchers from around the country to drive winter maintenance research and innovation. By evaluating materials, equipment, and methods in real-world conditions, Clear Roads identifies the most effective techniques and technologies to save agencies money, improve safety, and increase efficiency.

This TPF study's primary activities include:

- Researching winter maintenance materials, equipment, and methods.

- Developing specifications and recommendations for winter maintenance.
- Studying and promoting innovative techniques and technologies that will improve safety, save agencies money, and increase efficiency.
- Developing practical field guides and training curriculum to promote the results of research projects.

Clear Roads Resources

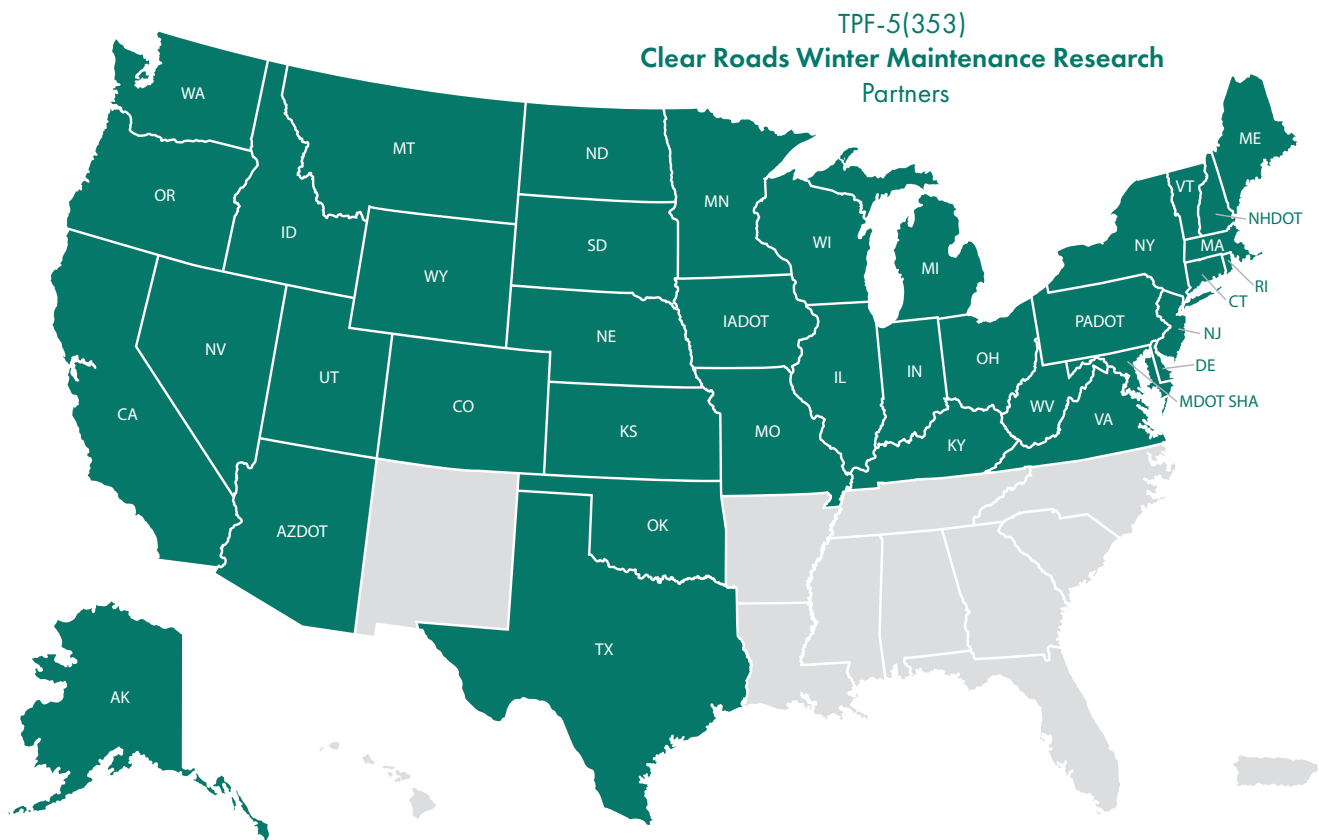
- Introduction to Snow Removal—Winter Operations Training Series 1 of 15 <https://www.youtube.com/watch?v=mnietSiZxSs>
- Winter Operations Training Program (volume 1)
<https://www.youtube.com/watch?v=rCKs2bTnCxE>

Maintaining Road Safety: Snow or Shine

Clear Roads supplies a wealth of resources, including training videos and toolkits, that support States and municipalities managing winter weather events. It has advanced the national state of the practice in winter maintenance by providing updated guidance and trainings to more than 1,145 agencies and creating more than 86 research products. The study serves as a one-stop shop operators can rely on for advice on procurement, safety training, snowplow deployment scheduling, and more. This TPF study has become a resource by gathering lessons learned from its partners and packaging them into an easy-to-understand format.

Clear Roads has also improved the state of deicer practices across the country. Through research and testing, the study identified best practices for applying deicer to keep salt on roadways and out of the environment. Maryland DOT found that implementing these best practices reduced the number of well contamination claims, saving the State more

Overview of
TPF projects
nominated for
the 2024 TPF
Excellence Awards
and their lead
State agency.
Source: USDOT.



than \$90 million over the last nine winter seasons. Similarly, after implementing corrosion prevention related deicer best practices, West Virginia DOT noted a dramatic reduction in corrosion damage and repairs.

Overall, Clear Roads has paved the way for a more collaborative, winter-resilient transportation network across the country, with many of its findings implemented nationwide. Seventy percent of study members have implemented findings from Clear Roads' material application projects.

Advancing Road Safety through Partnerships

The Clear Roads study benefits greatly from its partnerships. By pooling resources, agencies can conduct more extensive studies across a greater range of conditions than could be done by a single agency. For example, many State DOTs maintain their own qualified-products list (QPL) for snow removal equipment, but small agencies often lack the resources to test specific products themselves. Clear Roads' QPL levels the

playing field by providing a vetted list of winter maintenance products, saving time and energy for agencies of all sizes.

"There is power in working together, if every agency uses the QPL, manufacturers know what requirements they have to meet, and it makes the entire process...easier and less expensive for everyone," says Doug McBroom, Montana DOT.

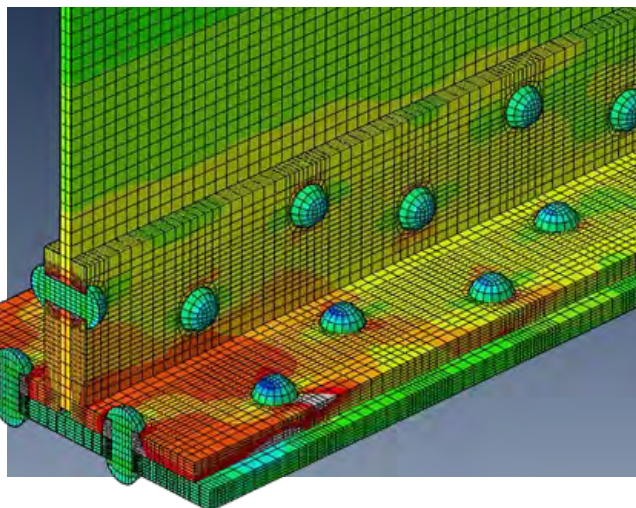
The Clear Roads study also provides an excellent opportunity to share best practices and subject matter expertise with agency members across the country through the technical advisory committee (TAC) meetings. Each TPF study includes a TAC that is made up of agency representatives and subject matter experts from all partners. Clear Roads TAC members meet twice a year to discuss and prioritize projects, share effective practices, and review research results.

Oregon DOT study member Patti Caswell states, "The networking capacity is immense. You have 39 peer DOTs to help solve a problem."

ABOVE: Map of Clear Roads Winter Maintenance Research State DOT partners.
Source: FHWA.

RIGHT: Clear Roads is helping States manage and optimize their snowplow fleets.
© Minnesota DOT.





LEFT: Full-scale testing of a mechanically fastened built up steel member.

© Purdue University.

RIGHT: A cross-section of one of the detailed three-dimensional nonlinear finite element analysis models build of the large-scale test specimens.

© Purdue University.

Member-Level Redundancy in Built-Up Steel Members

The second awardee of this year's TPF Excellence Awards is the Member-Level Redundancy in Built-up Steel Members TPF study (<https://www.pooledfund.org/details/study/482>). This study helped address the analysis, design, evaluation, and safety inspection of internally redundant built-up steel bridge members. Typically, built-up members will not fail if one of the components fails (whether through fatigue or fracture); however, before this study, there was very little experimental data quantifying the remaining fatigue life and strength of a steel bridge member in which one of the components had failed.

The study's primary activities involved testing full-scale specimens to gain deeper understanding of the energy release, load redistribution, and subsequent fatigue resistance of a damaged section and ultimately develop code-ready assessment methodologies. As a result of the extensive collaboration and research, the study created two new AASHTO guide specifications: *Guide Specifications for Internal Redundancy of Mechanically-fastened Built-up Steel Members* and *Guide Specifications for Analysis and Identification of Fracture Critical Members and System Redundant Members*. Transportation agencies around the country are already using these guide specifications to evaluate existing steel bridges and inform new designs.

Stronger Bridges, Safer Roads

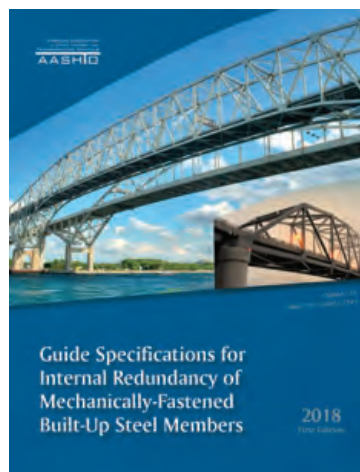
The Member-Level Redundancy in Built-up Steel Members study developed the first integrated fracture control plan, increasing knowledge of the reliability and safety of mechanically fastened steel bridges and advancing safety—a strategic goal of the U.S. Department of Transportation. It also paved the way for incorporating and integrating risk-based inspection strategies into existing AASHTO specifications. The study has allowed designers to utilize economical and innovative designs that can now be shown to have a high level of internal redundancy and reliability. Finally, transportation partners have benefited from study activities encouraging the transition from calendar-based bridge inspection strategies to more efficient risk-based approaches. This TPF study has strengthened the bridge and steel industries and serves as a success story for similar initiatives across the Nation. The results of the study have changed how the bridge engineering profession views an entire classification of structures and will result in immense savings related to the cost of in-service inspection strategies.

“This work TPF-5(253) ushered in a new family of structural steel members that take advantage of modern fabrication methods to cost-effectively improve reliability and bridge performance. Now, engineers have an accepted design approach to facilitate use of these members, thereby reducing in-service inspection costs and traffic disruptions,” says Ronnie Medlock, P.E., High Steel Structures LLC.

Collaborative Insights

The Member Level Redundancy in Built-Up Steel Members project required extensive public-private sector collaboration, including the participating agencies, AASHTO committees, Army Corps of Engineers, and the steel industry. The steel industry provided specimens and fixtures for testing at reduced or no cost. This industry support allowed the project to conduct the large number of full-scale tests needed to develop improved specifications.

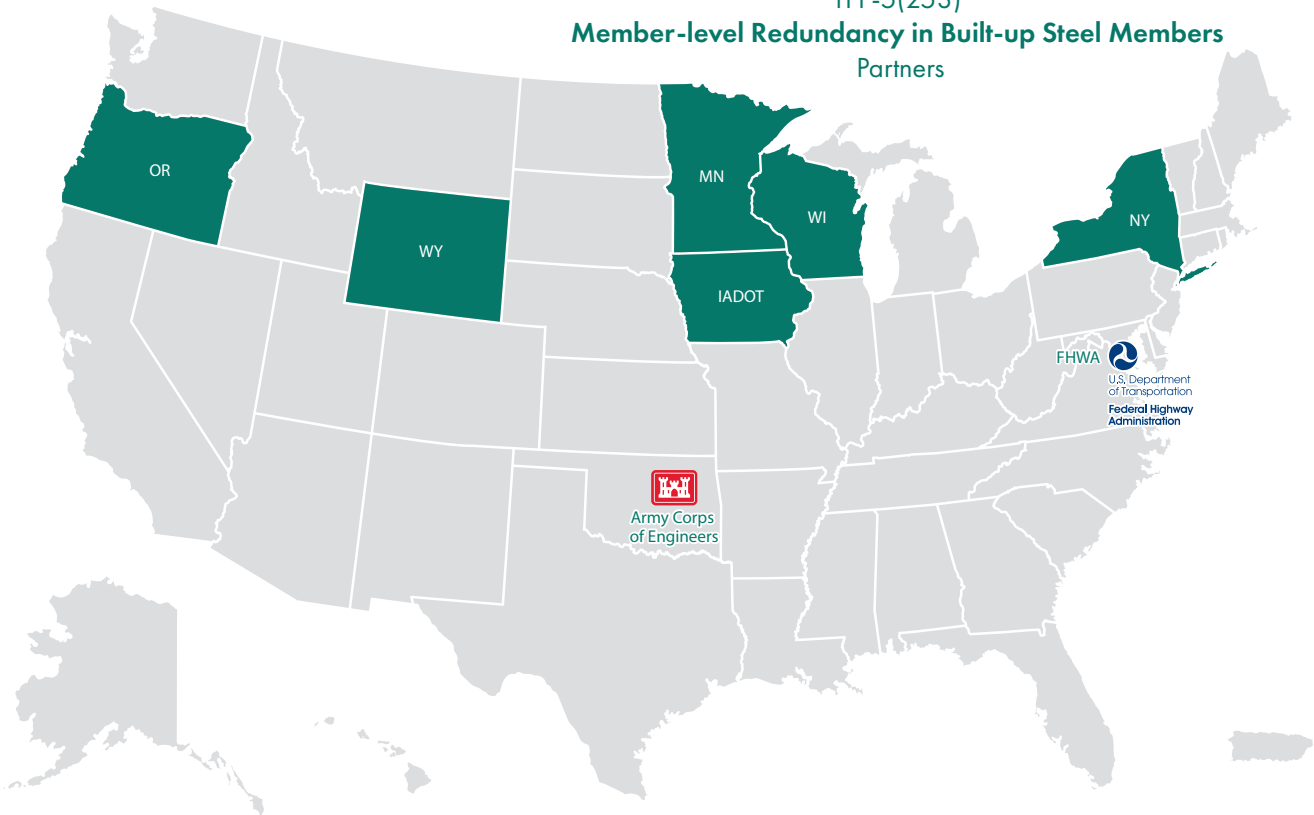
“The TPF-5(253) research work, which resulted in the new AASHTO *Guide Specification for Internal Redundancy of Mechanically Fastened Built-up Steel Members*, has been one of the more significant contributions to the steel bridge industry in recent history. This work and codified publication, recognized by the FHWA, filled a major industry gap, and now gives bridge engineers and owners the ability to recognize internal redundancy, exploit their advantages in strength and resistance to actual failure, and provide a more reasonable hands-on in-service inspection interval for these types of members which improves the safety of our bridge inspectors,” says Brandon Chavel, technical director, Michael Baker International.



Cover of *Guide Specifications for Internal Redundancy of Mechanically-Fastened Built up Steel Members*.

© AASHTO.

Member-level Redundancy in Built-up Steel Members Partners



Map of Member-level Redundancy in Built-up Steel Members partners.
Source: USDOT.

So, You Want to Start a Pooled Fund?

The TPF Program paves the way for collaboration and innovation. The Clear Roads and Member-level Redundancy in Built-up Steel Members TPF studies are great examples of partners coming together to address common problems like the safety of our bridge infrastructure and winter maintenance. The TPF Program supports a broad range of transportation research areas, including pavements, bridges, design, safety, administration, environment, security, and maintenance. Entities as wide ranging as State DOTs, academic institutions, industry associations, private industry, and foreign entities in good standing with the U.S. Government are eligible to participate in the TPF Program. If you want to get involved with innovative research projects advancing transportation, consider joining one of our many open studies (<https://www.pooledfund.org/Browse/open>).

Nominate Your Research for the Next TPF Excellence Awards

Applying for the TPF Excellence Awards is a great opportunity to showcase your achievements in regional and national collaboration. These awards are perfect for publicizing impactful TPF work, attracting more study members, and connecting stakeholders with the tools that can improve the transportation industry. Projects recognized through the TPF Excellence Awards can serve as examples of strong collaboration and the advancement of national research priorities.

The TPF Excellence Awards aim to inspire States and localities to create TPF studies and continue building partnerships that deliver a better transportation system for all. The 2026 awards nomination period will begin in fall 2025.

The TPF Program is fueled by your participation, and overall collaboration. Together we can lead the Nation to better transportation solutions for tomorrow.

TRICIA SERGESON, MPA, PMP, is the TPF program manager at FHWA's Turner-Fairbank Highway Research Center in McLean, VA. She has a master's degree from Rutgers University in public administration, and two bachelor's degrees in political science and foreign languages (Spanish) from Washington State University.

ZACHARY T. BERGERON is a transportation policy analyst at the U.S. Department of Transportation Volpe National Transportation Systems Center in Cambridge, MA. He provides research and policy support focused on micromobility, pedestrian safety, and asset management. He holds two master's degrees—one in sustainability science from the University of Massachusetts Amherst and the other in biology (visual ecology) from the University of Illinois at Urbana-Champaign—and a bachelor's degree in biology from the University of Maryland, Baltimore County.

MICHAEL YORK is a transportation policy analyst at the Volpe Center. He provides research and policy support focused on road safety, public park access, transit, and equity. He holds a master's degree in public policy from the University of Virginia and an undergraduate degree from the University of Richmond.

For more information about the award recipients, open TPF studies or the program, visit the TPF website at <https://www.pooledfund.org/> or contact Tricia Sergeson at patricia.sergeson@dot.gov. If you have any questions about the TPF Excellence Awards, you can reach out to tpfexcellenceawards@dot.gov.

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The New National Transportation Library Archives is Officially Open!

"Hidden" USDOT collections are now publicly available.



Posters Source: USDOT.

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The **National Transportation Library Archives** is devoted to the collection, preservation, and dissemination of materials that document the rich history of the U.S. Department of Transportation. The Archives holds collections previously unavailable to the public, including photographs, oral historical accounts, press releases, transportation maps, and other ephemera from all USDOT modes of transportation.

Services offered by the Archives include research support (on- and off-site), outreach, and archival processing, preservation, and digitization.

The Archives is open to the public, Monday–Thursday (10 a.m. to 4 p.m.) by appointment only.

For more information, visit <https://www.bts.gov/ntl/ntl-archives> or contact the Archives' Eden Orelove at eden.orelove@dot.gov.



From Farm to Market: The Data Challenges of Rural Roads

Using data and effective practices to identify and analyze the role of rural roads in safe and efficient goods movement.

by **BIRAT PANDEY** and **AMBER REIMNITZ**

About 15 percent of trucks registered in the United States are used for forestry, mining, and food service industries. In 2021, these sectors—combined with other related industries—contributed about 5.4 percent (\$1.264 trillion) of the total U.S. gross domestic product. Despite the growth in agricultural freight in the United States, the lack of data collected about the roadways connecting farms to markets limits transportation agencies' ability to measure performance, plan, and invest in agricultural freight infrastructure.

Factors such as network and equipment ownership, the use of multiple modes in many agricultural shipments, and seasonality all influence the availability and quality of data. For example, farms and freight trucks are primarily owned and operated by the private sector, while the public sector typically owns, operates, and maintains farm-to-market roads. In addition, trucks often transport agricultural products from the farm to a transload facility, where their journey continues by rail or barge. Such multimodal data can be challenging to obtain. Farm equipment is also less likely to traverse the interstate and arterial systems, where data sources collect road network conditions and performance, truck flows, traffic trends, and more. Agricultural truck traffic is often seasonal,

with major surges in truck traffic during harvesting. Though a few State departments of transportation (DOTs) identify and designate farm-to-market roads, data collection needs to be more consistent and reported to the U.S. Department of Transportation. The lack of nationwide data on the roads connecting farms to markets—and the safety concerns surrounding the journeys of produce and livestock—impede conducting a comprehensive evaluation of the U.S. agricultural supply chain and overall network performance.

Lack of consistent data definitions for “farm-to-market” roads also limit the full understanding of how these networks contribute to U.S. global competitiveness. In 2022, 2.9 of 4.2 million road miles in the United States were rural. Such roads support agricultural facilities or serve as gateways to other U.S. highways and interstates.

The U.S. agricultural sector and farms are essential for a healthy economy and national security. However, due to poor infrastructure, nearly all first-mile segments of farm-to-market (or agricultural) trips are the most unreliable components of the U.S. agricultural supply chain. These same roads may also not be designed to handle modern trucks in size and weight. Other infrastructure, like bridges, also have the potential to impact

The absence of data collected on farm-to-market roads hinders their inclusion in evaluations of roadway system performance and analyses of the supply chain.

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trucks and farm equipment travel. In 2016, nearly 9 percent of bridges on rural and local roads were rated as poor condition, proportionally higher than the other functionally classified roads. In addition, weather events (e.g., heavy rain, flooding, snow) on unpaved roads may make them impassable for trucks and farm equipment. With 70 percent of the U.S. road mileage being rural, including paved and unpaved streets, these networks are critical for a vibrant and resilient agriculture supply chain.

Filling in National Road Data Gaps

The Highway Performance Monitoring System (HPMS) is the key USDOT road data program for highway inventory, condition, performance, and operating characteristics. Each State DOT collects and reports these data to the Federal Highway Administration. Some States also designate farm-to-market roads and provide special funding for them. USDOT does not require data for farm-to-market designated roads to be reported back to the Federal government, creating a pool of data available locally but not federally.

While HPMS represents detailed road inventory and usage information for arterial and collector functional systems, summary data on local roads are more limited. HPMS road inventory data are updated annually and are used for Congressional reporting, identification, and designation of road networks to meet various statutory requirements. HPMS data are also used for mapping U.S. public roads and in the apportionment process for various Federal transportation funds. The lack of information about farm-to-market roads constrains the ability to comprehensively assess the U.S. agricultural supply chain. HPMS periodically reassesses its processes for data improvement. The expansion of HPMS sample sections to include rural minor collectors and local roads is one of the most feasible avenues for filling this national data gap.



Safety on Local Rural Roads

Rural road safety is a national priority. The latest data from the National Highway Traffic Safety Administration indicates that of the 42,939 motor vehicle fatalities in 2021, 40 percent occurred in rural areas—a 5-percent increase from 2020. Design, signage, and visual obstructions are some of the influential factors. For example, rural roads are typically narrow and winding, often lacking the proper traffic signage and markings standard to arterial roads. Rural roads are also subject to unique visual obstructions caused by seasonally growing crops. Crops in rural areas are attractive to animals, often leading to dangerous wildlife crossings and strikes. In addition, rural roads may be traversed by a wide variety of local farm vehicles and equipment (i.e., tractors, combines,

Safe, reliable, and efficiently interconnected roadway systems from farms to markets are critical for national security, the national economy, and the U.S. food supply.
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Lack of pull-off areas on narrow rural roads result in an increased potential for road departure incidents or collisions.

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farm buggies) and by cars, trucks, school buses, bicycles, and pedestrians. This mix of vehicles, topography, and road conditions increases the risk of unexpected events and incidents.

Many farm-to-market shipments often require transport in bulky freight trucks that require smooth, wide roads for efficient travel. The physical dimensions of the vehicles and the roads have both safety and efficiency impacts. For example, farming equipment traversing rural roads are often confronted with limited road widths, poor signage, oncoming traffic, queuing, and insufficient parking. Even though these vehicles travel at slow rates of speed, safety considerations still exist. Narrow rural roads leave no safe pull-off areas for the equipment driver or other vehicles and can lead to road departure incidents or collisions.

Trucks delivering products to receiving facilities located along rural roads often queue, while they are waiting to offload, on the limited shoulder available. These long queues create dangerous situations for others traveling along that route. Coordination with the receiving facilities (including ports) to understand their scheduling systems could support the improvement and reduction of these queues.

Deteriorating infrastructure conditions and congestion (due to weather-related incidents, lane closures, construction zones, etc.) can force farmers to divert their shipments onto longer, less-than-ideal routes. Longer routes can increase a farmer's shipment costs and the potential for food spoilage while reducing on-time deliveries. Increased shipping costs affect both the profit to farmers and the final costs to consumers.

Poor infrastructure conditions and congestion levels also impact

trucks trying to deliver agricultural goods at ports or logistics yards, causing them to potentially miss their unload times or experience a complete product loss.

Prioritizing funding for rural road construction and maintenance will help ensure truck drivers can take the most efficient routes. This dedicated funding would also help improve roadway safety (e.g., by widening roads and pull-off areas), protect farm vehicles against damage from uneven road surfaces and unmaintained roads, and shorten travel times for all drivers, including passenger cars and emergency vehicles.

How States Approach Designating Roads Connecting Farms and Markets

Although many State DOTs do not have laws and formal processes to exclusively integrate and designate these critical local roadways connecting farms to markets into their business process and long-range planning, a handful of States do. For the States that do have laws, however, their processes are unique to their respective State and may be vastly different than the other States with laws.

For instance, Texas DOT (TxDOT) typically designates and owns farm-to-market roads in the State. Such roads are typically two-lane, paved roads in rural areas with speed limits of up to 75 miles (121 kilometers [km]) per hour. Texas constructed its first farm-to-market road in 1937. In 1949, the State's legislature passed the Colson-Briscoe Act, calling for an annual appropriation of \$15 million from the State General Fund to construct additional farm-to-market roads. In 2022, farm-to-market roads represented 47 percent (37,907 centerline

Grant Program	Program Description
INFRA – Nationally Significant Multimodal Freight and Highway Projects.	Provides grants for multimodal freight and highway projects of national or regional significance. https://www.transportation.gov/grants/infra-grant-program
RAISE – Rebuilding American Infrastructure with Sustainability and Equity	Provides grants for surface transportation infrastructure projects with a significant local or regional impact (aka Local and Regional Project Assistance). https://www.transportation.gov/RAISEgrants
Rural Surface Transportation Grant Program	Provides grants for projects to improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, generate regional economic growth, and improve quality of life. https://www.transportation.gov/grants/rural-surface-transportation-grant-program
RTEPF – Reduction of Truck Emissions at Port Facilities Grant Program	Studies and provides grants to reduce idling at port facilities, including through the electrification of port operations. https://www.transportation.gov/rural/grant-toolkit/reduction-truck-emissions-port-facilities



miles [61,005 centerline km]) of the State's total roadway mileage. TxDOT designates agricultural roads as either farm-to-market roads or ranch-to-market roads. Ranch-to-market roads are in the Texas Trans-Pecos and Hill Country regions; farm-to-market roads are in other parts of the State. Humberto "Tito" Gonzalez, Jr., P.E., director of TxDOT's Transportation Planning and Programming Division expressed that "farm-to-market roads provide our agriculture, energy, and timber production regions with vital connections to rural areas and urban centers, facilitating the safe and reliable movement of people and goods. Providing access to healthcare, education, employment, entertainment, and other essential services, [farm-to-market] roads help improve the quality of life for Texans across the State."

In Washington State, the Washington DOT (WSDOT) identifies heavily used freight transportation networks and designates these corridors as the Freight and Goods Transportation System (FGTS). FGTS-identified roads may include State highways, county roads, and city streets. The FGTS designation informs investment from grants provided by the Freight Mobility Strategic Investment Board, which includes roadways that connect farms to markets. "The Freight and Goods Transportation System is unique to Washington State," said Jason Biggs, director of WSDOT's Rail, Freight, and Ports Division. "It provides a data-driven framework for designating corridors important to freight movement. WSDOT and our partners rely on this designation to prioritize freight investments and further improve [the] safe, efficient, and reliable movement of freight across Washington." WSDOT designates and updates the FGTS system every two years to

meet State legislative requirements, support transportation planning processes, and inform freight investment decisions.

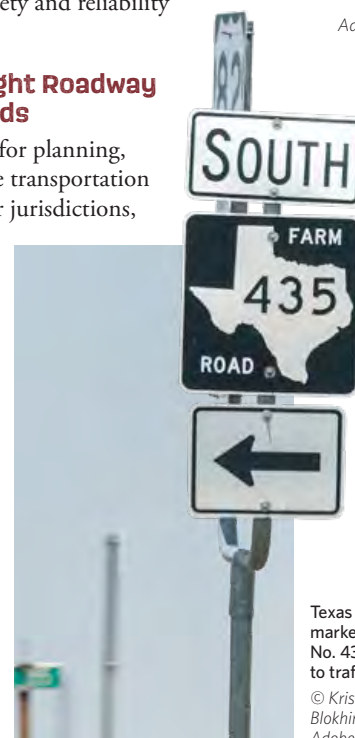
By incorporating freight corridor designation into investment considerations, Texas and Washington States are working toward improving safety and reliability of their rural road networks.

Federally Designated Freight Roadway Systems and Formula Funds

While U.S. States are responsible for planning, constructing, and maintaining the transportation systems and networks within their jurisdictions, Federal funds (both formula and discretionary) support States as they implement specific projects and strategies. FHWA administers two statutorily required freight-focused nationwide roadway network systems that are critical for the movement of freight across the United States. The Fixing America's Surface Transportation Act (also known as the FAST ACT) established the National Highway Freight Network (NHFN) and established funding for this network through the National Highway Freight Program

A handful of States across the Nation have laws that formalize the designation and funding for roads that connect farms to markets.

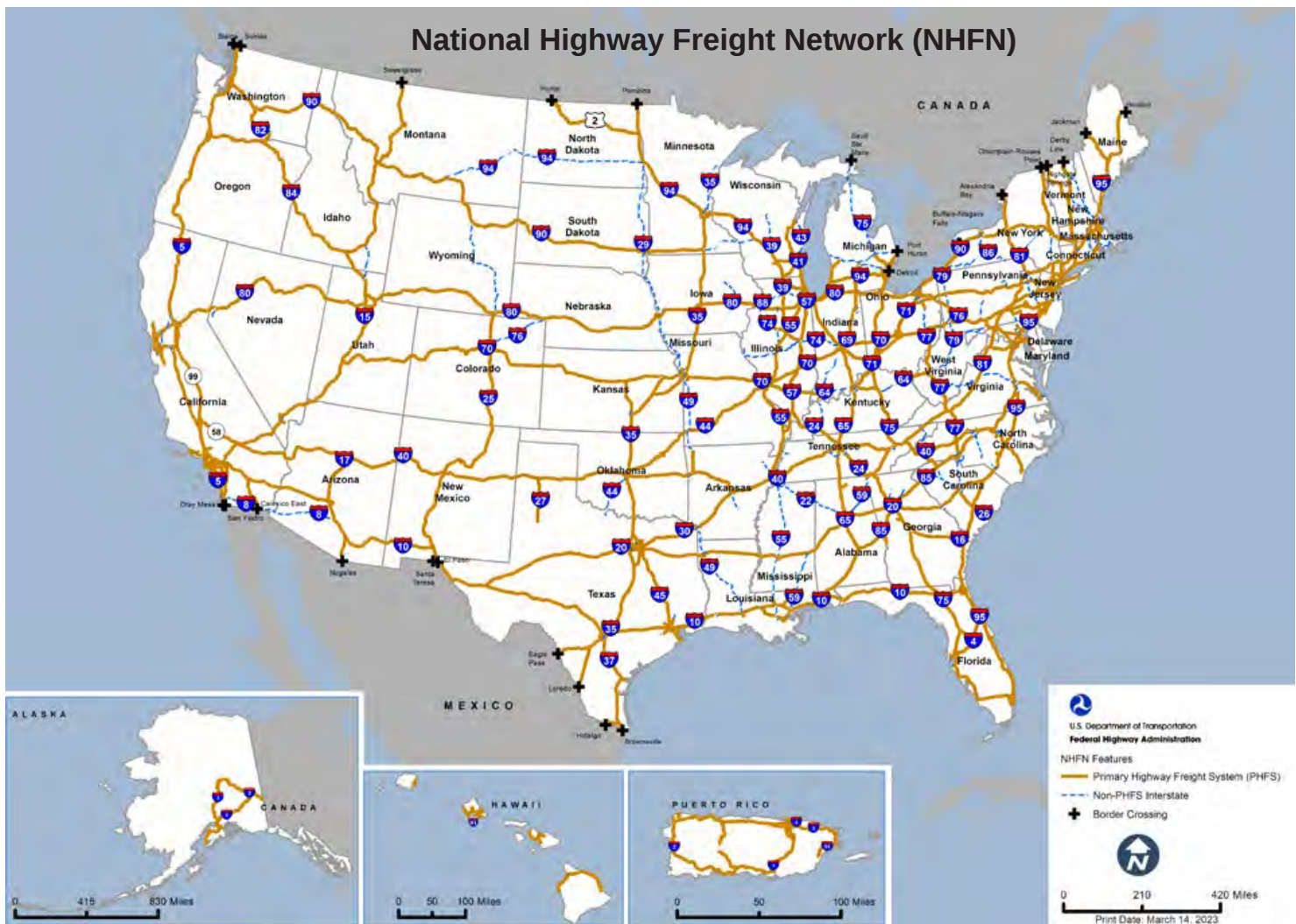
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Texas farm-to-market road No. 435 opened to traffic in 2010.

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National Highway Freight Network (NHFN)



States can use NHFN to prioritize investments that improve system performance and freight mobility.
Source: FHWA.

(NHFP). The National Network (NN) was authorized much earlier by the Surface Transportation Assistance Act of 1982 (Public Law 97-424) in 23 Code of Federal Regulations 658 and supports interstate commerce by regulating the size of trucks. The Federal government works with States and metropolitan planning organizations to designate their roadway network through the NHFP. Currently, these designations are focused on a higher functional class of roadway vehicles and national traffic flows.

Congress established a new NHFP in 23 United States Code 167 to improve the efficient movement of freight on the NHFN and ensure the network provides the foundation for the United States to compete in the global economy. The NHFP provides formula funding apportioned annually to States for use on the NHFN. From fiscal year 2021 through 2026, the NHFP funding totals \$8.64 billion. NHFP funds may be used for projects that contribute to the efficient movement of freight on the NHFN. A portion of NHFP funds may also be used for rail or water facilities (including ports) to facilitate intermodal transfer and access to the facility. This can be used to improve access for trucks carrying agricultural products to rail or barge transload facilities.

From a mileage perspective, NHFN is relatively small, representing 1 percent of the total 4.2 million miles (6.8 million km) of public roadways in the United States; it has great economic significance. Roads on the NHFN are within 10 miles (16 km) of 94 percent of all U.S. jobs and 92 percent of all U.S. business locations. The NHFN helps

facilitate domestic and international trade. Ninety-six percent of jobs in the U.S. transportation and warehousing sector and 94 percent of jobs in retail trade are within 20 miles (32 km) of the NHFN.

The NHFN consists of four separate highway network components: Primary Highway Freight System (PHFS), Critical Rural Freight Corridors (CRFCs), Critical Urban Freight Corridors (CUFCs), and portions of the interstate system that are not part of the PHFS (non-PHFS interstates). The PHFS and non-PHFS components of the NHFN represent roads that reflect the most critical highway portions of the U.S. freight transportation system. CRFCs and CUFCs are important freight corridors that provide local network connectivity. States may designate a public road within its borders as a CRFC if it is not in an urbanized area. Such designations can help strategically direct resources toward these roads that connects farms to markets. The 2021 Bipartisan Infrastructure Law increased mileage thresholds for CRFC from 150 to 300 miles (241 to 483 km) or 20 percent of the PHFS for that State, whichever is greater. Designation of CRFCs and CUFCs will increase the State's NHFN, allowing expanded use of NHFP formula funds. As of December 2022, about 60,110 centerline miles (96,738 centerline km) of U.S. roads are NHFN designated.

States are required to allow conventional combinations trucks on the NN, which includes the interstate system and portions of the Federal-aid primary system. Conventional combinations are tractors with one semitrailer up to 48 feet

(14.6 meters) in length or with one 28-foot (8.5-meters) semitrailer and one 28-foot (8.5-meters) trailer and can be up to 102 inches (259 centimeters) wide. The NN is approximately 200,000 miles (321,869 km) and is modified only if roadway segments are added to the interstate highway system or if States petition to have a segment beyond the interstate highway system added or deleted.

Funding of Freight Projects from Federal Competitive Grants

USDOT and FHWA competitive grant programs help fund different types of transportation projects and activities. These grants are often distributed through a competitive selection process targeted to interested and eligible applicants. Each operating administration (e.g., FHWA and Federal Transit Administration) solicits applications through a Notice of Funding Opportunity. Projects are selected based on program eligibility, evaluation criteria, and USDOT or program priorities.

Conclusion

Freight activity in the United States continues to increase yearly since the 2020 COVID-19 pandemic. Total U.S. trade was valued at approximately \$20 trillion in 2023, with trucks carrying 72 percent of flows. Between 2023 and 2050, the

U.S. freight activity is expected to grow by 78 percent and \$36 trillion, with trucks continuing to be the single most-used mode.

Rural roads comprise the largest portion of the U.S. road network, but the U.S. needs more data on their traffic volumes, condition, and performance to better analyze farm-to-market supply chains and their resiliency.

A freight supply chain is only as resilient as its weakest component. Safe, reliable, and well-connected farm-to-market roads are critical for national security, the national economy, and the U.S. food supply.

BIRAT PANDEY, an engineer, is the freight analysis and data program manager for FHWA's Office of Operations. He manages the agency's NHFN program and works freight modeling, freight truck automation, and emerging technology initiatives.

AMBER REIMNITZ is a certified Project Management Professional and engineer with over 17 years of experience in planning, engineering, and operations of emerging transportation technologies.

For more information, see <https://ops.fhwa.dot.gov/freight/>, or contact Birat Pandey at birat.pandey@dot.gov or Amber Reimnitz at amber.reimnitz@dot.gov. For more details on USDOT-provided grants, visit <https://www.transportation.gov/grants>.



USDOT and FHWA competitive grant programs are available to fund transportation projects and activities, including agricultural-related operations.
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ACCELERATING U.S. INNOVATION: Bringing Global Innovations to U.S. Highways

How the Federal Highway Administration transfers applicable technologies and best practices from overseas.

by **HANA MAIER**

The Global Benchmarking Program (GBP), formerly known as the International Technology Scanning Program, was authorized in 1991 in the Intermodal Surface Transportation Efficiency Act, known as ISTEA. While the program was modified and received a new name in 2015, its mission and purpose remain the same—identify, evaluate, document, and implement proven foreign innovations that have the potential to significantly improve highway system performance, mobility, and safety in the United States. The program was established after a very successful European pavement study tour that opened the eyes of many in the United States that domestic pavement performance was far behind that of many European countries. The study enumerated a set of improvements that practically became the roadmap for enhancing asphalt pavements in the United States. Although the study brought home and promoted many pavement advances, perhaps its most significant contribution was showing the U.S. highway transportation community the many benefits of learning from innovations abroad.

The benefits come from adopting other countries' advancements and avoiding unnecessary U.S. duplication of research and development. These studies also create synergy for promoting tested solutions to common challenges.

Other countries face similar challenges and, in many cases, have developed creative and highly effective solutions. Gaining from the advances of other nations, including lessons learned, the United States benefits by learning from other's mistakes and not "re-inventing the wheel." These benefits are ultimately realized in the road network and by roadway users.

Since its establishment, FHWA has organized and conducted more than 95 GBP studies on a broad range of topics. Many essential technologies and practices, including

those seen and experienced by roadway users every day, were either first identified by a GBP study or received substantial endorsement and widespread promotion from one. The following are some examples: heavy-duty asphalt that resists rutting; separated bicycle lanes; crash-reducing highway roundabouts; rumble strips; the pretreatment of roads with brine before snowstorms; variable speed limits to manage traffic; quiet pavements; wildlife passages under highways; warm mix asphalt that requires less energy; and pedestrian-protecting traffic calming approaches. As demonstrated in States, regions, and cities throughout the Nation, the identification and application of best practices from overseas through the GBP has helped save costs, time, and lives.

Study Topic Identification

Through its Office of International Programs (HPIP), FHWA funds and administers the GBP, with approximately two studies taking place each year. Subject matter experts and others submit study proposals through FHWA's core program offices. The proposals are evaluated based on their alignment with U.S. Department of Transportation and FHWA strategic goals

ABOVE: The positive impact and benefits of innovations shared from around the world can be felt here in the United States.

Inset images: See attribution note on page 33.

RIGHT: GBP features a systematic methodology that focuses on implementation. Each study includes five phases that span a 3-year period.

Source: FHWA.

Study Planning

(~4 months)

International Coordination

(~5 months)

Meetings and Site Visits Abroad

(1 week)



and objectives, potential to advance the U.S. transportation's state of the practice, transportation agency demand, and other related factors. The proposals also undergo risk analysis to ensure selected studies produce the highest benefit and value. The FHWA Administrator makes the final topic selections.

Once the FHWA Administrator has selected a topic, a team of five to seven experts is formed. This team includes two FHWA representatives (with one serving as team lead), two State department of transportation representatives (selected by the American Association of State and Highway Transportation Officials (AASHTO)—a longtime partner and stakeholder in advancing the program—and funded through the Transportation Research Board), and a report lead responsible for documenting study findings. Study teams may also include additional stakeholders (e.g., local government, association, and academia representatives) that have an important role with respect to the subject area of the study and the implementation of study findings.

Each study team travels abroad to observe innovations firsthand and to engage in in-depth discussions with foreign counterparts. Study team members collectively determine the locations

visited through a “desk study” where preliminary research of international innovators is performed. Study teams typically visit two to three countries over a

one-week period. In advance of the visits, targeted questions are formulated by the study team and submitted to hosting agencies by the GBP management team. These questions guide each of the hosting agencies in developing a program for the team's visit. Following study travel, team members evaluate findings and develop a comprehensive report that is shared publicly on the HPIP website, as well as through other FHWA offices and their respective webpages. Through presentations, webinars, technical sessions or meetings and more, the study team further disseminate their findings to the U.S. highway transportation community.

The most important element of the GBP is its focus on implementation. From its inception, each study is premised upon the study team leading an effort to implement key findings in the United States. Toward this end, study teams design and carry out an implementation plan outlining strategies for communicating, promoting, and encouraging the adaptation of key findings and promising international best practices to the U.S. context. GBP studies, in effect, become the stimulus for implementing new ideas and emerging technologies.

How GBP Benefits the United States

With its emphasis on observing and applying innovative technologies and practices from abroad, GBP provides both programmatic and technology-specific benefits. The programmatic benefits include:

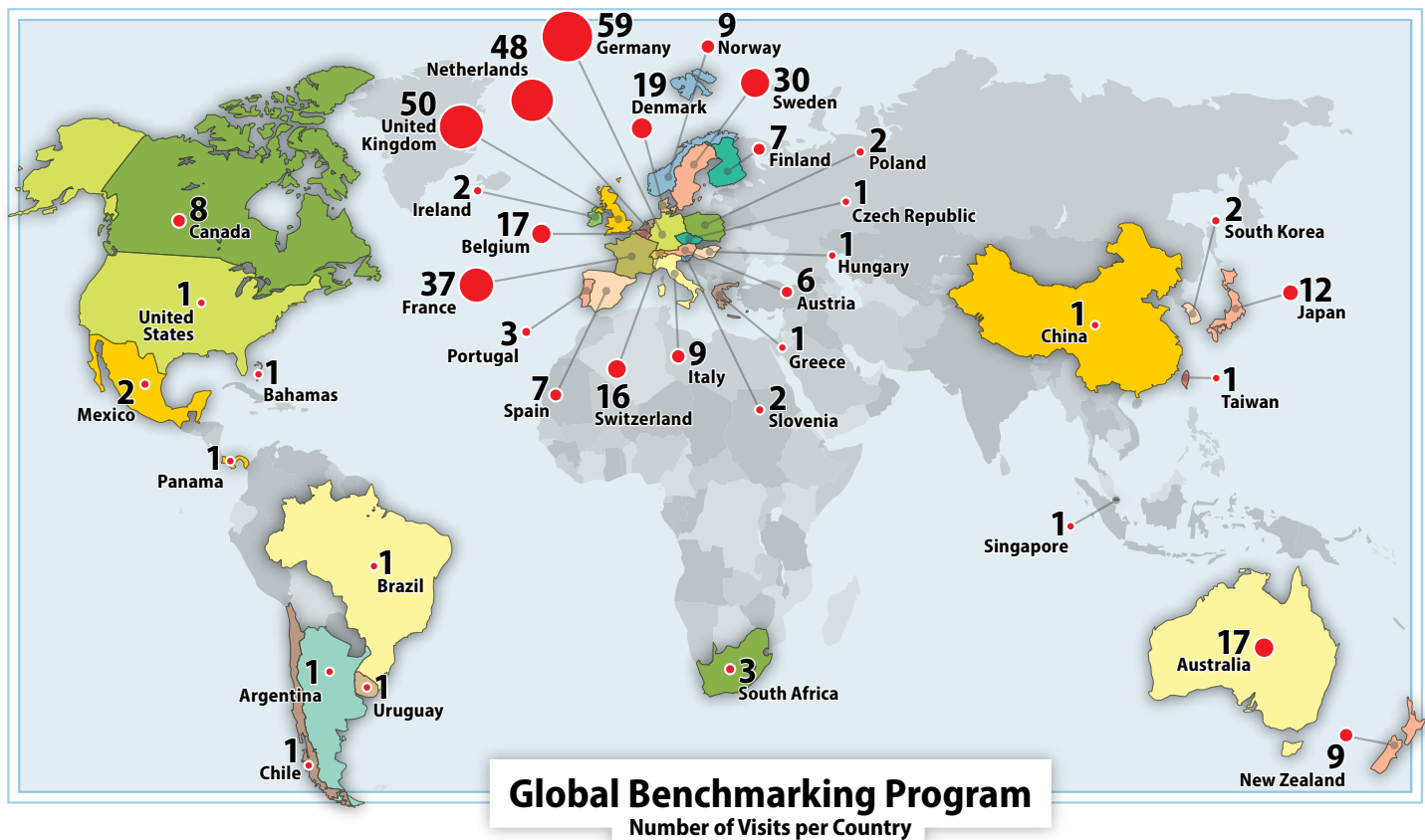
- Providing U.S. transportation professionals with the unique ability to observe foreign innovations firsthand, interact with international peers, ask specific questions, and evaluate for themselves how an innovation could be adapted and applied in the United States.

**Study Report and
Implementation
Plan
Development**

(~4 months)

Implementation

(Up to 2 years)



- Saving research dollars by capturing mature and emerging technologies, policies, and practices that do not have to be recreated from scratch in the United States.
- Accelerating improvements to U.S. transportation by:
 - Increasing the array of solutions available that can be pursued.
 - Acquiring innovations that already have been proven (i.e., have standards, specifications, and manuals) and often have evolved through more than one generation of development.
- Providing a window on the future by examining issues that are new in the United States but are mature or longstanding abroad (This future view allows U.S. observers to understand the stages of development and avoid the missteps that the early adopters already experienced).
- Creating U.S. advocates who have seen the successes abroad and who will promote the innovations to their peers in the United States.
- Promoting international cooperation by exposing U.S. officials to innovations abroad and exposing international officials to U.S. practices. For example, in several studies, international counterparts have said that U.S. questions caused them to examine their approaches from a new perspective. In several cases, GBP studies have also been invaluable in forging strong working relationships with international partners, including formal collaboration. These relationships continue to foster exchanges of ideas for years afterwards, contributing to progress in transportation in the United States and abroad.

These broad programmatic benefits are matched by a long list of technology, policy, and practice innovations. The following are just a few examples of benefits resulting from the momentum provided by the GBP. While it would be an

overstatement to say that these benefits came about solely because of the GBP, there is widespread recognition that GBP studies played a vital role in identifying and stimulating efforts to implement these ideas and technologies.

■ Road Safety Audits (RSA)

An RSA is a formal safety performance examination of an existing or future road or intersection by an independent and multidisciplinary team. First observed on a GBP study to Australia and New Zealand in 1996, RSAs are now employed by nearly all States, many local governments, and promoted by regional planning organizations. The audits are credited with reducing crashes, often with modest expenditures to improve sight distance or signage. In 2012, a Florida study found that crash rates decreased by 10 to 60 percent because of improvements recommended by RSAs.

The National Cooperative Highway Research Program (NCHRP) synthesis *DOT Practices on Road Safety Audits* just concluded: “The use of RSAs in the United States has grown significantly since the publication of NCHRP Synthesis 336 in 2004. RSAs are conducted by 43 of the 49 State departments of transportation (DOTs) that responded to the survey. Regarding the extent of DOT experience with RSAs, 36 DOTs have been conducting RSAs for at least five years. Regarding RSA frequency, 29 DOTs conduct 1–10 RSAs per year and 7 DOTs conduct more than 25 RSAs annually.”

“I’ve had the privilege of participating on numerous RSAs across the Nation and the most beneficial step of the process is the field review where you can see how traffic is moving, the speeds and understand the struggles of the vulnerable road users,” says Rebecca Crowe, FHWA transportation specialist and team co-leader. “That field review is critical to developing suggestions to minimize the risks.”

ABOVE: FHWA has conducted site visits around the world, bringing home best practices and innovations for the transportation community.

Map © Maxim Basinski / AdobeStock.com. Modifications by FHWA.

Roundabouts

Roundabouts are one of the original FHWA Proven Safety Countermeasures because they significantly reduce fatal and serious injury crashes at intersections through the reduction in speeds and conflicts for all users. Participants in early GBP studies focusing on highway safety found that European and Australian engineers had modernized the old traffic circle into a modern roundabout that substantially reduces the number and severity of intersection crashes. In mid-1997, there were fewer than 50 modern roundabouts in the United States. The number is now estimated at more than 10,000 and growing 25 years later. Following these studies, FHWA developed the first U.S. roundabouts informational guide (2000), promoted roundabouts extensively as a market-ready technology, and included them as one of the first Proven Safety Countermeasures (2008).

In 2018, FHWA *Research and Technology Evaluation: Roundabout Research* (FHWA-HRT-17-040) reported that roundabouts averted between 38,000 and 53,000 crashes, with an estimated societal cost savings of more than \$9 billion between 1990 and 2014. Well designed, roundabouts continue to reduce fatal and severe injury crashes significantly in the United States. According to Jeff Shaw and Hillary Isebrands from the FHWA Intersection Safety Team, “Roundabouts are a shining example of taking a successful idea from international practice, learning more about it from experts abroad through the deliberate and structured GBP process, and bringing back to the U.S. the confidence and knowledge to introduce a new and transformational life-saving intersection”.

Warm-Mix Asphalt (WMA)

Observed during a European study in 2002, WMA technologies allow the producers of hot-mix asphalt pavement material to lower the temperatures at which the material is mixed and placed on the road. This technology, in turn, enables extended paving seasons and significantly reduces energy consumption and associated greenhouse gas emissions. In 2010, WMA became an FHWA Every Day Counts initiative, which speeds the deployment of technologies that can improve

transportation projects’ quality, sustainability, and safety. Today, 44 States use WMA in their mixes and more than 40 percent of DOT sector asphalt in the United States is now warm mix. The estimated reduction in greenhouse gas emissions is approximately 0.10 million metric tons of CO₂ equivalent annually, equaling the annual emissions of 22,000 passenger vehicles.

WMA usage in the United States has expanded across a broader range of projects and climates and extensive research and field trials to optimize and validate the performance and environmental benefits of WMA have been conducted. Additionally, U.S. development of specific methodologies and guidelines for WMA implementation have helped standardize practices and encourage wider use, positioning the United States as a leader in the practical application and innovation of WMA technologies. According to Chris Wagner, FHWA technical director, Pavement and Materials Technical Service Team, WMA has been “transformative” and “the United States has made notable advances in both the adoption and further development of these technologies.”

Prefabricated Bridge Elements and Systems (PBES)

GBP has been instrumental in bringing this technology to the United States. PBES are manufactured offsite or near a job site under controlled conditions and then transported to the work zone ready to install. PBES save time, reduce traffic congestion, and result in more durable bridges.

With PBES, fabrication occurs out of the right-of-way at a nearby site, minimizing the need for lane closures, detours, and the use of narrow lanes. Since more of the work is done out of traffic, fewer workers are required over or near traffic, further enhancing safety. Fewer and shorter lane closures also improve safety for motorists since any deviation from normal traffic patterns can result in crashes. As a result, PBES lead to reduced traffic impacts, improved work zone safety, less disruption to the environment, better quality, and lower life cycle costs.

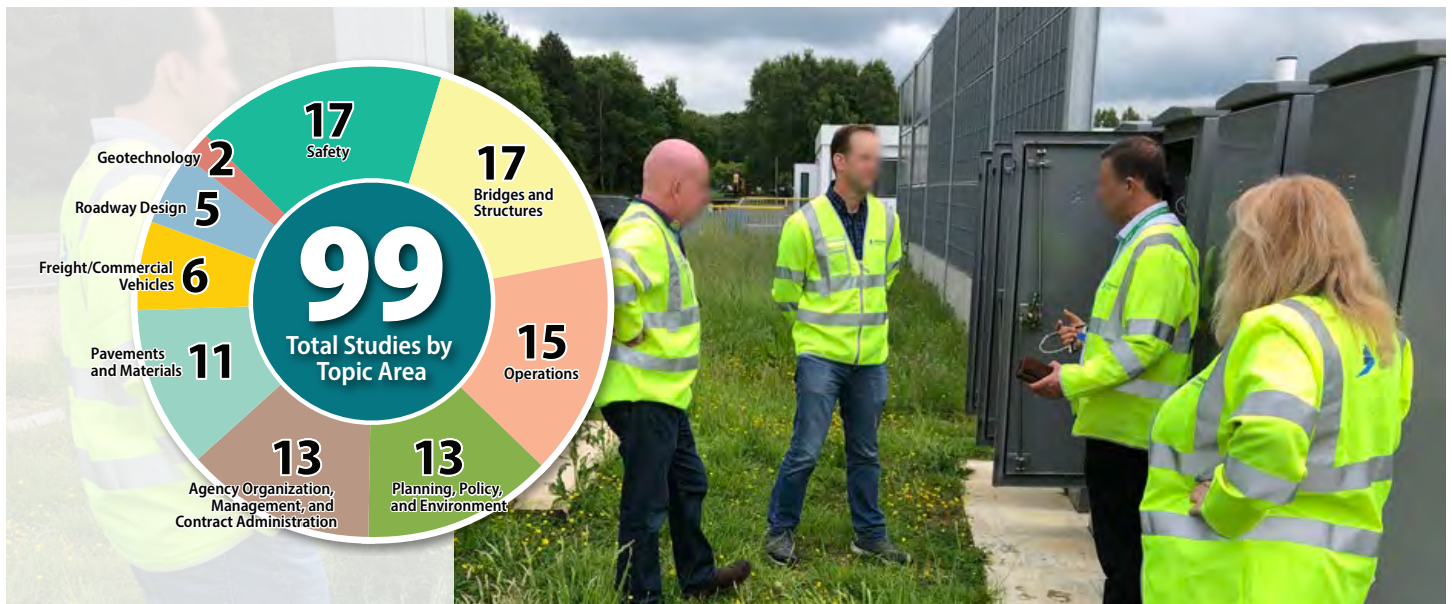
The study team reviewed international use of PBES and identified decision processes, design methodologies,

In 2022, the current edition of the National Bridge Inspection Standards (NBIS) regulation, 23 CFR 650 Subpart C, was enacted by FHWA. With the inclusion of risk-based inspection frequencies and more stringent program training requirements, among other key additions, this was “the first significant comprehensive update to the Bridge Standards since its inception” in 1971, states Tom Drda from FHWA’s Office of Bridges and Structures. This will help agencies improve safety and better focus resources, says Tod Kimball, with the FHWA Resource Center. “States should start seeing the benefit of efficiently using limited available resources,” he adds.

However, the journey to this significant development in our Nation’s bridge safety began 17 years ago with a Global Benchmarking study on Bridge Evaluation Quality Assurance in Europe. Following the study, the team—including Drda and Kimball—began the process of working with stakeholders to implement recommendations. The study played a leading role in the formation of the (2012) MAP-21 requirement for FHWA to develop a risk-based approach for determining bridge inspection intervals. This, in turn, led to the 2014 NCHRP Report 782 and its proposed guideline for reliability-based bridge inspection practices—and ultimately—the incorporation of risk-based inspection intervals in the 2022 revision to the NBIS. Studies like this are “critical to the U.S. so we can make improvements to our standards,” Kimball notes. Sometimes it takes the study to “open everyone’s eyes” in the first place, he adds.



Source: FHWA.



construction techniques, costs, and maintenance issues associated with use of the technology. This work became part of FHWA's Highways for LIFE and Accelerated Construction Technology Transfer initiatives, an AASHTO Technology Information Group focus technology, and a research topic in the second Strategic Highway Research Program.

Self-Propelled Modular Transporters (SPMTs)

Among the most impressive innovations identified by GBP are SPMTs. SPMTs are computer-controlled platform vehicles that can move massive objects with precision to within a fraction of an inch. On projects around the country, SPMTs are being used to lift and drive prefabricated bridge components to their final location in minutes, minimizing traffic disruption, improving work zone safety, and enhancing the quality of the completed bridges. Already, millions of dollars have been saved by reducing disruption of service costs with SPMTs.

"This technology offers the most speed and flexibility for bridge replacements. Since its initial use in 2006 following the scan, it has become more competitive, with dozens of highway and rail bridge projects completed in States across the Nation," says Mary Lou Ralls Newman, a former bridge engineer for the Texas Department of Transportation and study team member. "The study was the catalyst that started the use of SPMTs for accelerated bridge construction in the U.S."

The team for this study also developed a manual on the use of SPMTs. The team conducted open houses on SPMT construction projects in Florida and Rhode Island. This led other States to adopt the technology.

Policy Innovations

Some of the largest contributions from the GBP have come from policy-focused studies that promoted performance management, asset management, risk management, and financial management. All four of these practices, first examined by the GBP, were included in the Moving Ahead for Progress in the 21st Century Act, reflecting how studies help address both current and future issues that eventually mature into standard U.S. practice. Tim Henkel, formerly of Minnesota DOT, and John Milton of Washington State DOT participated in the 2012 study that resulted in the report

Transportation Risk Management: International Practices for Program Development and Project Delivery.

"We would not have been where we're at without the GBP study. It began the journey for every State," says Henkel.

GBP saves every State from "not having to research the problem or find the solution themselves...rather they can rapidly apply proven practices to their needs," says Milton.

Recent Benefits

Now in its fourth decade, GBP continues to access and adapt innovations from abroad. With new research ideas selected each year, the program supports evolving USDOT objectives with the best of domestic and global best practices. These studies are resulting in further improvements and savings for our Nation's transportation system. Recent examples include the following studies.

Pedestrian Safety

In response to a decade of rapidly increasing pedestrian fatalities on U.S. roads, FHWA undertook a GBP study to examine noteworthy approaches and innovations used by other countries to achieve reductions in serious pedestrian injuries and fatalities on arterial roadways—the corridors on which most U.S. pedestrian fatalities occur. The study team determined that the countries with the best combination of innovative practices, demonstrated success in improving pedestrian safety over time, and contextual similarity were New Zealand and Australia. The study included technical site visits and meetings in both countries over a one-week period.

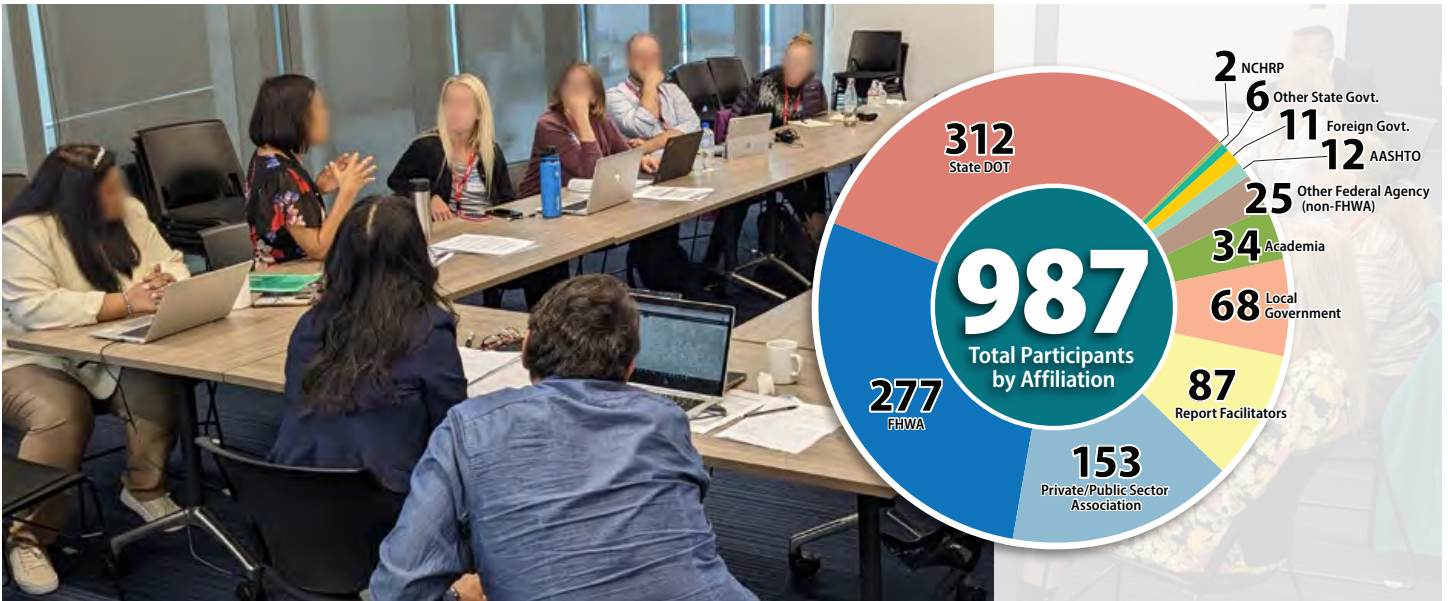
The study team identified three high-level takeaways:

- Pedestrian safety is foundational for wellbeing and livability.
- Movement and place are an interconnected system.
- Pedestrian safety challenges benefit from proactive and interdisciplinary solutions.

Following the study, the team produced the report *Improving Pedestrian Safety on Urban Arterials: Learning from Australasia*, which identifies key strategies from the Safe System Approach to eliminate fatal and serious injuries for all road users, with an emphasis on people walking, cycling, and rolling. In addition, the team conducted more than a dozen

ABOVE: Team members meet onsite with Waka Kotahi New Zealand Transport Agency to discuss the "Improving Pedestrian Safety on Urban Arterials" GBP study in 2022.

INSET: Nearly 100 studies have been completed, ranging from safety to geotechnology. Source: FHWA.



presentations, webinars, and workshops with thousands of participants to share study results.

“Uniformly, practitioners expressed appreciation for the compiled information and are motivated to expand and accelerate our U.S. efforts to prioritize pedestrian movement, reduce speeding, and integrate road safety audits throughout the life cycle of a project” says Shari Schaftlein, equity program director with FHWA and study team lead.

FHWA team members are currently preparing phase 2 of their implementation campaign, during which they will:

1. Engage State, regional, and local practitioners, including recipients of discretionary grant funding from the Bipartisan Infrastructure Law, in developing a national community of practice.
2. Provide dedicated technical assistance to help selected agencies adapt key strategies from the report into U.S. practice.
3. Develop supplemental guidance and resources for practitioners that align with the U.S. context, process, and requirements.

Unmanned Aircraft Systems for Infrastructure

FHWA conducted a GBP study that resulted in the report *Use of Unmanned Aircraft Systems (UAS) to Enhance the Design, Construction, Inspection, and Maintenance of Transportation Infrastructure*. Based on findings from a desk review, the study team conducted technical site visits and meetings with Federal, State, and local infrastructure owner-operators, practitioners, and policymakers in the United Kingdom and Germany. In addition to reviewing UAS best practices in a variety of use cases, the study team examined UAS digital models and data management, including asset life cycle management.

The study provided an opportunity to learn about remote and repeatable UAS operations and how they have led to a nearly 70 percent increase in efficiency in inspections at the Port of Hamburg. Domestically, multiple States are now looking to use similar UAS dock-based technology to enhance their own inspection programs. After successful trials in Alaska and California, FHWA will be hosting States for onsite demonstrations to make this innovation mainstream in the United States.

The study also examined the challenge of dealing with large amounts of data created by UAS, a problem shared by many countries.

FHWA UAS Program Manager and Study Team Lead James Gray says, “Leveraging common data standards to automate routine processes in the U.K. was eye opening and is something that many States are now working to build a strong data foundation through data management and common data definitions.”

To address this challenge, FHWA has funded about \$34 million in efforts to develop this foundation data framework to date and

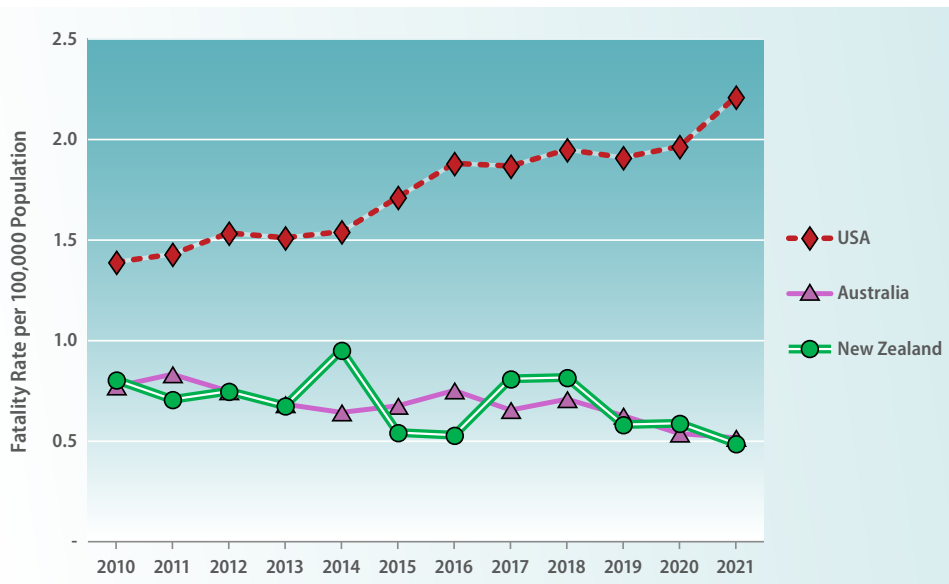
ABOVE: In 2022, the team met with representatives from Auckland Transport to discuss the “Improving Pedestrian Safety on Urban Arterials” GBP.

INSET: Over the years, nearly 1,000 individuals have participated in studies, including those from FHWA, State DOTs, and others.

Source: FHWA.

LEFT: Pedestrian fatality rate per 100,000 population 2010–2021.

Source: FHWA.



published a tech brief on the U.K. methodology.

“The value of standards cannot be understated,” says Aaron Chamberlin, senior transportation engineer at the California Department of Transportation and a study team member. “This was an area where Europe is far ahead of the U.S., and it has highlighted efforts needed to be worked on at a national level to make UAS systems repeatable.”

As a result of the study, the United States has an increased understanding of best practices for UAS and UAS collected data management which can be applied domestically to advance the adoption and use of UAS technology for transportation applications.

“The ability to review the domestic state of the practice for UAS operations and then measure ourselves against other advanced economies has been of incredible value,” says Gray. “We never want to assume that because we have found a method that works that we have found the best method.”

Bridge Evaluation Technology

A GBP study focused on electrically isolated tendons (EIT) examined how Italy and Switzerland have successfully used EITs as a nondestructive evaluation technology for posttensioned (PT) bridge structures, which represent a major component of the U.S. bridge inventory. The study provided valuable lessons for implementing and maintaining these systems in the United States.

According to Reggie Holt, FHWA senior bridge engineer and study lead, “The study has provided invaluable information to the U.S. bridge community in developing a new standard to qualify EITs in the U.S.”

In addition, the information collected from the GBP study has assisted bridge owners and practitioners to successfully deploy two U.S. EIT demonstration projects with a third project starting in fall 2024.

There were numerous complementary benefits to this study as well. The study informed the research team of other technologies that can advance the state of practice for the design, construction, and management of PT bridges in the United States. Two of these technologies have yielded implementable results. The first is a void/corrosion sensor for PT tendons that one of the EIT demonstration projects included. The second technology is a national posttensioning training and testing center, under development at the University of Texas at Austin, under a Transportation Pooled Fund study with 12 State DOT participants and the FHWA Office of Bridges and Structures. Other technologies that FHWA is investigating include automated grout plants, in-line grout density meters, and EIT perforation meters.

The study also developed relationships with international experts who share common interests. As a result of the study, formal collaboration on advancing technologies and practices that improve the resiliency of concrete bridges began between



the United States and Switzerland, and FHWA became a participating member of the International Federation for Structural Concrete (fib), facilitating continued international collaboration.

Building Information Modeling (BIM)

BIM for infrastructure is a collaborative work method for structuring, managing, and using digital data and information about transportation assets throughout their life cycle. BIM, also referred to as Better Information Management, offers benefits for all stakeholders involved in highway transportation. These include cost and resource savings, greater efficiency and shorter project life cycles, improved communications and coordination, and higher quality results. While the movement toward BIM for infrastructure has been growing in the United States, the international state of the practice is further ahead.

FHWA undertook a GBP study to learn from international experience and document evolving trends in BIM—all with a view to advance U.S. practice. The study team visited BIM-mature agencies in the United Kingdom, the Netherlands, and Norway to discuss and examine core aspects of BIM implementation in greater depth. The BIM development efforts of the studied agencies demonstrated clear motivation, purpose, goals, and top-line support, which recognize both the costs—more importantly—the benefits of adopting BIM for infrastructure.

“The officials visited offered the study team invaluable advice related to priority activities to focus on and key international efforts to follow in this fast-developing field,” says Katherine Petros, study participant and Infrastructure Analysis and Construction team leader at FHWA.

In recognition of the need to have a national strategic approach to BIM for infrastructure implementation, FHWA engaged with stakeholders to develop the *Advancing BIM for Infrastructure National Strategic Roadmap*, which was published in June 2021. This report, coupled with the GBP

ABOVE: Members of a GBP study team visit a tunnel that has experienced overhead strikes.
Source: FHWA.

study, created momentum for the establishment of a BIM for Infrastructure pooled fund study which provides a mechanism for stakeholders to work collaboratively to advance BIM for Infrastructure.

In addition, FHWA held a series of webinars that featured the participation of European officials from the study who shared noteworthy practices and translatable lessons learned. The interest generated from the webinars prompted FHWA to bring some of these European officials to the United States to present and interact directly with State DOTs as a part of a “BIM Week,” which brought together key AASHTO joint committees and BIM pooled fund participants.

“The ability for U.S. practitioners to directly engage with experts who have overcome similar challenges in their countries was priceless,” says Petros.

As part of the GBP outreach, FHWA also developed a video to help convey BIM concepts to State DOT senior leadership.

“It was clear from the discussions with the BIM-mature countries that understanding of BIM benefits and support from senior leaders was a big factor in the achievements they have made,” says Petros.

In addition to developing a deeper understanding of how BIM for infrastructure can be used to better deliver transportation projects, manage assets, and provide related services, the GBP study reinforced how important it is for the United States to participate in the global community as open data exchange standards are developed. Recently, FHWA became a corporate member in buildingSMART International, which is the international body that develops and maintains openBIM® standards. By representing U.S. interests along with AASHTO, FHWA can ensure that United States-based vendors and industry are able to compete in the global marketplace.

Looking Forward Toward New Ideas and Technologies

Over the years, GBP’s impact on the U.S. transportation community has been significant. The program has helped a broad spectrum of innovations used around the world become

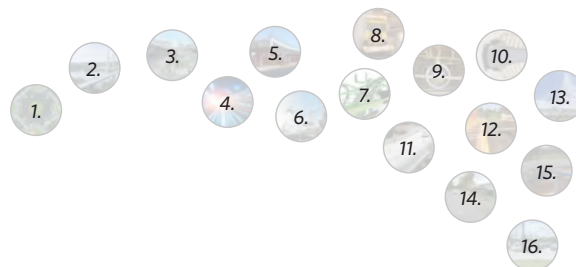
more widespread in the United States. Even some ideas that appeared to have no chance of adoption have evolved into practice. Ideas that never make it at least encourage the United States to reexamine and reinforce its practices.

There are still many things to be learned from other countries. This situation is true for prior topics that have momentum here but have continued to advance overseas, or entirely new topics currently being studied, such as turbo roundabouts; green public procurement; preventing bridge and tunnel strikes from oversized vehicles; and resilience for roadway design; construction; and maintenance. By accessing and adapting innovations from abroad through GBP, FHWA, U.S. States, regions, and cities are developing and implementing new ideas and technologies that will result in further improvements and savings for our Nation’s transportation system.

HANA MAIER is with the FHWA HPIP, and serves as the Global Benchmarking program manager. She has a master’s degree in international studies from American University.

For more information, contact Hana Maier at Hana.Maier@dot.gov.

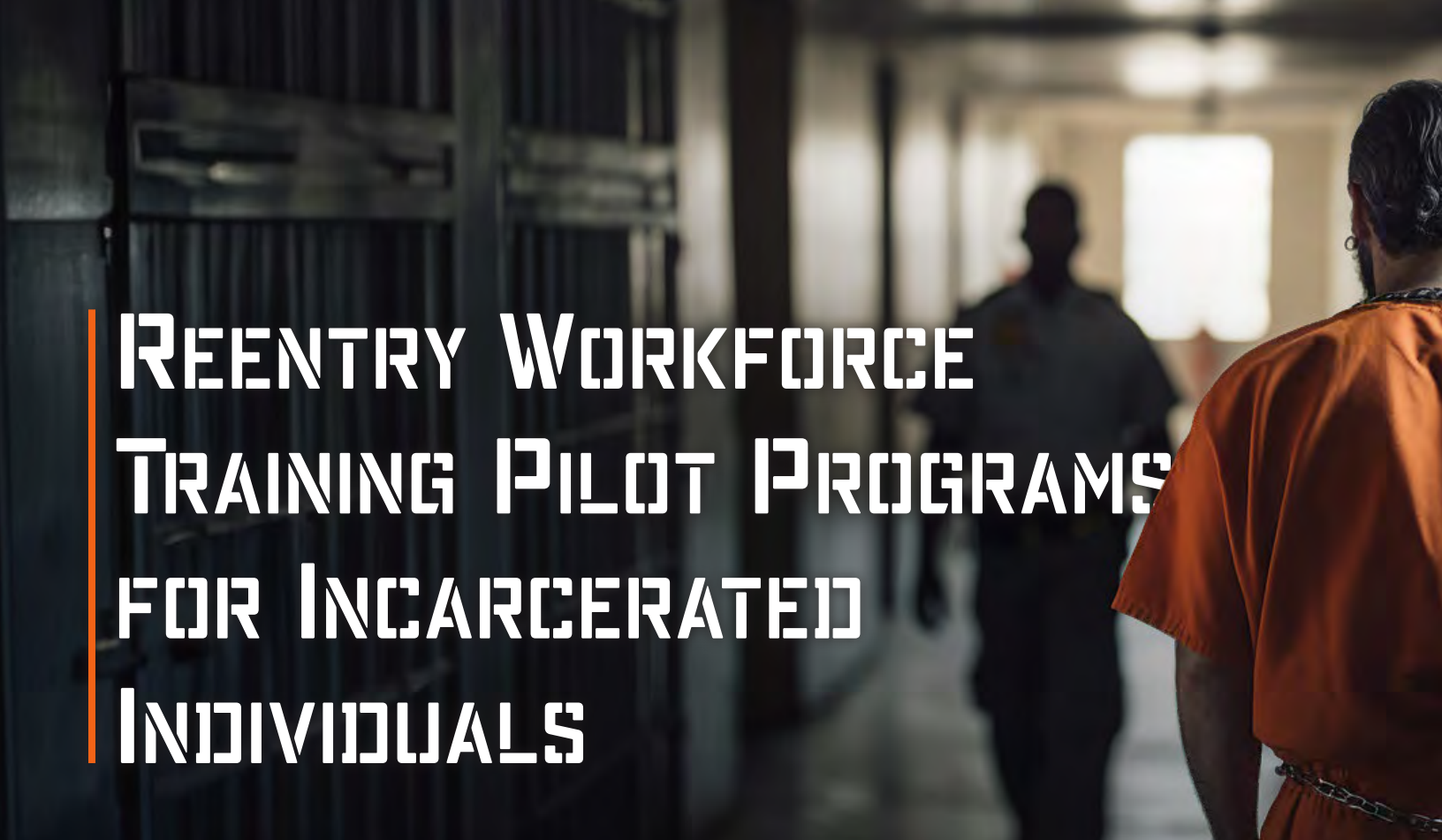
Page 26–27 image credits. Map and bridge: © chungking / scaliger / AdobeStock.com. Images in circles: 1. Source: FHWA; 2. Source: FHWA; 3. © Google Street View; 4. © 123rf.com; 5. Source: FHWA; 6. Source: FHWA; 7. © Trafikverket, Sweden; 8. Source: FHWA; 9. © WSP, USA; 10. © VSL International; 11. Source: FHWA; 12. © WSP, USA; 13. Source: FHWA; 14. © Google Street View; 15. Source: FHWA; 16. Source: FHWA.



For more information about the topics covered in this article, please see the following online resources:

- **Global Benchmarking Program** https://international.fhwa.dot.gov/programs/tbp/docs/33545_FHWA_OIP_Factsheet_Global_Benchmarking_v12_RELEASE_508.pdf
- **Office of International Programs** https://international.fhwa.dot.gov/programs/tbp/docs/29033_FHWA_OIP_Brochure_OIP_Story_and_Mission_v22_RELEASE_508.pdf
- **PUBLIC ROADS — Autumn 2022** <https://highways.dot.gov/public-roads/autumn-2022/02>
- **The Effectiveness of RSA Projects** https://safety.fhwa.dot.gov/rsa/case_studies/fhwasa12037/chap3.cfm#sec4.3
- **Warm-Mix Asphalt** <https://www.asphaltpavement.org/expertise/sustainability/sustainability-resources/warm-mix-asphalt>
- **Use of Unmanned Aircraft Systems (UAS) to Enhance the Design, Construction, Inspection, and Maintenance of Transportation Infrastructure** <https://international.fhwa.dot.gov/pubs/pl23007.pdf>
- **Global Benchmarking Webinar Series: Improving Pedestrian Safety on Urban Arterials** <https://www.pedbikeinfo.org/webinars/webseries/benchmarking.cfm>
- **Improving Pedestrian Safety on Urban Arterials: Learning from Australasia** https://international.fhwa.dot.gov/programs/mrp/improving_pedestrian_safety.cfm
- **Building Information Modeling (BIM) Practices in Highway Infrastructure** https://international.fhwa.dot.gov/programs/mrp/bim_practices_highway.cfm
- **Electrically Isolated Tendons in European Transportation Structures** https://international.fhwa.dot.gov/programs/mrp/electrically_isolated_tendons.cfm

Source: FHWA.



REENTRY WORKFORCE TRAINING PILOT PROGRAMS FOR INCARCERATED INDIVIDUALS

New initiatives offering employment, life skills training, and supportive services while creating a pipeline of skilled workers for the transportation industry.

by **ANDREA KIRK**

Transportation agencies and industry contractors struggle to find highway construction workers at all skill levels. State departments of transportation (DOTs) are turning to nontraditional recruitment programs, such as those designed for the incarcerated population, to fill this need. In similar fashion, in August 2023, the Federal Highway Administration began funding pilot programs in two States to pursue justice-impacted individuals for workforce reentry. The pilot programs were inspired by the Justice40 Initiative, and set out to create equity by providing resources and employment opportunities for financial, mental, academic, physical, and emotional stability. The pilot programs set out to offer supportive services (e.g., housing and transportation assistance, work uniforms and personal protection equipment, and abuse counseling); life skills training (e.g., financial literacy and driver's license recovery); and workforce certifications (e.g., Occupational Safety and Health Administration's Safety and Health Fundamentals Certificate Program, a commercial driver's license, and heavy equipment operator certification).

Along with generating equity, the pilot programs also set out to reduce recidivism, build a pipeline of skilled workers, and assist minority inmates in gaining meaningful employment in the construction industry. Such goals can be accomplished

as FHWA collaborates with stakeholders to design and launch a program model that meets the needs of the highway construction workforce and the pilots' participants; work with State transportation agencies and other local stakeholders to develop a roadmap or baseline for implementing a broader model of the pilot programs; and collaboratively develop metrics to evaluate the success of the programs.

Justice-impacted individuals include those currently or formerly detained in a carceral setting and those who are monitored by a probation or parole system.

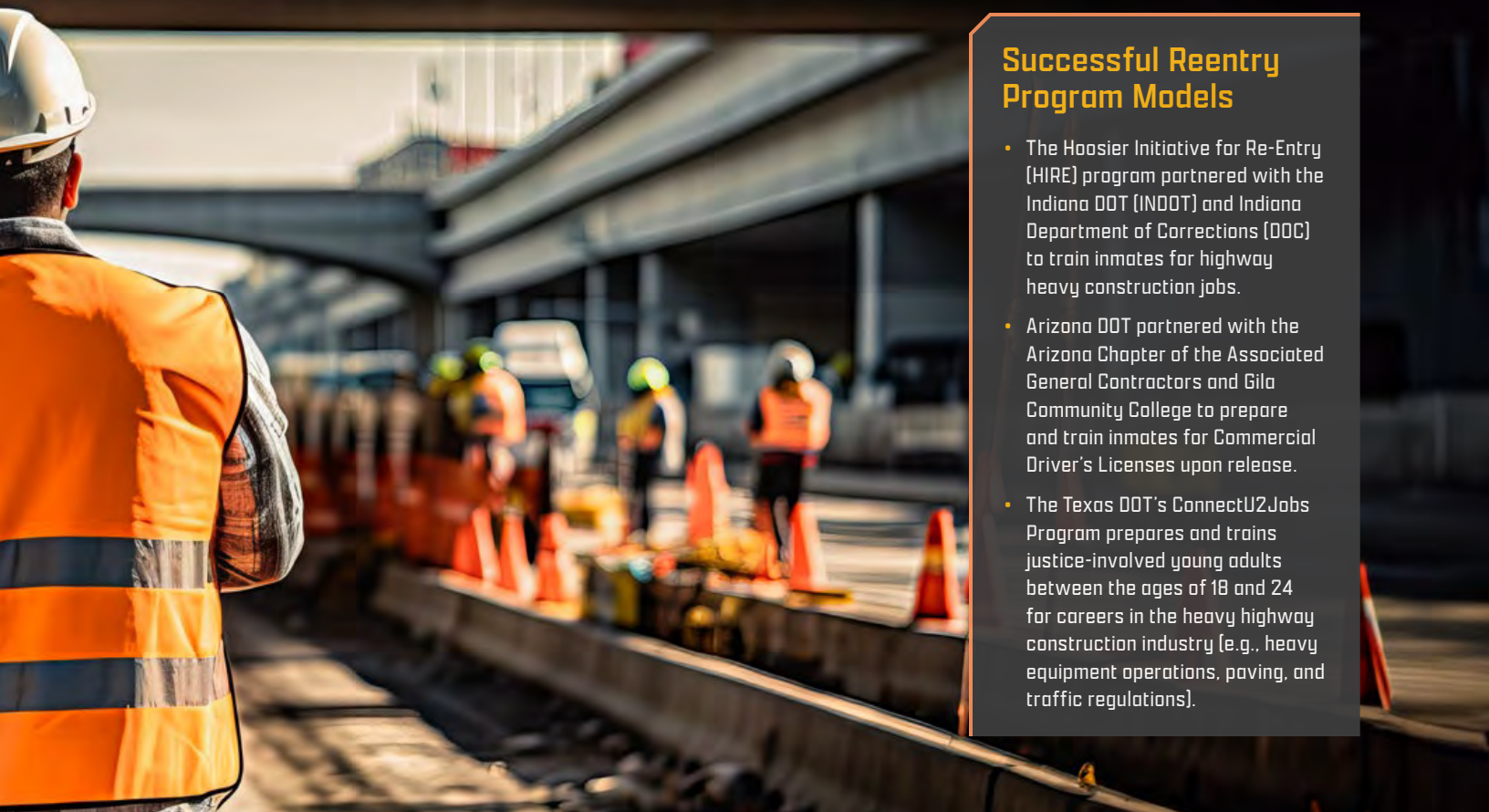
Why Was This Population Chosen and How Will the Initiative Benefit Participants?

Although minorities and persons of color comprise less than 50 percent of the general population in the criminal justice system, they are over-represented in local, State, and Federal jurisdictions. The Bureau of Justice Statistics reports that 35 percent of State prisoners are White, 38 percent are African-American, and 21 percent

are Hispanic. In 12 States, more than half of the prison population is African-American, and in 11 States, at least 1 in 20 adult Black males is in prison. These figures excluded incarceration in Federal prisons or jails, which would generally increase the number of people by approximately 50 percent.

In its November 2018 report entitled *Reentry Matters: Strategies and Successes of Second Chance Act Grantees*, the Council for State Governments Justice Center reported that although Tribal members represent a small proportion of people

ABOVE: State DOTs are turning to recruitment programs geared toward the incarcerated population to fill the growing workforce shortage in transportation.
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Successful Reentry Program Models

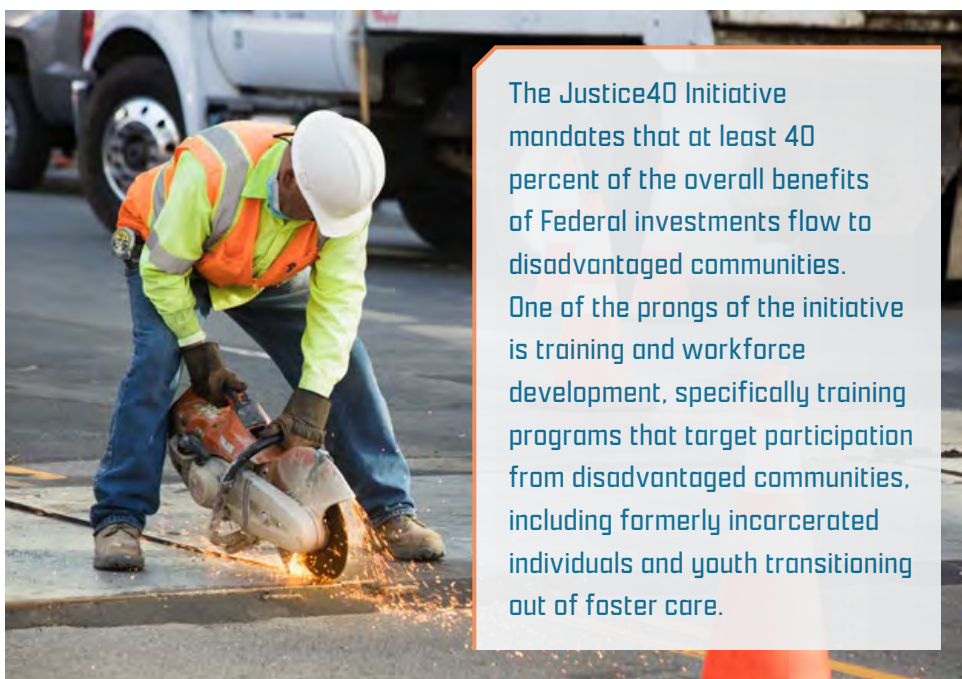
- The Hoosier Initiative for Re-Entry (HIRE) program partnered with the Indiana DOT (INDOT) and Indiana Department of Corrections (DOC) to train inmates for highway heavy construction jobs.
- Arizona DOT partnered with the Arizona Chapter of the Associated General Contractors and Gila Community College to prepare and train inmates for Commercial Driver's Licenses upon release.
- The Texas DOT's ConnectU2Jobs Program prepares and trains justice-involved young adults between the ages of 18 and 24 for careers in the heavy highway construction industry (e.g., heavy equipment operations, paving, and traffic regulations).

in jails, the number of them held in county and city jails across the country increased by almost 90 percent from 1999 to 2014.

Studies have shown that the ability of former inmates to secure and maintain stable employment significantly reduces the risk of recidivism. As the U.S. economy continues to expand into more technologically advanced directions, a lack of education is a nearly insurmountable barrier to success for this population. Many inmates lack a high school diploma, and although many prison educational programs provide opportunities to gain credits and degrees, it is not enough to overcome the collateral consequences of the incarceration itself, and the impact a criminal record has on employment prospects for former inmates.

Former inmates who participate in vocational training are more likely to be employed after their release from prison than those who do not receive such training. Vocational training programs—offering education in trade industries such as carpentry; plumbing; culinary arts; welding; and heating, ventilation, and air conditioning—have demonstrated the

greatest benefits to a reduction in recidivism as these training programs provide certifications and resources that enhance the marketability of the former inmates once released. According to a 2019 research brief sponsored by the U.S. Department of Labor and issued by two consultancies working to improve public well-being, training for specific occupational fields that offer growth opportunities improves the chances of stable long-term employment.



The Justice40 Initiative mandates that at least 40 percent of the overall benefits of Federal investments flow to disadvantaged communities. One of the prongs of the initiative is training and workforce development, specifically training programs that target participation from disadvantaged communities, including formerly incarcerated individuals and youth transitioning out of foster care.

Vocational training can lead to jobs and opportunities in the transportation industry.
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The pilot programs were inspired by the Justice40 Initiative, and set out to create resources and employment opportunities for financial, mental, academic, physical, and emotional stability.

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Which Two State DOTs Were Chosen to Conduct the Pilot Programs and Why?

One of the desired outcomes of the pilot programs is to identify challenges and model best practices for other State DOTs to launch and administer similar equity-driven programs.

After establishing specific requisite components and outcome metrics, FHWA selected INDOT and Wisconsin DOT (WisDOT) to host the pilot programs. The INDOT pilot builds on Indiana's existing HIRE program. The WisDOT pilot is actively focused on recruiting and training both the incarcerated population and the recently paroled and probation population of federally recognized Tribal members. The seed money for the pilot programs was provided through funding from FHWA's On-the-Job Training Supportive Services program.

- **INDOT: The Better Your Future (BY) Roads and HIRE Pilot**

INDOT is integrating its pilot program into an already established, long-running State initiative designed to ensure newly released inmates have the chance to reset their lives. The HIRE program has been in existence since 2012, and has successfully trained and placed thousands of former inmates in employment opportunities. The INDOT BY Roads program's highway construction curriculum offers certifications from the National Center for Construction Education and Research Core as well as highway specific safety modules for certified flagging and highway construction safety. The selected courses are designed to facilitate the participants' transition back into society. Financial literacy content is also included in the curriculum. "Our partnership with INDOT has been invaluable to the program," says Carrie Heck, the HIRE director for the Indiana reentry program. "We not only have several of our clients currently working with our partnering agency, but INDOT takes time to really listen to what our clients need, and assist in any way they can."

"INDOT has been one of the easiest partnerships for the HIRE Program. We communicate regularly and can really focus on working together to promote success for our client base," Heck continues.

INDOT partners with a host of service providers and State agencies to administer its program, including Goodwill Industries and the Indiana Construction Roundtable Foundation. With such partnerships, the capacity to deliver wraparound services such as lodging, transportation, and employee counseling are made possible. Identifying, establishing, and nurturing these relationships has been one of the most rewarding outcomes of the pilot for the participants and organizers.

- **WisDOT: The Tribal Pilot**

A review of the demographics of incarcerated individuals in the Nation revealed that Tribal members are more disproportionately represented in corrections facilities than any other minority group. Because Wisconsin has one of the highest concentrations of incarcerated Tribal members in State correction facilities, a Tribal Labor Advisory Committee and an Inter-Tribal Task Force were established within its DOT; they are ideally situated to address the needs of the State's Tribal population. The WisDOT pilot program is still in the developmental stage, and the first cohort of students entered the program in mid-summer 2024. The program will use the existing curriculum of WisDOT's Highway Construction Skills Training (HCST)—a six-week intensive training program that creates opportunities for underrepresented groups and prepares them for careers in the road construction industry. HCST includes a network of services and industry connections to enhance the success rate of its participants.

What Components Are Necessary to Launch and Establish a Successful Reentry Training Program?

Launching a successful reentry program is dependent on an underlying network of partners and opportunities. For one, a partnership between a State's DOC and DOT is essential as well as an existing job placement and supportive services memorandum of agreement between a DOC and external entities, including private sector companies. Many States also have existing agreements with both nonprofit entities and labor groups (e.g., unions), and contracting organizations. Other elements of a successful reentry program, include:

- Existing job training programs within the State's prison system for currently incarcerated individuals. These programs typically offer vocational certifications in a variety of careers, including welding, carpentry, general construction, and auto mechanics.
- A formalized relationship between each partner to clarify the expectations and roles and responsibilities of each agency to ensure the program is properly structured and supported.
- Established metrics from the DOCs and supportive services entities for recidivism prevention and job placement and retention. Goal setting is crucial to the success of an innovative program and tracking the journey of participants can identify gaps in service as well as potential improvements.

Conclusion

Full-fledged reentry workforce training programs can address both the historic inequities and disenfranchisement of marginalized communities and the growing workforce shortage

in transportation. For the justice-impacted population, reentry programs can be a means of providing a robust reintroduction into society and the necessary wraparound services to help ensure participants' success and reduce recidivism. A recent study found, overall, that individuals who completed vocational certification programs while incarcerated were 43 percent less likely to recidivate upon release and 13 percent more likely to secure employment than those who had not participated. For the transportation industry, reentry programs can be a means for State DOTs to build and sustain a pipeline of skilled workers. Justice-impacted individuals represent a marginalized sector of society that can help States meet the workforce needs for highway construction by serving as, for example, heavy equipment operators, construction laborers, traffic controllers, asphalt paving workers, and other infrastructure project roles.

"The reentry program is a great way to ameliorate current and future workforce shortages and provide equitable opportunities to participate in federally funded State DOT construction projects," says Martha Kenley, the National Disadvantaged Business Enterprise program manager in FHWA's Office of Civil Rights. By and large, investing in former inmates is an investment in future employees by which the industry can engage and continually support a creative, talented, and competitive workforce.

ANDREA KIRK is the program manager of FHWA's On-the-Job Training and Supportive Services program. She has a B.A. in English literature from Ohio University and a J.D. from Capital University Law School.

For more information, visit <https://www.fhwa.dot.gov/civilrights/programs/ojt.cfm> or contact Andrea Kirk at andrea.kirk@dot.gov.



Reentry workforce training programs support reintroduction into society for justice-impacted populations and reinforce a continual, creative, talented, and competitive transportation workforce.

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Along the Road features current and upcoming activities, developments, trends, and items of general interest to the transportation community.



Public Information and Information Exchange

Youngsters Wowed at TFHRC's 2024 TYCWD

In April 2024, in concert with National Take Your Child to Work Day (TYCWD), the Federal Highway Administration's Turner-Fairbank Highway Research Center (TFHRC) hosted its annual event.

TYCWD at TFHRC familiarizes kids with the STEM (science, technology, engineering, and mathematics) work their parents perform to enhance infrastructure design, driver and pedestrian safety, and other key areas of highway transportation. TFHRC Administrator Dr. Kelly Regal and chief scientist Craig Thor initiated the day's festivities by delivering an introduction about what was in store.

The children then took part in a slew of activities prepared by the staff of TFHRC's 15 cutting-edge laboratories. Activities

included the making and breaking of asphalt made of chocolate (to simulate the mixing and strength testing of asphalt cores); performing flame tests (to simulate research performed in the Chemistry Laboratory); and testing out the stream table inside the J. Sterling Jones Hydraulics Research Laboratory, a laboratory that tests the hydraulic performance of highway drainage structures and stream crossings (e.g., storm sewers).

"It's really fun. The activities are good, and the people that run the activities are amazing," said Ashley Shine, one of this year's children in attendance at the event.

The year's most popular activity was watching the Federal Outdoor Impact Laboratory crash test, a favorite among the children and their parents each year.

ABOVE: Two young boys display their amazement while participating in one of the day's many learning activities. Another young boy examines a piece of equipment nearby.

Source: FHWA.

RIGHT: The crash test simulation by TFHRC's Federal Outdoor Impact Laboratory remains a popular TYCWD activity every year.

Source: FHWA.



Effective Wrong-Way Driving Alert System Deployed by UDOT

Car crashes at typical highway speed limits are dangerous. Wrong-way vehicle crashes, which are usually head-on collisions occurring at highway speeds, pose even more danger on roadways. In 2022, eight wrong-way crashes caused 10 fatalities in Utah; a year later, wrong-way crashes more than doubled, resulting in six fatalities.

In February 2023, to help prevent similar incidents and additional deaths, the Utah Department of Transportation (UDOT) installed 15 new wrong-way driving detection systems around the State; eight more installations are slated throughout 2024.

The detection systems use radar, high definition/infrared cameras, and a series of red “Wrong Way” warning signs equipped with solar-powered, high-intensity light-emitting diodes (LEDs). When wrong-way drivers are detected, the warning signs trimmed in LEDs light up to alert drivers that they are driving their vehicle against the direction of traffic.

When a driver does not heed the warning from the signs and continues driving, the advanced detection system signals the UDOT Traffic Operations Center and Utah Highway Patrol to track the vehicle and apply intervention so the driver can be stopped. In the first test of this system, 23 wrong-way drivers avoided colliding with oncoming traffic after detection.

For more information on the wrong-way driving alert system, visit <https://www.udot.utah.gov/connect/2023/12/14/udot-aims-to-prevent-wrong-way-driver-crashes-with-new-detection-and-alert-system/>.

Grade Separation to Connect Parts of ASU’s Tempe Campus

In May 2024, the Arizona Department of Transportation (ADOT) announced it had selected a contractor to realize plans for a pedestrian and bicycle grade separation across University Drive in Tempe, AZ. The new underpass—inspired by Vision Zero—will work to deliberately separate pedestrians and cyclists from vehicles to create safer city travel and eliminate traffic-related injuries and fatalities. The grade separation will also provide a new path to the center of the historic Arizona State University (ASU) Tempe campus from ASU’s sports venues and Downtown Tempe—linking Tempe locales and enhancing campus connectivity and safety for students entering and exiting the campus. The path will also include access to the Tempe Transportation Center, a 40,000-square-foot (3,716-square-meter) facility that houses a retail store, transit store, bike repair shop, the city of Tempe Transportation Office, and traffic management center.

ADOT will provide engineering and oversight services. Grants through the Federal Highway Administration and an intergovernmental agreement signed by Tempe Mayor Corey Woods and ADOT made the project possible. Construction of the grade separation—to include public art, desert landscaping, and Americans with Disabilities Act-accessible ramps and provide a more efficient way of moving for all modes of travel—is anticipated to begin in late 2025.

For the latest ADOT news, visit <https://azdot.gov/adot-news>.

Internet Watch

Caltrans Launches New Clean California Project Map

In May 2024, the California Department of Transportation (Caltrans) launched an interactive map that identifies the locations of hundreds of beautification projects funded by Clean California—a \$1.2 billion, multiyear effort led by Caltrans to clean up, reclaim, transform, and beautify public spaces statewide. Nearly all the Clean California projects improve underserved communities by making them safer, cleaner, and healthier places to live.

Clean California funds infrastructure projects in three categories: Local Grant Projects, State Beautification Projects, and Local Transit Partnership Projects. Local Grant Projects are led by local governments, Tribes, and transit agencies; State Beautification Projects improve the aesthetic appeal, safety, and environmental quality of public spaces and roadsides on the State highway system, including the installations of new fencing, lighting fixtures, signage, public art, and murals; Local Transit Partnership Projects are led by local transit agencies; and State Beautification Projects are led by Caltrans.

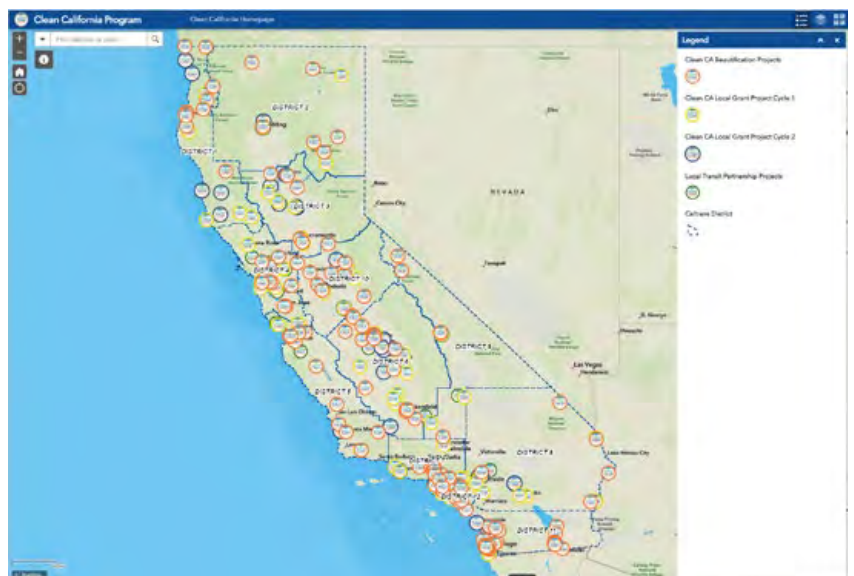
With the new geographic information system mapping tool (<https://caltrans.maps.arcgis.com/apps/webappviewer/index.html?id=7b5a27c1ae5048aeb1e1ba28e1c7e707>), users can search for active or completed Clean California projects by county, city, zip code, or address. The projects are color-coded based on the project categories. To date, efforts organized under Clean California have collected over

2.5 million cubic yards (1.9 million cubic meters) of litter, created over 18,000 jobs, including over 8,900 jobs for State Beautification Projects and 1,300 jobs for Local Grant Projects.

For more information about Clean California, visit <https://cleanca.com/>.

Efforts organized under Clean California have amassed over 2.5 million cubic yards (1.9 million cubic meters) of litter across the State.

Map: © ESRI.
Modifications by Caltrans.



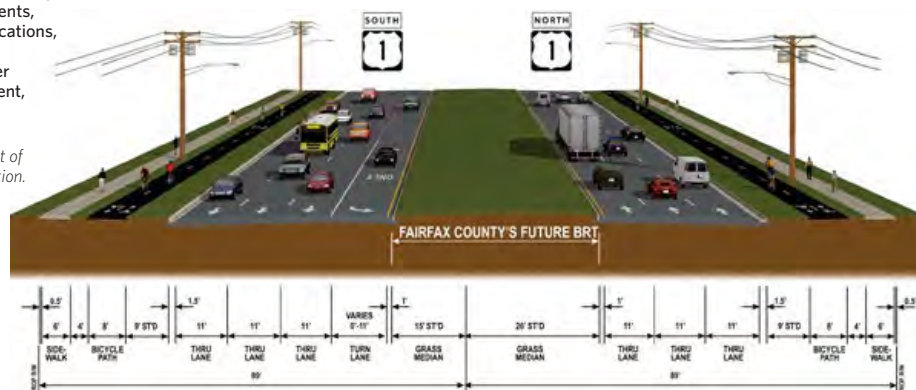
VDOT Places Corridor Improvement Projects on Interactive Display

The Virginia Department of Transportation (VDOT) is working to widen the roadway, improve safety, reduce congestion, construct noise walls, improve stormwater management, replace bridges, and encourage multimodal travel along three miles of Richmond Highway in Fairfax County.

More specifically, this project will include expanding the four-lane roadway to six lanes, adding or extending turn lanes, incorporating crosswalks at all signalized intersections within the project, constructing sidewalks and separate two-way cycle

The widening of Richmond Highway from four to six lanes will involve safety improvements, utility relocations, enhanced stormwater management, and more.

© Virginia Department of Transportation.



tracks on both sides of the road, reserving space in the proposed median for center-running bus-rapid transit lanes, and more. All pedestrian accommodations will be Americans with Disabilities Act-compliant, and signals throughout the corridor will be optimized or automatically adjusted to reflect the best possible timing settings to manage traffic.

The interactive mapping tool (<https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=78a81cd286524f79b2ffab1949c97ea9>) is an easy way for users to view which

improvements are projected along their route. While construction is slated to begin in 2027, several major milestones have already been met. For example, Phase 1 Right of Way Partial Acquisitions began in May 2024. Phase 2 Right of Way Partial Acquisitions is scheduled to begin in late 2024.

For more information on the Richmond Highway Corridor Improvements, visit <https://www.vdot.virginia.gov/projects/northern-virginia-district/richmond-highway-corridor-improvements-in-fairfax-county/>.

Technical News

Iowa Uses New Technology to Assist Safe Driving in Wintry Weather

In winter 2023, Iowa's Pottawattamie County Secondary Roads Service announced the use of new technology that assists travelers with exercising caution when inclement weather occurs across the State. With GPS devices installed inside road graders and plow units, the technology allows department administrators to track the current location of each unit in operation throughout the county.

The information captured by the GPS devices is relayed via data collected by the Pottawattamie County Geographic Information Systems onto a Snow Event Map (<https://apps.vertigisstudio.com/web/?app=ea02838538594748b2b6152fc0a7edf>), which permits travelers to view—on desktops or mobile

devices—where assigned county equipment has treated or cleared roads during winter weather events. Map information will continue displaying for 48 hours and show a 6-hour history of winter maintenance vehicles during snow events. While the technology should not be completely relied upon as an exact indicator of road condition, plowed status, or drivability, the map is designed to track where crews have been and act as a valuable tool for Iowa residents and visitors to choose the safest route.

For more information on Secondary Roads, visit https://www.pottcounty-ia.gov/departments/secondary_roads/faq/.

Policy, Regulations, and Grants

PHMSA Updates Hazardous Material Transportation Regulations

In April 2024, the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) announced the release of a new final rule to improve environmental safety, update policies surrounding the transport of essential products (e.g., medical supplies, batteries, and components used in manufacturing), and promote best practices in packaging goods for more efficient shipping.

The final rule (<https://www.federalregister.gov/documents/2024/04/10/2024-06956/hazardous-materials-harmonization-with-international-standards>) aligns Federal regulations with international standards that PHMSA helped develop. Amendments made by the final rule were necessary for several reasons, including the handling of hazardous materials in domestic and global commerce. For example, PHMSA is

removing some exceptions provided for small lithium cells and batteries for transportation by aircraft. This change is consistent with eliminating similar provisions in the International Civil Aviation Organization Technical Instructions.

PHMSA's mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential in daily life. In like manner, the final rule will help reduce greenhouse gas emissions and supply chain disruptions, and lessen the economic disadvantages faced by American companies that are forced to forgo exporting due to conflicting rules and regulations.

For more information on the safe transportation of energy and hazardous materials, visit <https://www.phmsa.dot.gov/>.

Interesting Facts

WATCH OUT FOR BLIND ZONES

The risk of injury or death to vulnerable road users (VRUs) — pedestrians, pedalcyclists, and other non-vehicle occupants — has rapidly increased over the past 20 years.

Most pedestrian fatalities occur in the front of the vehicle.



U.S. Department of Transportation
Federal Highway Administration

For more information: FHWA Pedestrian & Bike Safety — <https://highways.dot.gov/safety/pedestrian-bicyclist>

REDUCTION OF TRUCK EMISSIONS AT PORT FACILITIES (RTEPF) GRANT PROGRAM

The RTEPF Grant Program funds projects to cut port-related truck emissions by advancing electrification and efficiency. In addition to improving air quality at ports, FHWA's initial round will reduce emissions in near-port communities, which often have low-income, disadvantaged populations. A total of \$148,650,000* for 16 RTEPF Grants has been allocated to support these efforts.

STATES AND NUMBER OF RTEPF GRANTS:

- 1 - Alabama
- 1 - Hawaii
- 1 - Indiana
- 1 - Louisiana
- 1 - Maryland
- 1 - New Jersey
- 1 - Washington
- 2 - Florida
- 2 - Georgia
- 2 - Puerto Rico
- 2 - Texas
- 4 - California

Long Beach Container Terminal Electrification Advancement Project: this project reduces emissions by replacing fossil-fueled trucks and cargo-handling equipment with zero-emission technologies and by improving overall terminal efficiency to minimize truck idling and gate congestion.

Port of Savannah Renewable Fuel Project: this project is a four-year pilot program to replace the fossil-derived petroleum diesel fuel used by 621 port terminal trucks at the Port of Savannah with renewable diesel fuel, significantly lowering greenhouse gas emissions in the communities where Port terminals are located.

Electric Pilot for Port of New Orleans and Terminal Fleets: this project includes upgrading electrical infrastructure, purchasing 14 heavy-duty all-electric terminal trucks and five light-duty all-electric pickup trucks, tracking emissions and energy use, and evaluating new emissions-reducing equipment at the Port of New Orleans.

U.S. Department of Transportation
Federal Highway Administration

* FY 2022 and 2023 federal funding
** Three grants have been allocated to projects spanning multiple states.
For More Information: <https://ops.fhwa.dot.gov/bipartisan-infrastructure-law/index.htm>

TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO):

GETTING MORE FROM OUR EXISTING SYSTEM

Expanding travel choices to move more people.

49%

of shared electric scooter and bicycle trips replaced single-occupant vehicles.



80%

of people using express lanes in peak hours were riding on buses or carpooling.



U.S. Department of Transportation
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TSMO Strategies and Benefits:
https://ops.fhwa.dot.gov/plan4ops/focus_areas/integrating_operations_strategies.htm
Source: <https://ops.fhwa.dot.gov/publications/fhwahop22067/fhwahop22067.pdf>

FHWA SALUTES HILLARY ISEBRANDS PE, Ph.D.

As a Professional Engineer (PE) with the FHWA Resource Center, Hillary Isebrands' work focuses on keeping the nation safe by developing creative solutions to roadway safety and design challenges. Isebrands has been with FHWA since 2010 and was the 2019 FHWA Engineer of the Year and a 2020 Federal Engineers of the Year Top Ten Finalist.



U.S. Department of Transportation
Federal Highway Administration

Sources: FHWA, <https://www.linkedin.com/company/equal-opportunity-publications-eop/> (@EOPublications on Facebook and X)

For more interesting facts, visit the Federal Highway Administration on social media:

<https://www.facebook.com/FederalHighwayAdmin/>,
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Other Federal agencies, local and Tribal DOTs, field researchers and practitioners, and academia may also submit content for *Public Roads* but are encouraged to collaborate with FHWA and State DOTs.

Check out our **Writing for *Public Roads*: How-to Guide** to learn about the many ways you can contribute to *Public Roads*. From full-length feature articles to 200-word summaries, you can choose the option that best fits the information you want to share.

To access the guide and learn more about article types, submission deadlines, and requirements, visit <https://highways.dot.gov/research/publications/public-roads/FHWA-HRT-22-076>.

Questions? Contact us at PublicRoads@dot.gov.

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Writing for *Public Roads*: How-To Guide



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Federal Highway Administration

FHWA-HRT-24-097



From Soil to Skyline: Geotechnical Mastery With NHI Courses

by JONATHAN STRAUSS

A solid understanding of the earth and the foundation of our Nation's infrastructure is paramount in developing and maintaining an expansive and complex highway transportation system. The Federal Highway Administration's National Highway Institute (NHI) continuously shapes future geotechnical experts through training courses on everything from understanding soil mechanics to advances in geotechnical engineering principles. NHI offers a comprehensive suite of Web-based and Instructor-led courses that equip engineers, project managers, technicians, designers, and planners with the expertise needed to address challenges in difficult terrain, stable soils, subsurface exploration, foundation construction, and geotechnical analysis.

Designing Mechanically Stabilized Earth Walls

Highway engineers, consultants, and contractors can now enhance their expertise through NHI's newly updated Instructor-led course, *Design and Construction of Mechanically Stabilized Earth (MSE) Walls* (Course 132042). This training course covers the latest advancements and practices FHWA encourages in MSE wall construction, incorporating updates from the revised *Geotechnical Engineering Circular No. 11* manual.

Participants will gain in-depth knowledge of MSE wall terminology, critical project criteria, and soil reinforcement principles essential for designing safe and durable structures. The course includes real-world case studies to perform and evaluate preliminary designs, ensuring internal and external stability using advanced methods such as the coherent gravity method, the simplified method, the stiffness method, and the limit equilibrium method. Attendees will also learn to tackle complex geometric vendor designs and assess their durability through a performance-based approach, under impact and seismic loading. Equipped with these essential tools, participants will emerge with the skills necessary to design and review MSE walls on simple to complex transportation facilities. Interested participants can enroll in the course by searching for 132042 at <https://fhwanhi.geniussis.com/RegistrationByCourse.aspx>.

Mastering Subsurface Exploration for Transportation Engineers

NHI's *Geotechnical Subsurface Exploration* (Course 132084) is a Web-based learning module designed to educate transportation

engineers with the essential skills and knowledge to navigate subsurface exploration. The course covers earth materials, geophysical methods, and drilling techniques, imparting invaluable insights into soil and rock properties for designing robust foundations, walls, and other geotechnical features crucial to enduring transportation projects.

Participants will also learn to identify key geotechnical features, characterize subsurface conditions, and implement guidelines for geotechnical investigations. The intricacies of soil and rock sampling, in-situ testing, and groundwater investigation will also be covered in the course. The curriculum bridges the gap between theoretical knowledge and practical application, empowering participants to tackle real-world challenges with confidence and precision. Participants can explore new sessions of the course at <https://fhwanhi.geniussis.com/RegistrationByCourse.aspx> and search for 132084.

Exploring NHI's Geotechnical Expertise

NHI's course catalog is comprehensive and user friendly and contains a variety of geotechnical courses to help participants understand soil mechanics, master foundation design, or explore the latest in geotechnical engineering. A sampling of NHI's geotechnical course offerings includes the following:

- *Geosynthetics Engineering* (Instructor-led; Course 132013).
- *Design and Construction of the Driven Pile Foundations* (Instructor-led; Course 132021).
- *Geotechnical Site Characterization* (Instructor-led; Course 132031).
- *Soil Slope and Embankment Design and Construction* (Instructor-led; Course 132033).
- *Rock Slopes* (Instructor-led; Course 132035).
- *Drilled Shaft Foundation Inspection* (Instructor-led; Course 132070).
- *Design, Analysis, and Testing of Laterally Loaded Deep Foundations That Support Transportation Facilities* (Web-based; Course 132106).

Participants can search the course numbers (132) or keywords in the catalog at <https://fhwanhi.geniussis.com/RegistrationByCourse.aspx> to find related courses.

For more information about NHI course offerings, visit NHI's website at <https://www.nhi.fhwa.dot.gov/home.aspx>.

JONATHAN STRAUSS is a senior communications specialist contractor with NHI.

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