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Summer 2023

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U.S. Department  
of Transportation  
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### Also in this issue:

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- Missouri, Virginia Mark Roadway History
- Safe Transportation Pivotal to Health of Nation





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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?

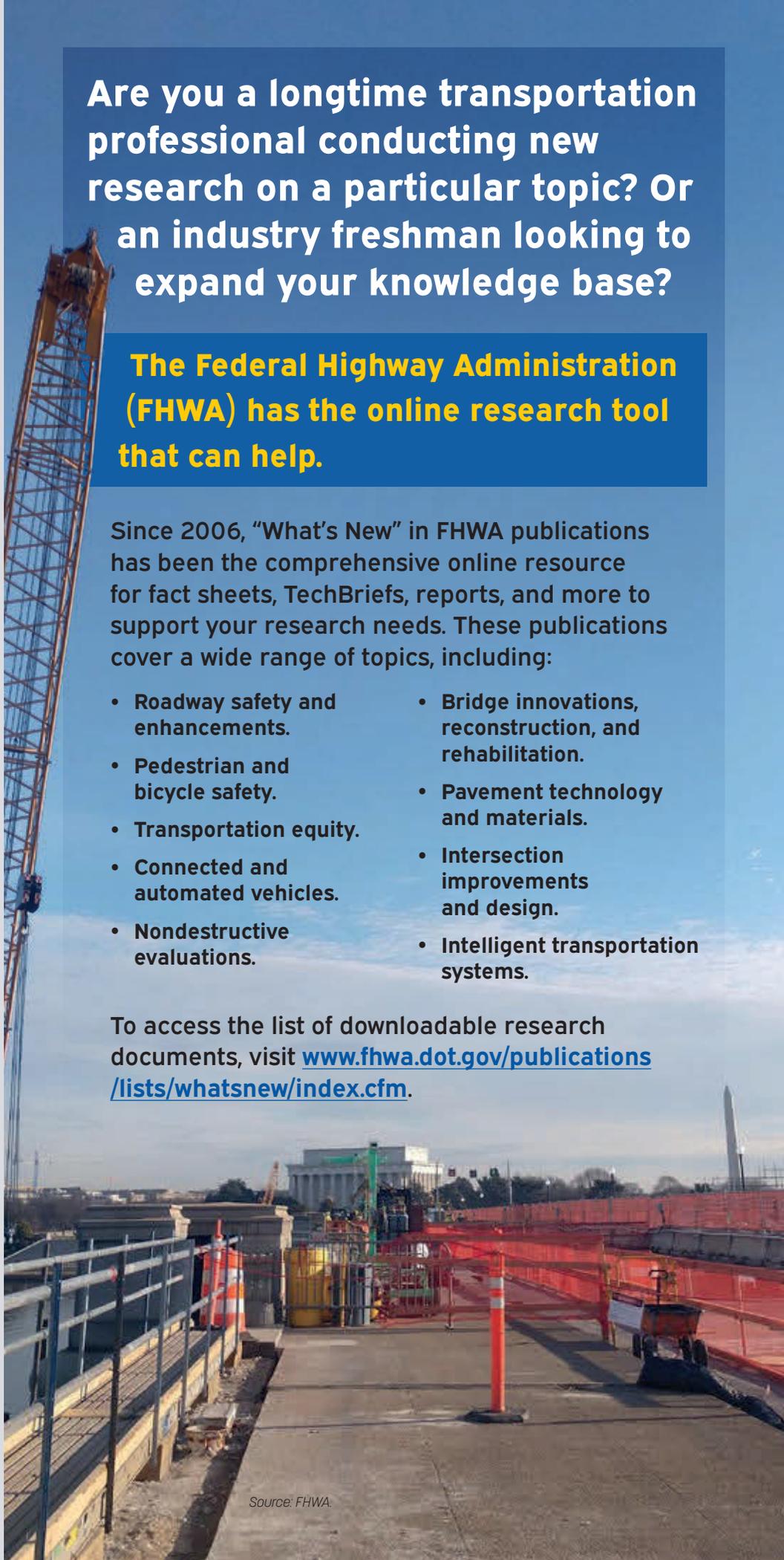
## The Federal Highway Administration (FHWA) has the online research tool that can help.

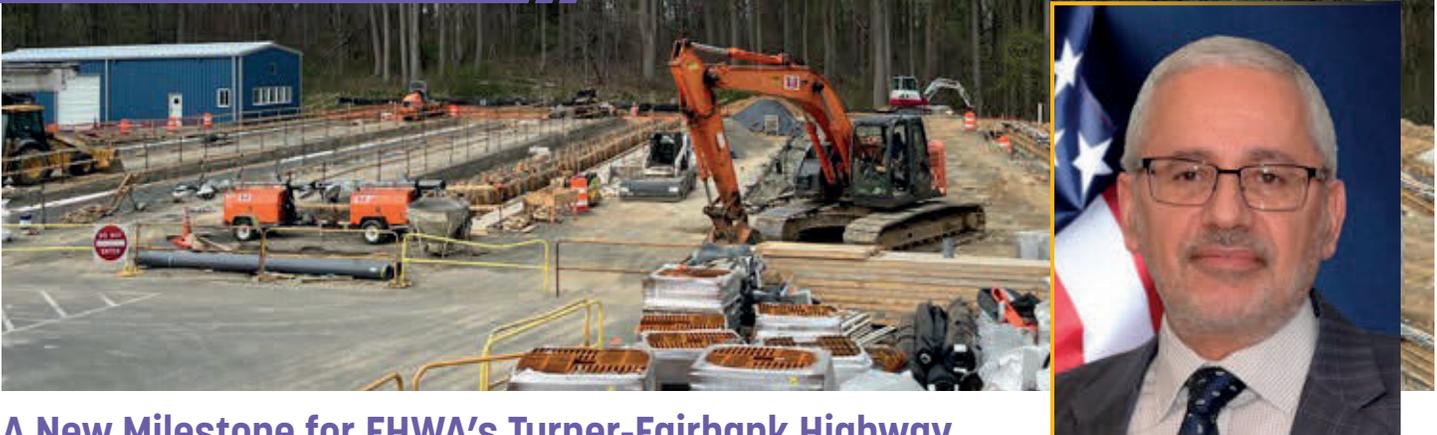
Since 2006, "What's New" in FHWA publications has been the comprehensive online resource for fact sheets, TechBriefs, reports, and more to support your research needs. These publications cover a wide range of topics, including:

- 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](http://www.fhwa.dot.gov/publications/lists/whatsnew/index.cfm).

Source: FHWA.





## A New Milestone for FHWA's Turner-Fairbank Highway Research Center—Reconstruction of the Pavement Testing Facility

Much has changed in the transportation industry over the years, with technology leading the way. From intelligent transportation systems to nondestructive evaluation, and ultra-high performance concrete, innovation has been the driving force behind advancing measures that provide the Nation with highways, bridges, and tunnels that are safe, resilient, and sustainable.

While the tactics and methods used have changed, what has not changed is the core mission of the Federal Highway Administration to serve as a pillar of safety, strength, and efficiency for the traveling public.

Earlier this year, I was honored to be appointed director of FHWA's Office of Infrastructure Research and Development (R&D). The Office of Infrastructure R&D conducts and oversees R&D programs and projects that address critical highway infrastructure needs and priorities of vital national importance. Studies in our office focus on the design, materials, construction, operation, preservation, and management of highway pavements, bridges, culverts, tunnels, and other structures.

Looking ahead to the future, what is clear is the importance of conducting innovative research, communicating with others effectively, and maintaining integrity to foster an environment of exchange, collaboration, and ingenuity. Why research is conducted is equally as important as the research itself, and how the research can be seamlessly implemented so that it benefits all stakeholders and partners. New trends in transportation need to be a priority and recognizing how those trends fit into FHWA's programs and overall goals as an office. While it is easy to fall into a trap of limiting ourselves to what was done in the past, progress and success come by forging ahead boldly with new methods and initiatives.

On any given day, the studies and experiments researchers conduct in Turner-Fairbank Highway Research Center's (TFHRC) state-of-the-art laboratories and facilities make a significant impact on the Nation's transportation system. The reconstruction of FHWA's Pavement Testing Facility (PTF) at TFHRC is one milestone that is set to advance innovation by leaps and bounds and is a testament to looking forward into the future and not back to the past.

**In conjunction with conducting multiple research programs using facilities and resources external to the FHWA, the Office of Infrastructure R&D operates the following 10 laboratories within TFHRC:**

- Aggregate and Petrographic Laboratory.
- Asphalt Binder and Mixtures Laboratory.
- Chemistry Laboratory.
- Coatings and Corrosion Laboratory.
- Concrete Laboratory.
- Geotechnical Laboratory.
- J. Sterling Jones Hydraulics Research Laboratory.
- Nondestructive Evaluation Laboratory.
- Structures Laboratory.
- Pavement Testing Facility.

Since 1986, FHWA has operated a PTF. The original facility was developed to generate pavement performance data related to design, rehabilitation, and the effect of increased loads and the long-term research efforts of the Strategic Highway Research Program.

After decades of operation, the existing facility and loading and monitoring equipment reached their end-of-life. FHWA needed to construct a new facility and procure new equipment to advance the state-of-practice for holistic pavement

design and analysis. A new design for a next generation PTF began a few years ago with a goal of maintaining FHWA's status as a leader in highway research and continues to provide impartial assessments and evaluations to our stakeholders.

The new PTF facility provides flexibility by isolating four pit areas from each other, which allows independent reconstruction of separate experiments. Within the next year, the PTF will begin experiments targeting resiliency and sustainability.

Two Accelerated Transportation Loading Systems have been procured and are primed to begin testing. These systems can apply 7,500 load passes every 24 hours, heat pavement up to 140 degrees Fahrenheit, allow up to 24-inch (0.61-meter) wheel wander to mimic real-world applications such as truck platooning, and use an automated laser-mounted profiler for profile measurements. The facility is equipped with more than 300 imbedded sensors and has its own weather station. The opportunities for the PTF cannot be understated and much more great work will come from the new facility that will improve the lives of people here in the States and around the world.

The official ribbon-cutting ceremony for the new PTF facility is slated for September 2023. FHWA looks forward to the beginning of the experiments and the development of innovative products that stakeholders can implement. A web-based data portal is currently being designed to make experiment results available to stakeholders and external researchers so they may multiply the benefits of this major investment in innovation.

**Jean Nehme, Ph.D., P.E.**  
Director, Office of Infrastructure Research and Development  
Federal Highway Administration

# HSIS Excellence in Highway Safety Data Award Opens Soon!

## Students, get ready to submit your 2024 papers!

Since 2016, the Federal Highway Administration's (FHWA) Highway Safety Information System (HSIS) program in partnership with the Institute of Transportation Engineers (ITE) has hosted a student research paper competition, the HSIS Excellence in Highway Safety Data Award.

HSIS is a highway safety database that contains crash, roadway inventory, and traffic volume data for a select group of States and cities, and it provides data to researchers including students.

The competition is open to undergraduate and graduate students in degree-granting programs that support highway safety.

## Paper Submission Period Approaching

The data request period is open! Papers will be accepted from January 1–March 1, 2024. Winners will be announced at the end of summer 2024.

For more information and submission guidelines, contact Dr. Carol Tan at [carol.tan@dot.gov](mailto:carol.tan@dot.gov) or visit <https://www.hsisinfo.org/award.cfm>.

**HSIS**  
HIGHWAY SAFETY INFORMATION SYSTEM

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Since 1988, MATC has provided technical assistance to agencies and other members of the asphalt community.  
Source: FHWA.

## Demos at Your Doorstep: The FHWA Mobile Asphalt Technology Center

A national pavement program that continues to evolve, even after 30 years in practice.

by **LESLIE MYERS, RAM VEERARAGHAVAN, OTTO CARDENAS ARRIETA, DEREK NENER-PLANTE, and TIFFANY L. TOLBERT.**

The Federal Highway Administration's Mobile Asphalt Technology Center (MATC), a traveling asphalt laboratory and field testing program, debuted its new trailer at the 2023 Transportation Research Board (TRB) Annual Meeting in Washington, DC. MATC supports State agencies and the asphalt pavement community in exploring innovative laboratory testing procedures and construction testing methods by conducting demonstrations onsite. While the program is more than 30 years old, MATC now offers transportation professionals increased opportunities to further their innovation experience with hands-on and expanded educational activities right at the site of the project.

### History of MATC

Through the years, MATC has evolved in both name and aim. Formerly known as the Mobile Asphalt Laboratory and Mobile Asphalt Testing Trailer—among other handles—the traveling workroom has championed support for State agencies via various FHWA initiatives. For example, in the late 1980s, its focus was on the field management of asphalt mixtures and the implementation of the original Strategic Highway Research Program; and in the early 2000s, it educated States and contractors on new mixture performance tests that supported pavement design advancements. Historically, MATC's primary audience comprised of researchers and State departments of transportation (DOTs).

In recent years, MATC has extended its activities to paving contractors, local agencies, and other practitioners who support State DOTs. This wider reach is supported through coordinated efforts with the FHWA Resource Center and the FHWA Asphalt Binder Mixture Laboratory Implementation and Delivery programs. These FHWA offices collaborate on delivering, via MATC, onsite field evaluations and hands-on training on lab and field equipment; asphalt materials (binder, aggregate) and field materials testing; support in implementing innovative practices and sustainable materials; demonstrations and equipment loans; independent specification reviews; and virtual training via webinars.

Additionally, MATC has also grown to provide more support to other FHWA programs in the areas of pavement sustainability and safety. For example, the Life-cycle assessment (LCA) Pave tool has been added to their onsite activities to introduce a wider audience

to pavement sustainability initiatives underway at FHWA. MATC also hosts FHWA division office and Federal Lands Highway engineers in a 2-week onsite rotational program as a means of getting engineers up to speed on the latest innovations and basic elements of asphalt testing and paving.

“Compared to 20 years ago, the impacts of our site visit don't just end after we leave the site anymore; we now have a continued synergy with the State and their industry partners long after we depart the project,” says Brendan Morris, MATC project manager. “The impact is that now MATC has a broader reach with stakeholders and is including more of the contractor and local agency communities through site visits, conference exhibits, and the equipment loan program.”

### Process and Benefits of a Site Visit

A site visit from MATC starts with a virtual kickoff meeting nearly two months before the scheduled onsite visit and includes a discussion around such topics as logistics and test plans with members of the State DOT, paving contractor team, State asphalt pavement association, and FHWA Division office.

Once onsite, an open house is conducted in a classroom setting during the morning and tours of the MATC trailer and equipment demonstrations are provided in the afternoon. The event is open to paving industry members, members of the State DOT, local agencies, Local Technical Assistance Program staff, consultants, universities, and any Federal partners in the area. During the project, material samples are taken from the field and tested in the mobile laboratory and field technologies are demonstrated across multiple days at the construction site. At the end of the visit, a close-out meeting is held at the trailer to discuss the test results. Finally, within six months of the visit, a 2-day “Quality in the Asphalt Paving Process” workshop is held at the State DOT's facility to provide a platform for the exchange of information between all project participants and to aid in resolving current State-specific issues and concerns with asphalt materials and construction.

“The MATC site visit really gave us good insight into how the [stone matrix asphalt] treatment we were piloting performed in comparison to our regular Superpave wearing course mixtures,” says Aaron Schwartz, a bituminous concrete engineer at the



MATC has traveled to all 50 U.S. States; since 2021, nearly 50 equipment loans, 2-day workshops, and field demonstrations have been administered.

Source: FHWA.

Vermont Agency of Transportation (VTrans). “Not only that, there was a lot of excitement on both the agency side and the paving industry side in regard to the up-and-coming technologies that were demonstrated as part of the visit. VTrans have found their expertise to be extremely valuable, regardless of whether it’s a site visit to assist in evaluating a new pavement treatment like in June 2021, or an in-depth analysis of our performance test data.”

MATC typically stays onsite for one month and can accommodate four to six site visits per year. Since the program’s inception in 1988, it has traveled to, or conducted field demonstrations in, all 50 U.S. States as well as Washington, DC, Puerto Rico, and the U.S. Virgin Islands. MATC is typically scheduled one year out and is now accepting site visit location requests for 2025.

Field demonstrations usually lead to the borrowing of equipment from MATC. To increase the likelihood of adoption of new technologies, MATC loans several pieces of equipment to agencies, contractors, and researchers for various lengths of time. By taking advantage of the equipment loan program, an agency or contractor has the opportunity to learn the equipment and to visualize how it could be best used to improve pavement quality before making an investment. Since initiation of the equipment loan program in 2020, MATC has lent equipment to 24 organizations (a mix of State DOTs, contractors, and universities), delivered twelve 2-day customized training workshops, and conducted 15 field demonstrations. In 2023, so far, eight additional organizations have been granted equipment loans and four additional workshops are already planned, with more on the way. Dr. Jorge Duran, the pavement management program supervisor at the Maricopa County DOT in Phoenix, AZ, has attended several MATC project site visits, including an open house workshop and laboratory demonstration in June 2022, and requested equipment for the county to try out. “I believe FHWA’s workshops and training programs potentially contribute to bridging the gap between innovation and implementation,” says Duran. “These unique opportunities keep you up with the latest technologies, methodologies, standards, and regulations; boost your professional network; and allow you to gain insight from lessons learned and best practices experienced by other agencies.



The Equipment Loan Program is the cherry on the cake, making this an interesting starting point for the execution of new equipment, especially for local government agencies.”

### Paving Forward Progress

Now, in the 2020s, making the connection between asphalt pavements and sustainability is a primary focus for MATC. And in continuing its mission of providing education and leadership, creating opportunities for communication, and advancing new and emerging asphalt materials and construction technologies, the new MATC trailer unveiled at TRB offers additional space to conduct onsite demonstrations, solar panels for energy generation, and a rear hydraulic lift that makes the trailer accessible to all visitors.

“It’s great to see FHWA continuing to invest in the Mobile Technology Centers,” says Rick Bradbury, director of Materials Testing at the Maine Department of Transportation in a social media response to the new trailer. “These are an excellent resource that provide State agencies and other stakeholders with the opportunity to evaluate the latest technologies in highway construction materials design and testing.”

**LESLIE MYERS**, senior asphalt pavement engineer in FHWA’s Office of Infrastructure (at Headquarters), manages the MATC Program and holds a Ph.D. from the University of Florida. She also holds registered professional engineer (PE) licenses in New Jersey and Pennsylvania.

**RAM VEERARAGHAVAN**, project engineer for MATC, holds a Ph.D. from Worcester Polytechnic Institute, and is experienced in Superpave performance testing on hot mix asphalt nationwide.

**OTTO CARDENAS ARRIETA**, field construction technician with MATC, is experienced in the construction of asphalt pavements and density measurement. He leads the field demonstrations for asphalt construction and testing technologies for MATC and conducts asphalt mixture testing.

**DEREK NENER-PLANTE**, pavement and materials engineer in the FHWA Resource Center, provides nationwide technical assistance in asphalt paving and holds an M.S. from the University of Connecticut. He is also a registered PE in Maine.

**TIFFANY L. TOLBERT** is a contracted writer and editor for *Public Roads* magazine.

For more information, see <https://www.fhwa.dot.gov/pavement/asphalt/MATC/> or contact Leslie Myers (202-981-2875, [FHWA-MATC@dot.gov](mailto:FHWA-MATC@dot.gov)).

Tests for pavement safety are conducted in the MATC laboratory on specimens as well as out in the field after the completion of compaction.

Sources: FHWA.



## Virtual Reality Simulation Training at the 102nd Transportation Research Board Annual Meeting

by **ERIC R. BROWN, MIGNON WHITTED,** and **SABRINA SYLVESTER**

Virtual reality (VR) is simulation technology that allows the user to become involved in and interact with a three-dimensional, computer-generated environment in real time. Many organizations are using this technology to provide a more engaging, interactive, and innovative experience for learners in a training environment.

The Federal Highway Administration's (FHWA) National Highway Institute (NHI) provides transportation training that cultivates innovation to enhance the learning experience. NHI demonstrated such innovation in January 2023 at the 102nd Transportation Research Board (TRB) Annual Meeting in Washington, DC, by offering participants VR simulation experiences at its TRB exhibit hall booth:

- **Virtual Reality bridge inspection (VR VBI):** Participants learned how to inspect a bridge using various tools.
- **Rivers and floodplains:** Participants discovered river interactions and processes.

A video highlighting both VR simulations was displayed for TRB participants as they waited in line to take part in this experience.

### VR VBI

NHI has developed a VR version of the award-winning VBI course known as the VR VBI.

The original computer-based training *Safety Inspection of In-Service Bridges* (FHWA-NHI-130055) and *Safety Inspection of In-Service Bridges for Professional Engineers* (FHWA-NHI-130056), both courses updated in 2016 respectively, are based on FHWA's 2015 *Bridge Inspector's Reference Manual* for training on the safety inspection of in-service highway bridges for professional engineers. As technology evolves, software continues to provide learners with an increasingly realistic inspection experience. If a physical



NHI staff assisting an FHWA employee while participating in the rivers and floodplains virtual experience.

Source: NHI.

bridge is unavailable for inspection training due to inclement weather, traffic, or unsafe conditions, the VBI option is a viable alternative.

The VR VBI, a proof-of-concept technology currently in development, provides training participants with an interactive, immersive experience for learning techniques and procedures.

### Rivers and Floodplains at Elwha River

By using advanced technology, FHWA effectively promotes knowledge and understanding of river functions and processes critical to highway planning and design. FHWA worked with consultants to develop a VR site visit of the Elwha River in Washington State. A diorama of the site leads participants through a series of locations along the river, including the former location of Glines Canyon Dam, the U.S. 101 bridge crossing, and the river's confluence with the Strait of Juan de Fuca.

The VR simulation provides opportunities for participants to learn about river methods and interactions with dams, bridges, and other infrastructure. Embedded media, including stationary and drone videos, movie clips, and 360-degree photos, complemented the site visit content to enhance learning outcomes for participants. Also, an aqua grid allows users to move throughout the space to various points around, under, and on the U.S. 101 bridge to view erosion details, sediment accumulation, large wood material deposits, and other natural processes.

As a proof of concept, FHWA's hydraulics team and NHI are currently exploring and planning how to cultivate these and other innovative technologies to enhance participant engagement and learning throughout all its program areas for future development.

For more information on NHI training, please see the Training Update in this issue of *Public Roads*.

**ERIC R. BROWN** is a civic hydraulics engineer for FHWA.

**MIGNON WHITTED** is a training program manager for NHI.

**SABRINA SYLVESTER** is a senior marketing analyst contractor for NHI.



FHWA Office of Transportation Workforce Development and Technology Deployment Associate Administrator Amy Lucero participates in the VBI virtual experience.

Source: NHI.

October 4-5, 2023 | Chicago, IL

# NATIONAL PEER EXCHANGE on Freight Resiliency for Climate-Related Disruptions

The Federal Highway Administration (FHWA) invites public sector transportation agencies actively engaged in freight resiliency planning to attend the in-person National Peer Exchange event to:

- Discuss different approaches to freight resiliency.
- Share successful strategies for incorporating climate resiliency concepts into freight transportation plans and decisionmaking.
- Learn about Federal resources available to support States' freight resiliency efforts.

For more information on the current state of practice in freight resiliency planning, please review the final report:

**[“State of the Practice Scan: Freight Resilience Planning in the Face of Climate-Related Disruption”](#)**.



Registration will open in late spring 2023. Sign up to stay informed:  
<https://forms.office.com/g/fNn601pNU4>

Note: The event is free to attend, but space is limited. Travel costs are not included.

For more information, contact Mack Frost, FHWA, at [Mack.Frost@dot.gov](mailto:Mack.Frost@dot.gov); or Yujin Kim, U.S. Department of Transportation Volpe Center, at [Yujin.Kim@dot.gov](mailto:Yujin.Kim@dot.gov).

# THE SILT FENCE: KEEPING SEDIMENT WHERE IT BELONGS

Enhancing the design of silt fence sediment barriers used during highway construction.

by J. BLAKE WHITMAN, MICHAEL A. PEREZ, and BRIAN L. SMITH

**M**anaging stormwater to protect the Nation's waters is a common challenge of highway construction sites. Most water quality problems in lakes and rivers are the result, in part, of stormwater runoff. Typically, grading and earth-disturbing activities during construction require removal of vegetation that dissipates raindrop energy and filters and controls stormwater pollution. Construction grading and earth disturbance leave areas of land susceptible to rainfall-induced soil erosion caused when raindrops fall directly on the soil surface and dislodge soil particles. These dislodged soil particles are suspended in stormwater runoff and may carry fertilizer, pesticide residue, and other chemicals that are detrimental to aquatic life. While erosion is a naturally occurring process, construction exacerbates

erosion rates. Erosion rates on construction sites can be as high as 500 tons (454 metric tons) per acre per year, rates which are 100 times greater than agricultural land uses, and 2,000 times greater than erosion of land protected by leaves and vegetation in naturally wooded areas.

Sediment—materials that are transported in water runoff from one area to another as the result of erosion (e.g., tiny particles of clay, rock, and minerals)—can have negative consequences on downstream receiving water bodies, including impacts on water clarity, disruptions to aquatic ecosystems, and repercussions on human, animal, and plant health. Installing a silt fence, also known as a sediment fence, on construction sites is a standard practice used for controlling runoff and mitigating the

effects construction site runoff has on the surrounding environment, including lakes, streams, and habitats.

In addition to ecological issues, excessive amounts of sediment may change the characteristics of a streambed and impair streamflow through culverts. Flooding, increased culvert maintenance, increased drinking water treatment costs, and loss of recreational value are other impacts that can occur from excessive sedimentation.

## First and Last Defense

One of the principal objectives of the Clean Water Act is to “maintain the chemical, physical and biological integrity of the Nation's waters.” Per 23 CFR 650.203, it is also the policy of the Federal Highway Administration that all highways funded

Both the schematic drawing and implementation of the design taken from the 2021 Alabama Department of Transportation Standard and Special Drawings for Highway Construction.  
© 2021 ALDOT. Modified by FHWA.



in whole or in part under Title 23 of the United States Code shall be located, designed, constructed, and operated according to standards that will minimize erosion and sediment damage to the highway and adjacent properties and abate pollution of surface and ground water resources. To meet these goals, contractors rely on erosion and sediment control practices and products. One of the first sediment control practices employed on a construction site, prior to major ground disturbances, includes sediment barriers (e.g., silt fences, fiber rolls, synthetic rolls, and compost socks). Sediment barriers often function as the last line of defense prior to stormwater runoff discharging from a site. As runoff flows across construction sites, sediment particles may become dislodged and suspended by the kinetic energy of runoff flow velocity. Sediment accumulates and will stay suspended until the velocity and kinetic energy reduce, providing favorable conditions for sedimentation to occur. Sediment barriers provide favorable settling conditions by creating areas of impoundment (pooling water behind the barrier), thereby reducing runoff velocity, and retaining sediment onsite.

Silt fences are one of the most common and recognizable practices used in construction stormwater management, but silt fences have issues of their own. Design guidelines typically stipulate the installation of silt fence sediment barriers on level ground along the construction site's contour lines to intercept sheet flow to spread flow across the entire length of fence, thereby maximizing the impoundment area. It is often difficult to precisely follow a site's contour lines

during installation, and site constraints may not allow for proper placement. When these difficulties arise, the resulting installation of silt fences leads to points of concentrated stormwater impoundments at lower elevations—where deeper impoundments with a smaller surface area will decrease functionality of a silt fence and possibly lead to installation failure. Failure can be in the form of structural collapse or undermining leading to decreased performance, which may render the silt fence completely ineffective due to minimal impoundment capabilities. Excessive wetness, ponding water, or silt fence failure can result in a costly delay for the construction schedule.

### Large-Scale Testing Enhances Defense

Recently, the Alabama Department of Transportation (ALDOT) sponsored a study with the Auburn University–Stormwater Research Facility (AU-SRF) to evaluate the installation effectiveness of their standard silt fence detail. AU-SRF is one of the university stormwater research facilities across the Nation that partner with State departments of transportation and regional, local, and Tribal transportation agencies and assist with research, product evaluation, nonproprietary innovations, and first-hand training to facilitate innovative and practical solutions for stormwater management. Large-scale testing of silt fence installations by AU-SRF used hydrologic conditions mimicking runoff from a 0.5-acre drainage basin spread across 100 feet (30 meters) of wire-backed reinforced silt fence, resulting in a testing flow rate of 0.22 cubic feet (0.006 cubic meters) per second across a 20-foot (6-meter) wide installation. This flow rate is indicative of the expected runoff from a 2-year, 24-hour storm event for construction conditions in central Alabama. Sediment loading of 1,128 pounds (512 kilograms) was introduced to the runoff across the 30-minute test duration to simulate sediment-laden conditions. This loading is also based upon typical construction conditions in Alabama and calculated using the modified Universal Soil Loss Equation. During testing, structural integrity, sediment retention, and water quality parameters were assessed to determine performance.

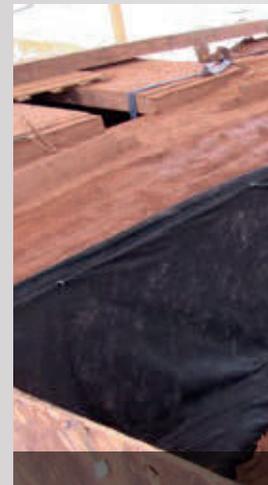
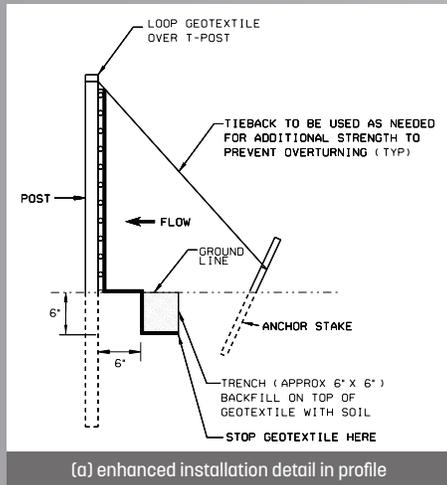
A poorly installed and maintained silt fence at highway construction sites can have negative consequences, including disruptions to aquatic ecosystems and repercussions on human, animal, and plant health.

© 2019 Auburn University.



Offsetting the location of the trench allows the T-post to gain additional ground support in anchoring of the geotextile due to the force of impounded water bearing on the fabric.

(a) © 2021 ALDOT / (b and c) © 2018 Auburn University.



### Modified Universal Soil Loss Equation

$$Y = 95(Qq_p)^{0.56} K \times LS \times C \times P$$

Where,

Y = sediment yield for an individual storm (tons)

Q = volume of runoff (acre-feet)

$q_p$  = peak flow rate (cfs)

K = soil erodibility factor

LS = length-slop factor

C = erosion control factor

P = sediment control factor

ALDOT used a silt fence consisting of 3.5 ounces (99 grams) per square yard of nonwoven geotextile fabric, installed on metal T-posts with wire backed reinforcement. ALDOT's design guidance for a standard installation of silt fences specifies maximum T-post spacing of 10 feet (3 meters) and an installed height of 32 inches (81 centimeters). A silt fence may be positioned in a 6-inch by 6-inch (0.15-meter by 0.15-meter) trench or sliced in with a silt fence slicing machine. Although the American Association of State Highway and Transportation Officials require minimum steel T-post densities of 1.3 pounds (0.59 kilograms) per foot, silt fences installed in Alabama are often supported by 0.85 to 0.95 pounds (0.39 to 0.43 kilograms) per foot T-posts.

When assessed at 5 and 10 feet (1.5 and 3 meters) post spacing, the 0.95 pounds (0.43 kilograms) per foot posts were severely deflected, resulting in structural failure after the third performance test to the same installation. For installations evaluated

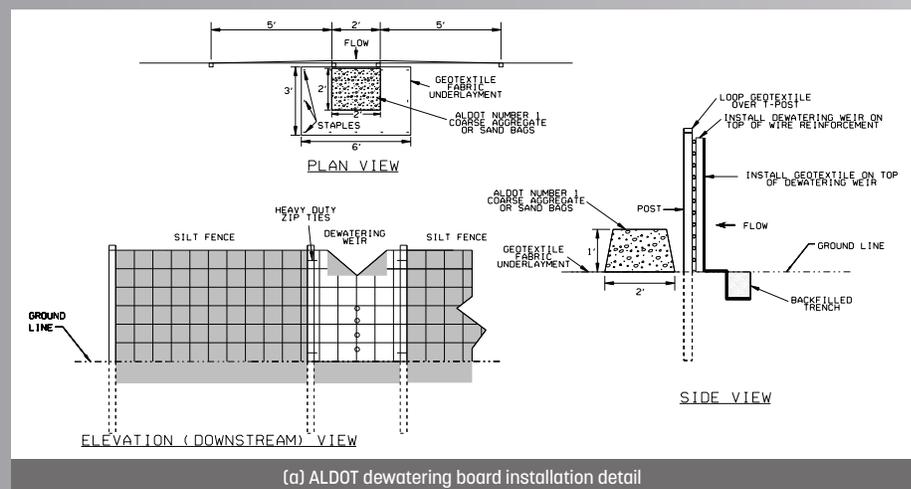
using 10 feet (3 meters) post spacing of 0.95 pounds (0.43 kilograms) per foot posts, the middle post deflected, on average, 2.3 feet (0.70 meters) after the third performance test on that installation. Through a variety of installation modification iterations, an enhanced installation was developed that consisted of 1.25 pounds (0.57 kilograms) per foot steel T-posts spaced 5-feet (1.5-meter) on-center and offset 6 inches (0.15 meters) downstream of the trench. This installation resulted in the least amount of post deflection, with the center middle T-post deflecting only 0.15 feet (0.05 meters) after the third performance test. Offsetting the location of the trench allowed the T-post to gain an additional 6 inches (15 centimeters) of ground support as it was no longer installed within the trench. Furthermore, the offset installation reduces the height of the fence and provides additional anchoring of the geotextile due

to the force of impounded water bearing on the fabric. Offsetting the trench also enhances compaction, as it allows for a tamper or compaction plate to traverse over the back-filled trench without tearing or snagging the silt fence. A complete testing methodology is available in the 2021 publication of Journal of Irrigation and Drainage Engineering (<https://ascelibrary.org/doi/10.1061/%28ASCE%29IR.1943-4774.0001521>).

Silt fence sediment barriers that perform as intended result in large impoundments, especially when sediment clogs or blinds the geotextile, greatly reducing the amount of water allowed to flow through. Researchers at the AU-SRF also developed a dewatering weir that acts to control the discharge of impounded stormwater at a controlled rate. The weir is comprised of common plywood and includes a v-notch and a series of orifices. The weir relieves excessive impoundment, while the orifices

Correct installation of the modified silt fence design results in the collection of sediment; it allows for a tamper or compaction plate to traverse over the back-filled trench without tearing or snagging the silt fence.

(a) © 2021 ALDOT / (b and c) © 2018 Auburn University.



(a) ALDOT dewatering board installation detail



(c) final installation

dewater impoundment over the course of several hours.

Even though water passes through this dewatering mechanism and not through a “filtration medium,” sediment capture upstream of the sediment barrier was minimally affected as both installations, with and without the dewatering board, captured over 90 percent of the sediment introduced by volume. This high performance is due to the impoundment depth and length being minimally affected by the dewatering board. These installation concepts can help practitioners maximize silt fence performance by minimizing structural failure and downtime associated with large impoundments affecting work areas.

The design was accepted by the Alabama Soil and Water Conservation Committee (ALSWCC). Perry L. Oakes, a professional engineer (PE) and Erosion and Sediment Control Program coordinator for ALSWCC, acknowledges the scientific validity of the design, “ALSWCC maintains Alabama’s Erosion and Sediment Control

Handbook. The ALDOT research at the Auburn University Stormwater Research Facility ensures that the practices in our handbook are innovative and scientifically based, not only for ALDOT sites, but for construction sites throughout the State.”

“The Alabama Department of Environmental Management (ADEM) greatly appreciates the continued collaborative efforts between ALDOT and Auburn University regarding enhancements of best management practices for erosion and sediment control,” says Shelane P. Bergquist, chief of the Construction Permits Section Stormwater Management Branch at the Water Division of ADEM. “These efforts will continue to pay dividends in the protection of our waterbodies.”

### Promising Modifications for Silt Fences

Richard Klinger, an environmental construction engineer at ALDOT, embraced the innovative design and worked to develop a Standard Specification (665608, <https://aub.ie/siltfence>) released in 2021. Of the designs, Klinger states, “ALDOT strives to continuously improve erosion and sediment control practices to keep pace with the ever-evolving environmental regulations.” He further comments on the modified silt fence design saying that “reduced height requires less material which is more environmentally friendly while delivering increased performance. At times, field conditions may differ from the design or an issue with the grading operation may cause unintended impoundment of the silt fence. The increased post spacing and the dewatering weir are a maintenance measure for these areas of unintended impoundment. The additional posts and dewatering weir can be installed in the existing silt fence without jeopardizing the structural integrity of the fence or having to

completely remove sections and re-install. The dewatering weir is simple to construct, easy to install, and gives the contractor the ability to get back to work in these areas much quicker than with previous practices.”

Wade Henry, assistant bureau chief of final design at ALDOT, declares that the modified design “is just one of many examples where ALDOT’s investment in Auburn’s research continues to pay off. ALDOT is committed to continue to learn and practically apply that knowledge to evolve our erosion prevention best management practices, so that we can address erosion in the most effective and efficient ways possible.”

**J. BLAKE WHITMAN**, Ph.D., PE, Certified Professional in Erosion and Sediment Control (CPESC), is an assistant professor at Middle Tennessee State University in the School of Concrete and Construction Management. Whitman completed his Ph.D. at Auburn University where he evaluated the performance of ALDOT sediment barrier practices used on construction sites.

**MICHAEL PEREZ**, Ph.D., PE, CPESC, is an assistant professor in the department of Civil and Environmental Engineering at Auburn University. He teaches courses in construction and stormwater management and oversees the research program at AU-SRF.

**BRIAN SMITH**, CPESC, is an ecologist for the FHWA Resource Center - Office of Innovation Implementation. He holds a B.S. degree in biological science from Illinois State University and an M.S. in geology from Northern Illinois University.

For more information, visit <http://stormwater.auburn.edu> or contact Michael Perez at 334-844-6267 or [mike.perez@auburn.edu](mailto:mike.perez@auburn.edu).



(b) downstream vantage point



(c) final sediment deposition pattern



# From Then to Now: History Along the Roadway

How historical markers in Missouri and Virginia are still used to enlighten the public about significant historic resources and events in their States.

by KAREN L. DANIELS, MICHAEL MEINKOTH, and JENNIFER R. LOUX

Historical markers have a distinct mission. Across the Nation, mile after mile, on roadway after roadway, historical markers link important stories to the landscapes where they took place. Whether situated high above the ground or lying directly on the terrain, markers work to make history feel more immediate, and, in some cases, bring into light incidents largely forgotten or intentionally ignored. Virginia's historical marker program has the distinction of being one of the oldest in the Nation, while Missouri's program carries the distinction of making its State the first in the Midwest to completely mark a modern cross-state highway with historical markers.

The primary purpose of the Missouri Department of Transportation (MoDOT) Historic Preservation Section—the section of MoDOT that researches the State's history for highway projects relating to prehistoric archaeology, archaeology, architectural history, bridges, and roadways—is to ensure compliance with Federal historic preservation laws, specifically Section 106 of the National Historic Preservation Act (Section 106). MoDOT archaeologists, architectural historians, and other staff have performed extensive research into the history of Missouri's highways, so much so the Historic Preservation Section has become the State's go-to resource for questions about the highway system, old maps and roadside parks, highway beautification efforts, and historical highway markers.

Via its research, the MoDOT Historic Preservation section also understands the importance of making the highway system's history accessible to the public and supports other practitioners in the field of transportation with mitigation efforts. One of the ways this research becomes accessible is through displaying and promoting interpretive markers, often in partnership with other public and private organizations.

Virginia's nearly 2,600 roadside historical markers,

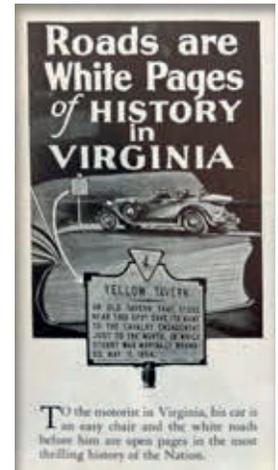
recognizable by their iconic silver and black design, have turned the State into an open-air museum for nearly a century. Managed by the Virginia Department of Historic Resources (DHR), a State agency, the marker program educates Virginians and visitors about significant places, people, and events representing hundreds of years of history—from before the era of European colonization until roughly five decades ago. Markers acknowledge both the inspiring and disturbing events of Virginia's past, encompassing such topics as the founding of the Nation, scientific achievements, and civil rights victories, as well as the displacement of many Native Americans, the sale of enslaved people, and the lynching of African-Americans. They are not erected to honor the subjects or to serve as monuments or memorials. Instead, their primary purpose is to provide information of high educational value, illuminating the past in the interest of understanding the present.

## Historical Marker Programs: The Beginnings

Virginia's marker program began in 1927 when the State's new Commission of Conservation and Development installed the first markers along U.S. Route 1. This commission—which coordinated the State's programs for parks, forestry, geology, water power, history, and archaeology—was

charged with stimulating economic development using strategies tailored to the age of the automobile. The marker program was intended to entice motorists to explore Virginia via the State's new highway system, and spend money on food, gasoline, and lodging along the way. According to an early advertisement for the marker program, the traveler's car was to be like “an easy chair” and the “roads before him” would be “open pages in the most thrilling history of the Nation.”

By 1942, when the Commission of Conservation and Development's marker program was suspended during World War II, about 1,400 markers lined the highways. When the Virginia Historic Landmarks Commission—the forerunner of today's Virginia DHR—was created in 1966 to manage the State's historic preservation



An early advertisement for Virginia's marker program.  
© Virginia DHR.



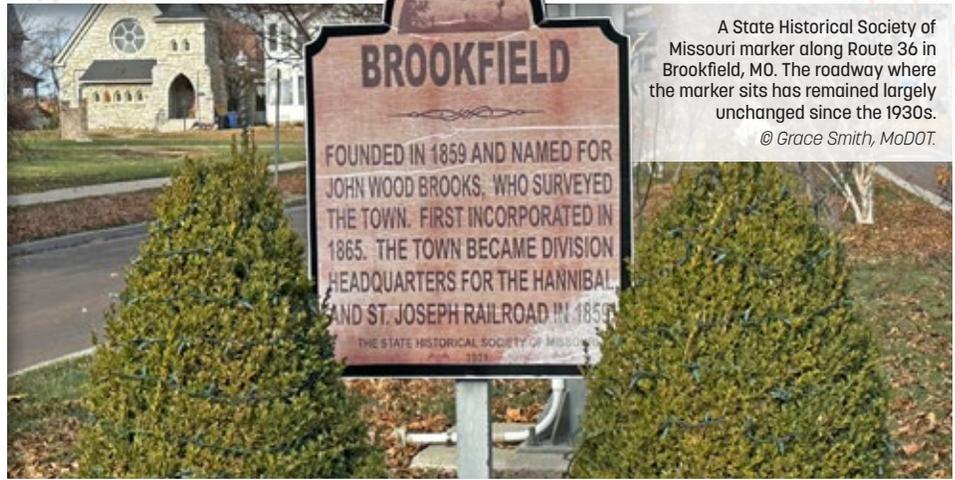
Four markers along U.S. Highway 58 in Mecklenburg County, VA, erected between 1930 and 2001.  
© Jennifer Loux, Virginia DHR.

efforts, it assumed responsibility for the marker program.

MoDOT Historical Preservation Section's current processes also build upon a long tradition of marking history along the roadway. In 1913, the Missouri Daughters of the American Revolution (DAR)—who were instrumental in the adoption of the Missouri State flag and the development of genealogical libraries throughout the State—partnered with the newly created Missouri State Highway Department (SHD) to mark highways that were important during Missouri's Spanish and French colonial and territorial eras. Early in the partnership, the two organizations advocated for and raised funds to mark four highways: Boone's Lick Road, Santa Fe Trail, El Camino Real, and Daniel Boone Trail. Markers associated with two of these programs still exist today.

For example, in 1917, DAR marked El Camino Real (also known as Kings Highway or Kingshighway) by placing a marker in each county between St. Louis and Caruthersville. The highway (roughly corresponding to modern U.S. Route 61) is the oldest in Missouri that originally connected the French settlements along the Mississippi River. When Americans started arriving shortly before the Louisiana Purchase it also connected the settlements of Americans. El Camino Real was the first highway designated by the Missouri territorial legislature, which was incorporated into the early highway system.

Likewise, many of the original Boone's Lick Road granite markers, some in the shape of millstones and others stone slabs,



A State Historical Society of Missouri marker along Route 36 in Brookfield, MO. The roadway where the marker sits has remained largely unchanged since the 1930s.  
© Grace Smith, MoDOT.

were placed at the edge of State highway rights-of-way and continue to be along State highways. Many in the area have been surveyed for MoDOT projects, especially those that are along present-day Interstate 70 outer roads and along St. Charles County Route N. However, some of Missouri's early highways were relocated, as were their markers. Today, many of the original markers are located near prominent buildings or natural features.

### **I The Middle-of-the-Roads**

In the spring of 1932, the State Historical Society (SHS) of Missouri, working with SHD, erected historical markers along U.S. Highway 36 in northern Missouri—between the cities of Hannibal and St. Joseph—as a way of popularizing State history. Markers were dedicated to important figures who had lived along the corridor including writers Mark Twain and Eugene Fields, Senator David R. Atchison, and U.S. Army Officer John J. Pershing. Communities including the cities of Laclede, Hannibal, Cameron, Linn, Brookfield, and St. Joseph received markers, as did Buchanan County. The first railroad across

Missouri, the Hannibal and St. Joseph Railroad, was also marked. With these placements, Missouri became the first State in the Midwest to completely mark a modern cross-state highway with historical markers. George A. Mahan, who was president of SHS at the time, purchased plantings to beautify the marker locations.

In the fall of 1932, at the Missouri State Fairgrounds in Sedalia, SHS dedicated a marker to the State Highway System at the SHD Highway Gardens exhibit location on the fairgrounds. This marker told the history of highway funding in the State from territorial appropriations to the Centennial Road Law which created the State Highway System.

In the 1950s, SHS and SHD entered into a formal agreement to place historical markers across the State over a 10-year period. Per the agreement, SHS would research and write the content for the markers and SHD would prepare appropriate locations for their placement. Appropriate locations included areas adjacent to State highways where right-of-way was wide enough to provide safe access to the marker, and where the marker was positioned in a landscaped area such as roadside parks with amenities or simple pull-offs with a driveway. Each county and the city of St. Louis would receive at least one marker (typically large, two-sided tablets). In the end, 121 markers were placed across the State. Since their placement, many of the county markers have been relocated to the county's courthouse lawns.

According to Beth Pike, SHS' current assistant director for Communications and Education Outreach, the society has made its "mission to collect, preserve, and make material related to Missouri history available to the public." Pike "still gets excited" when she discovers a new-to-her marker in traveling across the State. "Often, I learn something new about Missouri."



The Lewiston DAR marker along the Boone's Lick Road commemorates the community of Lewiston, which became the first county seat of Montgomery County, MO.  
© Karen L. Daniels, MoDOT.

In the 1970s, the Commonwealth of Virginia stopped providing regular funding for new markers. Over the last four decades, most new markers have been created via an application process that allows individuals or organizations—such as historical societies, churches, alumni associations, museums, and tourism bureaus—to propose topics and to submit draft text for the markers. In this way, hundreds of people have worked with DHR to tell the stories that are important to them and the State. Nelson Harris, a minister and former mayor of Roanoke, VA, has successfully applied for a number of markers. “I am often amazed at how little the general public knows about their locality’s history but is keenly interested in finding out. I know first-hand how markers are appreciated by locals and used by others to promote history-related tourism and research,” Harris says. “They allow readers to reflect upon [the past] in ways that might be inspirational or cautionary, but always educational.”

### Historical Marker Programs: The Now

To be eligible for a marker in Virginia, an event, person, or place must be of regional, statewide, or national significance; subjects of strictly local importance do not qualify. The subject must have attained its significance at least 50 years prior to the current year, and a marker may not focus on a living person. DHR staff members conduct research on each topic, consulting primary sources when possible, and edit each text for accuracy, clarity, brevity, thoroughness, and educational value. The staff members work closely with applicants to arrive at a final draft of about 100 words, which is then presented to the Marker Editorial Committee, a group of historians, archaeologists, and copy editors. As Harris notes, the markers “tell a fact-checked narrative, and that elevates them above other forms of historic recognition in the public sphere.” If the committee accepts the text, the staff members present it for official approval at a quarterly meeting of the Virginia Board of Historic Resources, a seven-member body appointed by the governor. Applicants pay approximately \$3,000 for the manufacture of the marker, if their proposal is approved.

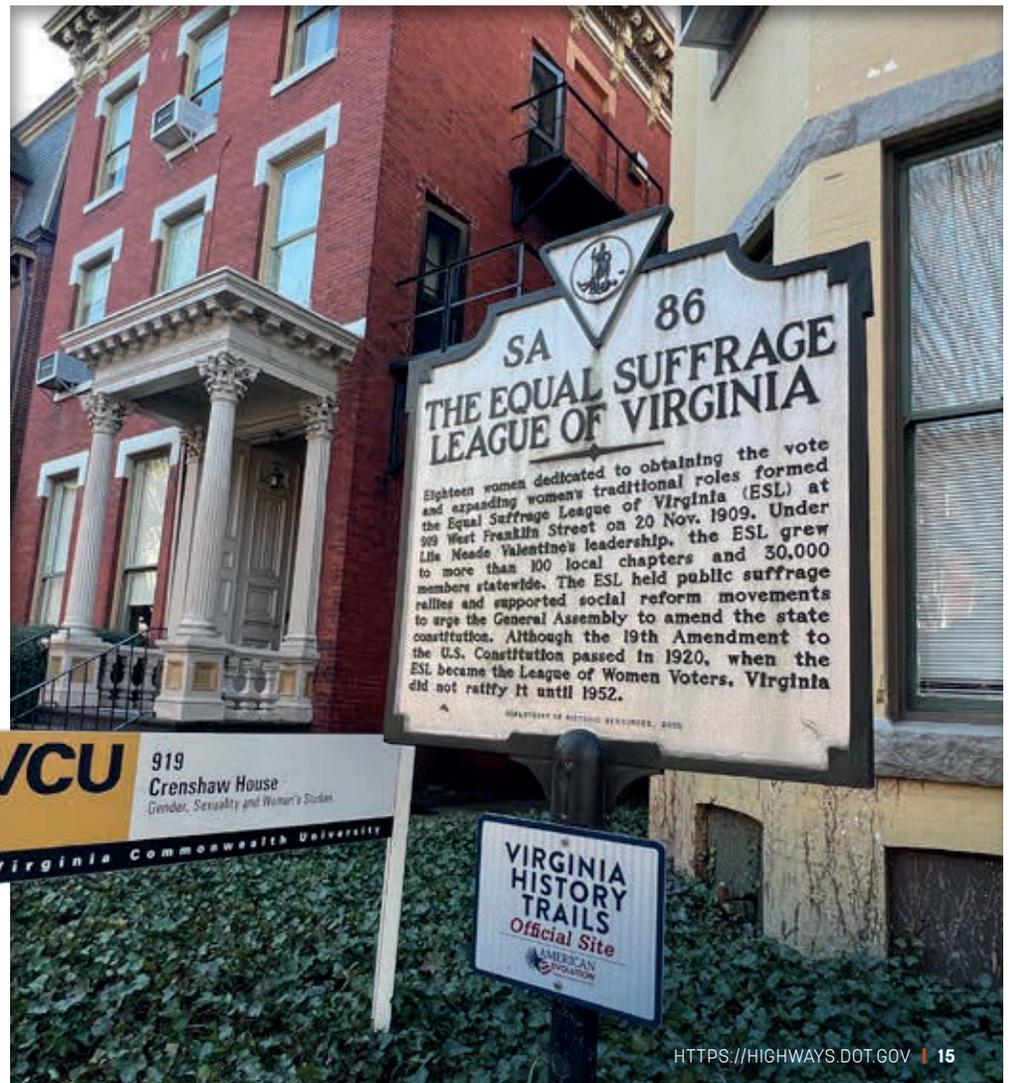
While DHR is responsible for the information that appears on State markers, the Virginia Department of Transportation (VDOT)

handles marker site approvals, installation, and maintenance. VDOT, whose history traces back to the establishment of the State Highway Commission in 1906, builds and maintains transportation infrastructure on the VDOT rights-of-way. The close partnership between these two State agencies is vital to the success of the marker program. “Working with DHR, VDOT has been able to maintain existing, replace damaged, and erect new historical markers on VDOT’s right-of-way at key locations denoting significant historical events,” says Rick Burgess, manager of VDOT’s Integrated Directional Signing Program (IDSP). “The traveling public is utilizing our available restaurants, lodging facilities, service stations, camping sites, and other related attractions... I believe this has helped to stimulate economic growth.” The IDSP, which oversees revenue-generating logo signs (i.e., for gas, food, lodging, and attractions on limited-access highways) and other similar programs, provides funding for historical marker installation and maintenance. In cities and towns that maintain their own roadways, the local public works

departments approve sites and install and maintain markers.

Historical markers, and closely related interpretive panels and markers, are often used by State departments of transportation to provide a public benefit when historic resources—properties that are eligible for listing on the National Register of Historic Places (NRHP)—will be adversely affected by construction projects. Under Section 106, if these adverse effects cannot be avoided or minimized, they must be resolved through mitigation, which can include historical markers, interpretive markers, and interpretive panels and kiosks. These help explain to the public what has been lost as well as interpret what remains. Since Missouri does not have an active official State historical marker program, the MoDOT Historic Preservation Section uses interpretive panels and markers and other efforts to comply with Section 106.

For example, when the Missouri River bridge at Boonville, Cooper County, MO, was replaced in 1995, the cobblestone landing along the riverfront was unearthed—a significant archaeological find



The Equal Suffrage League of Virginia marker stands on the campus of Virginia Commonwealth University in Richmond.

© Matt Gottlieb, Virginia DHR.



The interpretive panel for the New Franklin Viaduct in Missouri tells about the history and engineering of the bridge, the importance of the community to the MKT railroad, and the removal of the bridge.

© Karen L. Daniels, MoDOT.

eligible for listing in the NRHP. Working with the city of Boonville, a park—dubbed Cobblestone Park—was established along the riverfront showcasing the historic cobblestones. Because the Boonville Bridge was also NRHP-eligible and was adversely affected by the project, elements from the bridge, including pieces of the railing and the bridge plaques, were incorporated into the park. MoDOT provided interpretive panels about the Boonville Bridge and the significance of the riverfront cobblestones for the park. Making the mitigation relevant to the public is desirable, and one way to do that is through interpreting the resources that are affected using interpretive panels.

In another instance, the New Franklin Viaduct on Missouri Highway 5—the longest State highway and the only highway to transverse the entire State—spanned a division yard for the Missouri Kansas Texas (MKT) Railroad. The MKT ceased operation in 1986 and Missouri acquired the right-of-way, which developed into the Katy Trail State Park. MoDOT proposed to remove the viaduct in 2008, since the structure was no longer needed. Since the viaduct was NRHP-eligible, as part of the Section 106 mitigation for the removal of the massive concrete structure, it was proposed that a trailhead for the Katy Trail be developed adjacent to Missouri Highway 5, and that an interpretive panel on the history of the viaduct be included in the trailhead. MoDOT worked with Missouri State Parks to develop and install the interpretive panel. Railings from the viaduct were installed along Missouri Highway 5 adjacent to the trail.

Interest in the Virginia historical marker program has also recently surged, resulting in the approval of as many as 50 to 60 new markers per year. At the same time, supply chain problems and high demand at the foundry that manufactures the markers have reduced the pace at which new signs

can be delivered, and a substantial backlog has formed. In December 2021, the Board of Historic Resources adopted new, more selective approval procedures for marker proposals in recognition that the program's rate of growth was unsustainable. Instead of accepting 10-15 applications from the public per quarter, DHR staff members now use a scoring rubric to select the top five applications received by each quarterly deadline. Proposals that receive the highest scores are those that have great potential to educate the public; address a topic that the program has not extensively covered; focus on the history of a community that has been marginalized or underrepresented; demonstrate statewide or national significance; and contribute to a more equitable geographic distribution of markers.

After a marker is in place, its sponsoring organization typically holds a dedication and unveiling ceremony. These events celebrate the completion of the project, bring communities together to learn more about the subject featured on the marker, and stimulate media reports that educate the wider public. "Time and

time again, I have witnessed Virginia's highway marker program galvanize communities around a shared sense of purpose and history. Attending a marker unveiling is a moving experience, during which attendees witness first-hand the power of history. I have lost count of the number of times that these events have moved me to tears," remarks Julie Langan, director of DHR.

### Markable Challenges

While having a nearly century-old marker program is a point of pride in Virginia, the program's longevity has also created challenges. The sensibilities and scope of the program have changed radically since its early decades, when markers focused largely on colonial houses and churches, the expansion of European settlement westward, and political and military history—with an emphasis on Civil War battles and troop movements. Information about the history of Native Americans (other than armed conflicts with settlers), African-Americans, and women was virtually excluded until the 1980s, when the program's definition of what qualified as "historic" or



A crowd gathered in 2014 at the dedication of the marker for the Dinwiddie Industrial School, a historically African-American school.

© Brad McDonald, Virginia DHR.

“significant” began to broaden.

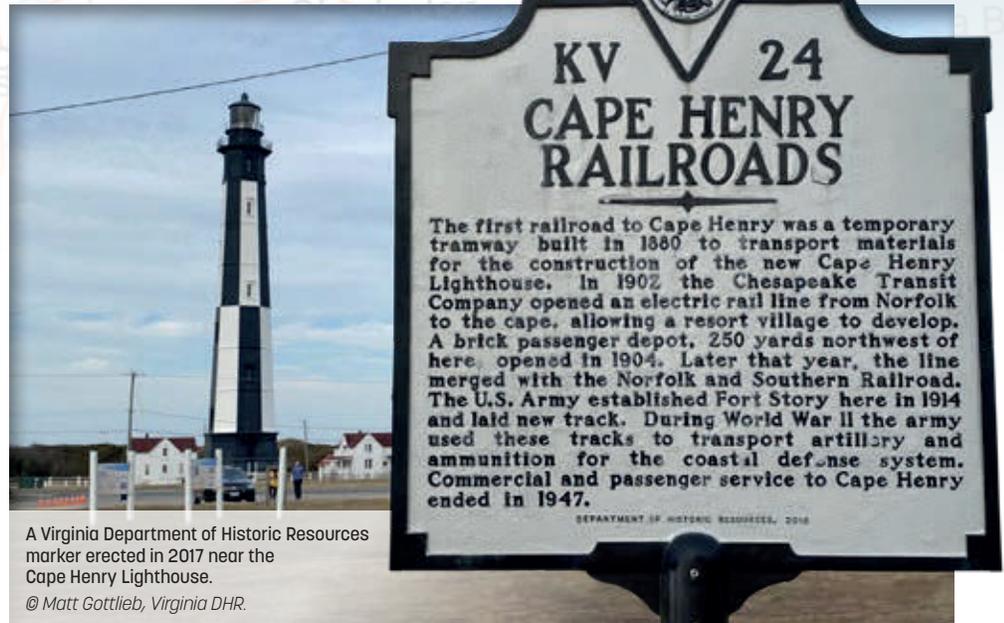
Since the 1990s, DHR has made vigorous efforts to diversify the content of the program so that it presents a more complete and accurate account of Virginia’s past. A series of Federal grants received between 1996 and 2009 allowed DHR staff and community partners to develop a variety of new markers about Native Americans, African-Americans, and women, highlighting such topics as a Monacan Indian village, the 23rd U.S. Colored Troops (USCT), the Equal Suffrage League of Virginia, and jazz singer Ella Fitzgerald. In addition, the Virginia General Assembly allocated funding in 2021 to support the production of 35 diversity-related markers. Despite these efforts, the program’s earlier history of exclusion means that, in terms of absolute numbers, the marker system still doesn’t adequately reflect the reality of Virginia’s multicultural past, an ongoing problem given that markers are often perceived as an official representation of what the State considers to be important.

A second challenge stemming from the program’s age has been the lingering presence of markers that are deteriorated, outdated, misleading, or erroneous. Markers are intended to stand on the roadsides for decades, and there is no way to revise them—other than full replacement—when

new information comes to light or when terminology evolves, rendering certain words antiquated or offensive. DHR’s marker retirement policy allows for the removal and replacement of markers that are in poor physical condition, contain factual errors, or have limited educational value because their texts

are exceedingly brief, lack historical context, or are otherwise inadequate, as determined by a detailed evaluation based on thorough research. Markers from the 1920s through the 1950s often contained very short texts and omitted information now considered essential. For example, markers about plantations did not mention the labor of enslaved people. Updated replacements contain longer, more comprehensive texts based on modern historical scholarship.

Although the demand for replacements is great and the associated expenses are substantial, DHR and VDOT have worked steadily to reduce the number of markers that do not meet the modern standards of the program. Federal grant funding in the 1990s and early 2000s allowed for the first large-scale replacement of older markers, bringing an aesthetic improvement to the roadsides as rusty and cracked iron signs gave way to new aluminum markers. Recently, State funding allowed DHR and VDOT to partner in the replacement of about 100 markers in 2017-2018, and, as of 2020, a reliable stream of funds from VDOT’s IDSP covers the cost of replacing about 10-15 missing or deteriorated markers per year. An infusion of State funds in 2021 is also supporting the replacement of damaged or outdated markers in cities and towns that are outside VDOT’s jurisdiction. Because older markers may retain special significance to the community and are often regarded as important artifacts, those that are retired from the roadside may be donated for indoor display to museums or other organizations that have an educational mission.



A Virginia Department of Historic Resources marker erected in 2017 near the Cape Henry Lighthouse.

@ Matt Gottlieb, Virginia DHR.



The 23rd USCT at the Alrich Farm highway marker before its unveiling in 2014.

@ Jennifer Loux, Virginia DHR.

## Hitting the Mark: Historical Marker Contests

As the design-build Request for Proposals in Missouri was being developed, Brandi Baldwin, deputy project director for the Champ Clark Bridge Project, contacted the MoDOT Historic Preservation Section about including a required interpretive marker or panel as part of a science, technology, engineering, and mathematics (STEM) challenge. Baldwin explains: “[I] always had a great passion for STEM, and when I saw the requirement for an interpretive panel, I saw an opportunity to engage the local schools. I wanted to give high schools students the opportunity to have a life-long impact on their community and with their families, and be able to say, ‘look what I did when I was a kid.’”

Five schools in Missouri and one in Illinois participated in the challenge, which was set up like the design-build procurement process. Aaron Gander, machine tool instructor with the Hannibal Career and Technical Center whose students had the winning design, said “my best memory of the design challenge was the teamwork I witnessed amongst our students. They spent many hours designing and evaluating their design to meet the contest criteria. I feel the students benefited beyond the challenge as it prepared them for requirements of college and work. Working with others, compromising, and then rallying around each other to reach a goal. The students were so proud

of their accomplishment, and it was a lot of fun!” The marker is a result of compromise: one school had the winning design, while another school had the winning text.

The interpretive marker in its final form was dedicated on a cold, drizzly January day in 2020. Despite the weather, nearly 75 people attended the dedication, including three of the students who had worked on the winning design.

In Virginia, the State’s Department of Education partnered with DHR to sponsor three contests in which K-12 students submitted ideas for historical markers during Black History Month in 2020 and 2021, and during Asian American and Pacific Islander Heritage Month in 2021. The best entries were selected, resulting in 20 new markers that cover such people and topics as civil rights activist Barbara Johns, NASA mathematician Katherine Johnson, Tuskegee Airman John L. Whitehead Jr., Filipinos in the U.S. Navy, and Vietnamese immigration to Northern Virginia. These contests “were examples of hands-on, relevant, real-world learning at its best,” Lewis Longenecker, history teacher at Cumberland Middle School, observes. “Students had the opportunity to use their voice to ensure lesser-known historic figures acquired the recognition they deserved.” Participants “gained an understanding that there are common values, such as the

importance of education, unselfishness, service to others, and a love of democracy that people of all backgrounds share,” he adds.

## Marking a Path Forward: The Future

As the Virginia marker program looks forward to commemorating its 100th birthday in 2027, it can point to many successes. The program, featuring nearly 2,600 markers, now highlights a wide variety of topics, from the Shoeless Wonders Football Team in Lynchburg and the Roanoke Life Saving and First Aid Crew to the 1889 Thaxton train wreck and the origins of Virginia’s chapters of the youth development program 4-H. Although Virginia’s marker program was slow to begin diversifying, it now features more than 430 markers that focus on African-American history.

Looking toward the future, a priority is to use available technology to make the historical content of the marker program more easily accessible to the public. While DHR’s website already offers a searchable marker database, the agency is working with VDOT on a new, more flexible ArcGIS app that will allow users to search for markers by keyword, subject, or locality and view the results on a map. In ways that couldn’t have been imagined a century ago, the program will forge ahead in its mission to spark interest in Virginia history, draw visitors



The historical marker for the Champ Clark Bridge in Missouri was designed during a STEM competition by the Hannibal Career and Technical Center and the text written by the Pittsfield High School.

@ Karen L. Daniels, MoDOT.

## Old Greenville Interpretive Panel Consultation

Old Greenville is a community that was relocated for planned dam construction in the 1940s. Much of the town site survives as archaeological remains on the Wapappello Dam reservation and the town site is listed in the NRHP. In 2005, MoDOT planned improvements to U.S. Highway 67—which runs adjacent to Old Greenville—and those improvements would have destroyed a small portion of the site and had an adverse effect under Section 106.

Instead of traditional archaeological mitigation, consisting of excavation of the site, the U.S. Army Corps of Engineers (Corps) and the Old Greenville descendant community asked MoDOT to consider alternative or creative mitigation, including developing interpretive panels that would tell the history of the community. This had been on the Corps' wishlist for many years but had never been funded.

MoDOT and the Federal Highway Administration agreed that this would be a better use of public funds than to reexamine the Old Greenville archaeological site which had already been tested. According to David

Clarke, the FHWA Federal preservation officer, "FHWA's policy regarding mitigation that utilizes public funding, including creative mitigation that is done in addition to, or in lieu of standard approaches to mitigation, is that it represents a reasonable public expenditure when considering the impacts of the action and the benefits of the proposed mitigation measures."

The Corps, the Old Greenville descendant community, and MoDOT agreed to a list of themes that would be interpreted and a budget that the mitigation effort would not exceed. In addition to panels about Old Greenville, the Trail of Tears was also a theme since the Bengé Route went through the area.

The Cherokee Nation was very involved in the development of the two panels related to the Trail of Tears. One panel explained the history of the Bengé Route—a route used by only one of the 13 groups traveling west to present-day Oklahoma. Another interpretive panel was developed for and placed at the Bettis Ford site along the St. Francis River—a known, actual location the Cherokee passed through. The Cherokee Nation helped research information, edit text, and select imagery (including a painting by a Cherokee artist, to whom a license fee was paid for by MoDOT) for placement on the panel, to accurately illustrate their ancestors' experience and ensure their story was told.

Once the panels had been drafted with text and images, MoDOT hosted an open house to allow stakeholders and the public to provide feedback. Many comments were received, with feedback from the public regarding errors in the historical record and assurances that old divisions within the community were accurately reflected were shared. The National Park Service provided comments on the illustrations depicting the Trail of Tears to the project team.

Once the comments were addressed, MoDOT had the interpretive panels manufactured and worked with the Corps on the installation. A series of dedication ceremonies were held as interpretive panels were installed and became accessible to the public.

Drafts of the Old Greenville Interpretive panels were reviewed by the descendant community with an opportunity to provide feedback, which was valuable in understanding gaps in the historical record.

© Mike Meinkoth, MoDOT.



to historical sites, and educate the public about a wide range of significant people, places, and events that shaped the past and influenced the present.

The MoDOT Historic Preservation Section's interpretive panel program also looks forward to securing more partnerships through identifying resources that will benefit from panels, identifying appropriate locations on or off MoDOT rights-of-way, and providing feedback on drafts of interpretive text to ensure local perspectives are captured and critical errors are avoided. Similarly, opportunities to establish a growing network with local partners (i.e., cities, historical societies, and special interest groups) exist in locations that are accessible to the public (and in areas where the risk of vandalism is low) and where the consulting parties and the public have an interest in the resources. There must be local interest and support for the development and placement of interpretive panels to be considered as a good Section 106 mitigation measure by MoDOT. Nonetheless, MoDOT will work with stakeholders to develop the necessary support to continue to mark State history.

**KAREN L. DANIELS**, MoDOT's architectural historian, has a B.S. in historic preservation from Southeast Missouri State University and a master's in heritage preservation from Georgia State University.

**MIKE MEINKOTH**, historic preservation manager at MoDOT, has a B.A. in anthropology from Southern Illinois University and an M.A. degree in archaeology from the University of Illinois.

**JENNIFER R. LOUX** is highway marker program manager at the Virginia DHR. She received a Ph.D. and M.A. in history from Johns Hopkins University and a B.A. from the College of William and Mary.

For more information on the MoDOT Historic Preservation Section, visit <https://www.modot.org/historic-preservation> or contact Karen Daniels, 573-526-7346, [karen.daniels@modot.mo.gov](mailto:karen.daniels@modot.mo.gov). For more information on the Virginia marker program, visit <https://www.dhr.virginia.gov/highway-markers/> or contact Jennifer Loux at [jennifer.loux@dhr.virginia.gov](mailto:jennifer.loux@dhr.virginia.gov).

# Resources for Understanding Challenges and Opportunities for Coastal Highway Projects

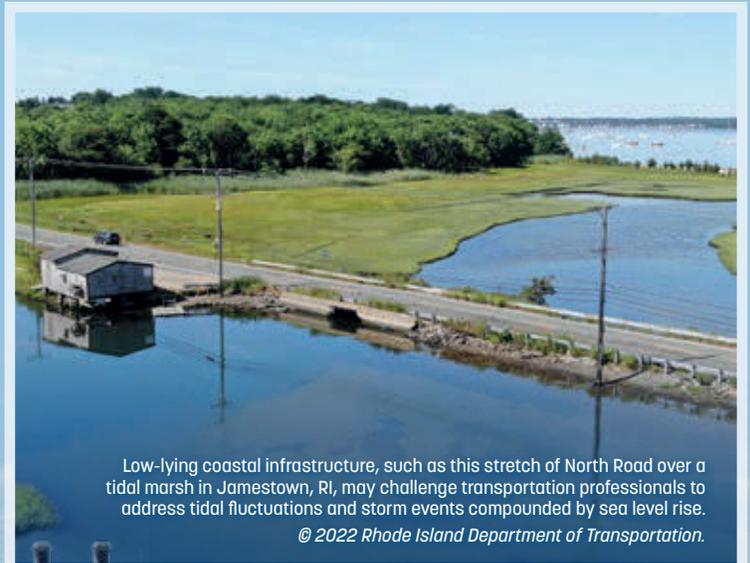
The Federal Highway Administration develops and deploys technical information and training to aid transportation professionals with understanding coastal processes, infrastructure vulnerabilities, and concepts important to resilient and sustainable planning and design of coastal highways.

by **DANIEL S. SHARAR-SALGADO** and **ERIC R. BROWN**

## Highways in the Coastal Environment

“Two of the United States’ most storied love affairs are with the coast and with roads. Where these two intersect, coastal highways, there is a need for wise engineering, planning, and design,” says Dr. Scott L. Douglass, professor emeritus of Civil, Coastal and Environmental Engineering at the University of South Alabama in Mobile. Regularly delivering trainings on highways in the coastal environments to State departments of transportation (DOTs) across the country, Dr. Douglass often opens his courses with this quote. Having spent the last 40 years providing coastal engineering design in the highway environment, he has an acute understanding of the importance and challenges of coastal highways.

The Federal Highway Administration (FHWA) strives to support this work. With an estimated 60,000 miles of coastal highways in 30 States and all U.S. territories, these roadways remain a primary means for supporting mobility, economic opportunity, safety, and well-being for local communities and resources. As a result, FHWA provides foundational resources and training opportunities for developing and maintaining knowledge of and experience with coastal processes and their interactions with highways.



Low-lying coastal infrastructure, such as this stretch of North Road over a tidal marsh in Jamestown, RI, may challenge transportation professionals to address tidal fluctuations and storm events compounded by sea level rise.

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Coastal engineering expertise and know how is requisite for the planning, design, and operation of coastal roads and bridges.

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## Coastal Highways and Vulnerabilities

Coastal highways face exposure to various phenomena and processes that may result in infrastructure damage and effects on transportation system users. Extreme weather events, such as coastal storms, hurricanes, and tsunamis, may damage or destroy roads and bridges and reshape coastlines. In many locations, rising sea levels increase the vulnerabilities of coastal infrastructure to these events. Rising sea levels also contribute to high-tide flooding in low-lying areas. This flooding may cause minor roadway damage, traffic disruptions, and shoreline erosion.

According to Dr. Douglass, “Many roads and bridges are vulnerable because they are in the unique coastal wave and water level design environments. And that vulnerability is increasing with sea level rise [SLR].” The effects of SLR and related climate change impacts may lead to challenges for transportation professionals, such as more frequent minor flooding, greater flooding extents (the extent of land that has been, or might be, flooded), and damage from extreme weather events. Matthew Lauffer, assistant State hydraulic engineer at the North Carolina DOT, related, “At North Carolina, we have experienced numerous hurricanes that have caused significant damage to our coastal roads and bridges. With rising sea levels, these events will only become worse and more frequent in the years to come. Fortunately, our management supports our efforts to create more resilient coastal roadways and has supported us working with coastal engineers on coastal roadway projects.”

## FHWA Resources for Coastal Highways

Increasing infrastructure stressors due to SLR notwithstanding, Dr. Douglass said, “We are deciding that many of the best adaptations for climate change are the same sound, proven coastal engineering and management approaches needed for improving the resilience of these roads today.” FHWA promotes a range of technical resources and training courses to provide State DOTs and others with the basic coastal engineering principals needed to develop and maintain coastal highways. These resources include technical manuals, training courses, pilot projects, and peer exchanges.



Rising sea levels, among other factors, may contribute to flooding in low-lying coastal areas during normal tidal cycles.  
© 2017 Joe Krolak.

## Technical Manuals

*Highways in the Coastal Environment: Hydraulic Engineering Circular Number 25, Third Edition (HEC-25)* remains FHWA’s most comprehensive resource on coastal processes and interactions upon highways. This manual introduces many complex topics in a manner suitable for transportation professionals with little background in coastal science and engineering. A few of the covered coastal topics are:

- Basic theory of waves
- Water levels
- Sediment transport
- Practical implications of coastal processes
- Shoreline recession
- Bridge deck damage mechanisms
- Foundation erosion (i.e., scour)

*HEC-25* also provides overviews of various engineering practices (e.g., rock protection, seawalls, and nature-based solutions) that protect coastal infrastructure. The final section of the manual focuses on the project processes for planning, designing, and building a coastal highway that is resilient to the processes it may face. The manual includes practical methods for determining the level of effort needed for a highway project, depending on its location and complexity. Several short examples given range from simple, quick projects to large, complex efforts.

FHWA has a few more specialized technical resources for those interested in delving a little deeper into specific topics. *A Primer on Modeling in the Coastal Environment* introduces many concepts used



A bridge damaged by a hurricane. Investigators determined wave action displaced the deck panels.  
Source: FHWA.

in computer software to estimate coastal storm impacts. The primer covers modeling theory and important steps of the modeling process. *Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide* provides pragmatic information about the process of implementing a range of nature-based solutions, starting from planning to design, construction, and maintenance phases.

### Training Courses

FHWA provides a wealth of training course offerings through the National Highway Institute (NHI). A development team recently updated NHI 135082—*Highways in the Coastal Environment*—a 3-day, instructor-led course that serves as a companion to the HEC-25 technical manual. The previous version of this course taught basic coastal science and engineering concepts through a variety of hands-on techniques, such as operating a wave flume, performing hand calculations, and participating in an interactive trivia game. The updated course keeps or enhances many of these core activities while adding new material on coastal scour (i.e., erosion of soil around a structure's foundation), SLR,

nature-based solutions, and coastal project development. NHI 142085, *Addressing Climate Resilience in Highway Project Development and Preliminary Design*, also includes methods for assessing future impacts of climate change and sea level rise on highways.

FHWA has also developed four web-based trainings (WBT) focused on the basic terminology and principles of coastal science. These courses are titled:

- NHI 135082A, *Future Sea Levels for the Design of Highways in the Coastal Environment*
- NHI 135082B, *Waves for the Design of Highways in the Coastal Environment*
- NHI 135082C, *Water Levels for the Design of Highways in the Coastal Environment*
- NHI 135082D, *Sediment Processes for the Design of Highways in the Coastal Environment*

Participants may complete these free WBT courses by registering at the NHI website and selecting the courses of interest. The developers designed each of these WBTs to be completed in 1 to 2 hours. A fifth WBT called NHI 135082E, *Nature-Based Solutions for the Design of Highways*

*in the Coastal Environment*, is currently in development for release in 2024.

### Research, Pilot Projects and Peer Exchanges

FHWA also sponsored a series of pilot projects and peer exchanges to explore coastal planning and design challenges and work together with States, municipalities, and consultants to identify potential climate impacts on surface transportation infrastructure and brainstorm solutions:

- The Gulf Coast Phase 1 and Phase 2 studies measured the potential damages and costs to transportation assets in the central Gulf Coast region by simulating SLR and hurricane impact scenarios.
- The transportation engineering approaches to climate resiliency (TEACR) study analyzed how individual transportation assets could be modified or adapted to withstand future climate conditions, including SLR and future coastal storms.
- The report *Emerging Issues Associated with Sea Level Rise: Findings from FHWA Peer Exchanges* documents a series of peer exchanges involving State

FHWA staff operate the wave flume used in the NHI 135082 *Highways in the Coastal Environment* training course. Student feedback recognizes the flume as a hands-on activity that allows course participants to visualize and understand coastal processes and their impacts on roads and bridges.

Source: FHWA.



and local transportation agencies that focused on the impacts of SLR on coastal roadways.

- A number of transportation resilience pilots have investigated resilience solutions to current and future extreme weather events, reducing future maintenance costs over the full life cycle of transportation assets.

“When we first started considering the potential impacts of climate change and relative SLR on transportation infrastructure, we were not sure how to approach the problem” said Robert Kafalenos, an environmental protection specialist and member of FHWA’s Resilience Team. According to Kafalenos, who has led many of FHWA’s resilience research projects, “We conducted research to better understand future impacts and develop methods and tools for assessing resilience and adaptation options for transportation projects. We also supported State- and MPO-[metropolitan planning organization] led pilot studies to apply our methods and tools, as well as others, to assess vulnerabilities of their transportation systems and projects. Our State and local partners did a great job documenting their resources, constraints, and the decisions the work lead to. The best part about these projects was that it set a template for other States and locals who will likely be facing similar concerns in the future.”

## Looking Ahead

By understanding and applying concepts presented by these FHWA resources and tools, project teams may enhance the resilient design and operation of coastal highways. FHWA continues to develop resources for educating practitioners and students in the understanding, assessment, and application of coastal processes and their interactions with transportation infrastructure. For more information on FHWA coastal highway initiatives and activities, please reach out to the authors or your FHWA hydraulic engineering point of contact.

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For more information, see <https://www.fhwa.dot.gov/engineering/hydraulics/> or contact Daniel Sharar-Salgado (202-366-8791/[d.shararsalgado@dot.gov](mailto:d.shararsalgado@dot.gov).)

## FHWA Coastal Highway Resources

FHWA’s latest learning resources:

- *Highways in the Coastal Environment: Hydraulic Engineering Circular Number 25, Third Edition* (<https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif19059.pdf>)
- NHI 135082, *Highways in the Coastal Environment* ([https://www.nhi.fhwa.dot.gov/course-search?tab=0&key=135082&sf=0&course\\_no=135082](https://www.nhi.fhwa.dot.gov/course-search?tab=0&key=135082&sf=0&course_no=135082))
- NHI 142085, *Addressing Climate Resilience in Highway Project Development and Preliminary Design* ([https://www.nhi.fhwa.dot.gov/course-search?tab=0&cat=10&srt=10&sf=0&course\\_no=142085](https://www.nhi.fhwa.dot.gov/course-search?tab=0&cat=10&srt=10&sf=0&course_no=142085))
- A five-part WBT series (NHI 135082A-E) on resilient coastal highway project development and design (available summer 2023 through the NHI website: <https://www.nhi.fhwa.dot.gov/>)
  - NHI 135082A, *Future Sea Levels for the Design of Highways in the Coastal Environment*
  - NHI 135082B, *Waves for the Design of Highways in the Coastal Environment*
  - NHI 135082C, *Water Levels for the Design of Highways in the Coastal Environment*
  - NHI 135082D, *Sediment Processes for the Design of Highways in the Coastal Environment*
  - NHI 135082E, *Nature-Based Solutions for the Design of Highways in the Coastal Environment*
- *A Primer on Modeling in the Coastal Environment* (<https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif18002.pdf>)
- *Nature Based Solutions for Coastal Highway Resilience: An Implementation Guide* ([https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing\\_and\\_current\\_research/green\\_infrastructure/implementation\\_guide/fhwahep19042.pdf](https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/implementation_guide/fhwahep19042.pdf))
- *Emerging Issues Associated with Sea Level Rise: Findings from FHWA Peer Exchanges* (<https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif22051.pdf>)
- Gulf Coast Study Phase 1 and Phase 2 ([https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing\\_and\\_current\\_research/gulf\\_coast\\_study/index.cfm](https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/gulf_coast_study/index.cfm))
- TEACR study ([https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing\\_and\\_current\\_research/teacr/](https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/))
- Resilience pilots (<https://www.fhwa.dot.gov/environment/sustainability/resilience/pilots/>)

Please contact the authors to discuss these and related FHWA resources.

## Where to Start Learning the Basics

Hot Topics	“Cool” Resources
Coastal processes	<ol style="list-style-type: none"> <li>1. NHI 135082A-E</li> <li>2. NHI 135082</li> <li>3. HEC-25</li> </ol>
Coastal modeling principles (e.g., water surfaces, waves)	<i>A Primer on Modeling in the Coastal Environment</i>
Coastal design concepts	<ol style="list-style-type: none"> <li>1. NHI 135082A-E</li> <li>2. NHI 135082</li> <li>3. HEC-25</li> <li>4. Resilience pilots</li> </ol>
Coastal highway vulnerability assessments and resilience	<ol style="list-style-type: none"> <li>1. NHI 142085</li> <li>2. Gulf Coast Phase 1 and Phase 2 studies</li> <li>3. TEACR</li> <li>4. Resilience pilots</li> </ol>
Extreme weather events	<ol style="list-style-type: none"> <li>1. HEC-25</li> </ol>
Nature-based solutions	<ol style="list-style-type: none"> <li>1. NHI 135082E</li> <li>2. <i>Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide</i></li> <li>3. Resilience pilots</li> </ol>
SLR	<ol style="list-style-type: none"> <li>1. NHI 135082A</li> <li>2. HEC-25 (chapter 4)</li> <li>3. <i>Emerging Issues Associated with Sea Level Rise: Findings from FHWA Peer Exchanges</i></li> </ol>

# FORTY YEARS OF THE FEDERAL LANDS HIGHWAY PROGRAM

CONNECTING THE WORLD TO AMERICA'S MOST BEAUTIFUL PLACES.

FHWA's Federal Lands Highway Program, with its motto, "We work where you play," brings America's natural and cultural heritage within reach, like Many Glacier—a popular tourist area within Glacier National Park in Montana.

Source: FHWA.

by **DOUG HECOX** and **SCOTT JOHNSON**

For 40 years, the Federal Highway Administration's Federal Lands Highway (FLH) Program has built, maintained, and repaired one of the world's largest transportation networks. Created in 1983, the FLH Program now manages a budget of more than \$1.5 billion to oversee more than a half-million miles (805,000 kilometers) of roads, more than 11,000 vehicular bridges, and more than 1 billion acres on Federal properties owned by the Bureau of Land Management (BLM), Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (USACE), Presidio Trust, U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS) and National Park Service (NPS).

"Since 1905," says Tim Hess, FHWA's former associate administrator for FLH, "the Office of Federal Lands Highway and its predecessor agencies have assisted Federal Land Management Agencies in the design and construction of public roads, giving the American public access to and through the National Parks, the National Forests, and other Federally-owned lands. These roads, bridges, and tunnels allowed the public to access and

experience the highest mountains, the quietest forest, the purest streams, and the best scenic views in America. The Office of Federal Lands Highway continues to this day to provide a safe, reliable, equitable, and resilient transportation system for all those accessing Federal Lands."

### **MOTORIZATION OF THE PARKS**

In 1906, the West Coast was still recovering from the devastating earthquake and fires in San Francisco. More than 108,000 cars were in use, though America's roads remained largely unpaved and rural. Cars of that era were still rare and, compared to their modern counterparts, unreliable and uncomfortable. The best-selling car that year was the Ford Model N, a four-cylinder two-seater with a top speed of only 40 miles (64 kilometers) per hour. Because of the rough condition of many roads, the undependable machinery powering such vehicles, and the relative shortage of trained mechanics, drivers rarely ventured too far from their respective homes. Interstate traffic was virtually nonexistent.

In the same year, at only 47 years old, Theodore Roosevelt was making his mark on the Nation. A few years earlier, America's youngest president—elected in 1901 at 42 years old—made headlines by riding in a Columbia Electric Victoria Phaeton through parts of New England. It was the first time any U.S. president had ridden in a car as part of his official duties as commander in chief—making it the Nation's first presidential motorcade.

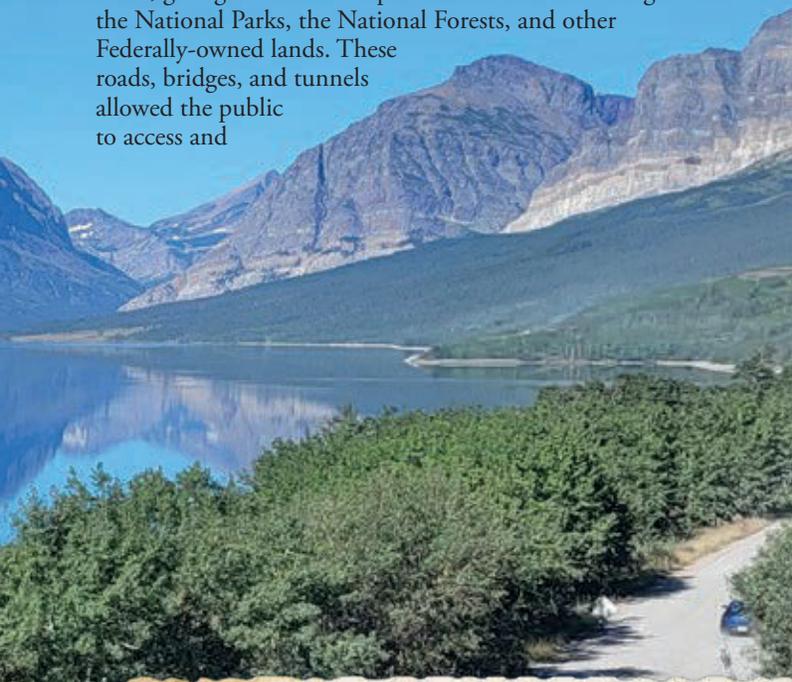
Roosevelt's enthusiasm for the great outdoors was widely known. The man who historians would later call the "conservation president" spent much of his two presidential terms in the White House preserving wildlife, naming national monuments, and creating five new national parks—Crater Lake in Oregon, Wind Cave in South Dakota, Sullys Hill in North Dakota (which was later re-designated a game preserve), Mesa Verde in Colorado, and Platt in Oklahoma (now part of Chickasaw National Recreation Area).

With a stroke of his pen, Roosevelt also enacted the Antiquities Act of June 8, 1906, which enabled him and his presidential successors to proclaim historic or prehistoric structures, landmarks, and other resources of historical value or scientific interest in Federal ownership as national monuments. Within the first 6 months of signing the act into law, Roosevelt proclaimed four national

monuments—Devil's Tower in Wyoming, El Morro in New Mexico, and Arizona's Montezuma Castle and Petrified Forest. He also used the act, in subsequent years, to protect a large portion of Arizona's Grand Canyon as a national monument.

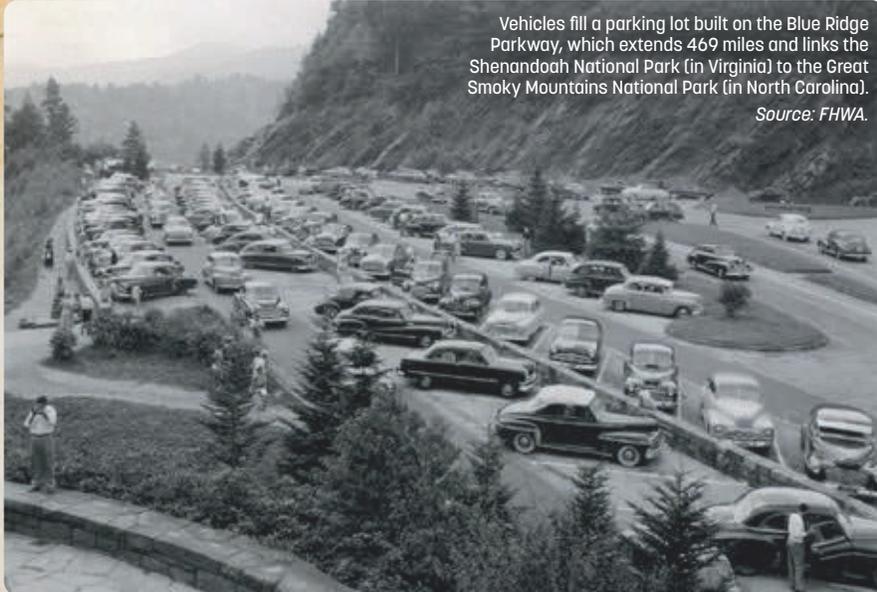
By the end of his second term, Roosevelt had called for the preservation of six cultural areas and a dozen natural areas. Much of the total land area of these sites was initially administered by the U.S. Department of Agriculture (USDA), since NPS was still 10 years away from creation.

Car ownership was climbing rapidly throughout the 20th century's first two decades. For example, in 1900, the United States had 8,000 registered vehicles. By 1920, that figure had grown a thousand-fold to more than 8.1 million. With the rise of registered vehicles came a rise in new drivers who were eager for new places to visit, and automobiles were increasingly



Vehicles fill a parking lot built on the Blue Ridge Parkway, which extends 469 miles and links the Shenandoah National Park (in Virginia) to the Great Smoky Mountains National Park (in North Carolina).

Source: FHWA.



driven beyond cities and into country hamlets and scenic picnic-friendly meadows. America's tourism industry had begun.

In 1902, Henry G. Merry sneaked his 1897 Winton into Yellowstone National Park—making it the first car to enter the park. He raced his car past the guards at the Gardiner Entrance, who gave chase on horseback and caught up to him on a steep hill. The guards tied ropes to Merry's car and dragged it to the park's headquarters, where the park superintendent ordered it out of the park—after demanding a ride.

### THE BEGINNING OF DRIVE-THROUGHS

While interest in exploring the Nation's parks and monuments by car was growing, the official stance of the U.S. Department of the Interior—which manages America's natural resources and heritage—was that no automobiles would be allowed in the national parks. Gradually, that stance began to change.

In 1907, a year after the enactment of the Antiquities Act, the issue was drawing congressional attention. Sen. Henry Myers (D-Montana) represented many constituents eager to drive through Glacier National Park, near Kalispell, in Montana. "We are very anxious to have the regulation so framed that automobiles may be used on the roads in the Park," wrote Montana resident Fred Whiteside on March 24, 1911. "In the Yellowstone Park, nothing but horses are allowed, but we believe we have now reached the stage of civilization where it will be better to use automobiles even if the horses are to be left out."

With the creation of NPS in 1916, there was a

recognition of the need to create roads and bridges with which to accommodate growing public interest in these wild, new, untamed lands.

"The motorization of park transportation was generally regarded as a positive development," wrote NPS Historian Timothy Davis in the 2004 book, *America's National Park Roads and Parkways: Drawings from the Historic American Engineering Record (The Road and American Culture)*. "Not only did it eliminate the tedious and uncomfortable experience of clattering along in slow and dusty stagecoaches, but by significantly reducing the time and expense of park vacations, automobiles made the national park experience available to a broader segment of the public," Davis recalled. "The automobile was greeted with a mixture of enthusiasm and apprehension when it clanked and wheezed its way into national parks at the turn of the 20th century."

### DISTINCTIVE DESIGNS

Upon its creation, NPS proclaimed, "that one of its most pressing tasks was to upgrade the [NPS] to accommodate motorists." According to a book published by NPS, *Historic Roads in the National Park System*, "[d]esigners during the 1920s tended to perceive roads and buildings as necessary

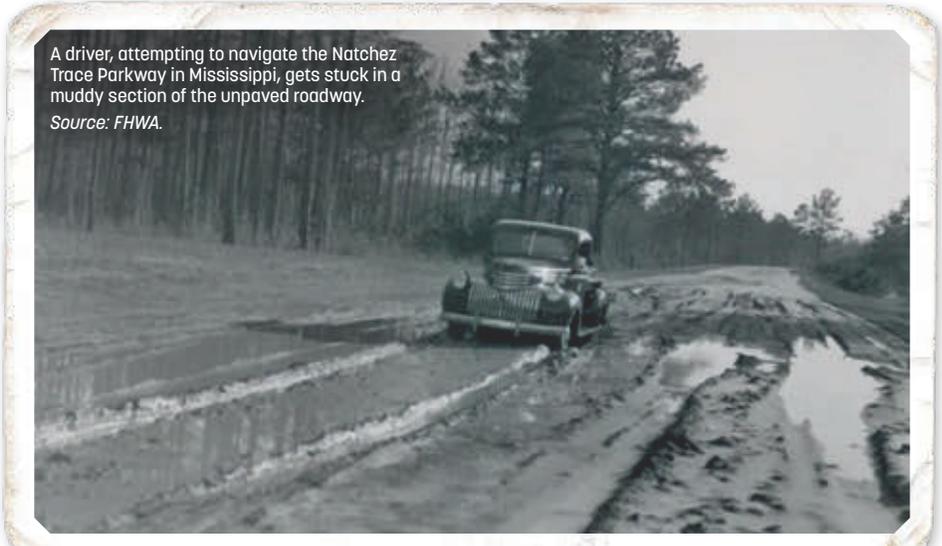
evils, and they incorporated a variety of means in their designs to achieve harmony with the surrounding environment."

"Roads and related features were to be designed to harmonize with their surroundings," Davis added, "and great care was taken to ensure that the parks were not gridironed by excessive road construction." Road designers would commonly use onsite, natural materials that supported the local environs, and curvilinear road alignments that hugged the topography—techniques today known throughout the FHWA as "context sensitive design." Because this approach was widespread throughout the newly minted NPS, these new roads gave national parks a "distinctive, identifiable look and feeling."

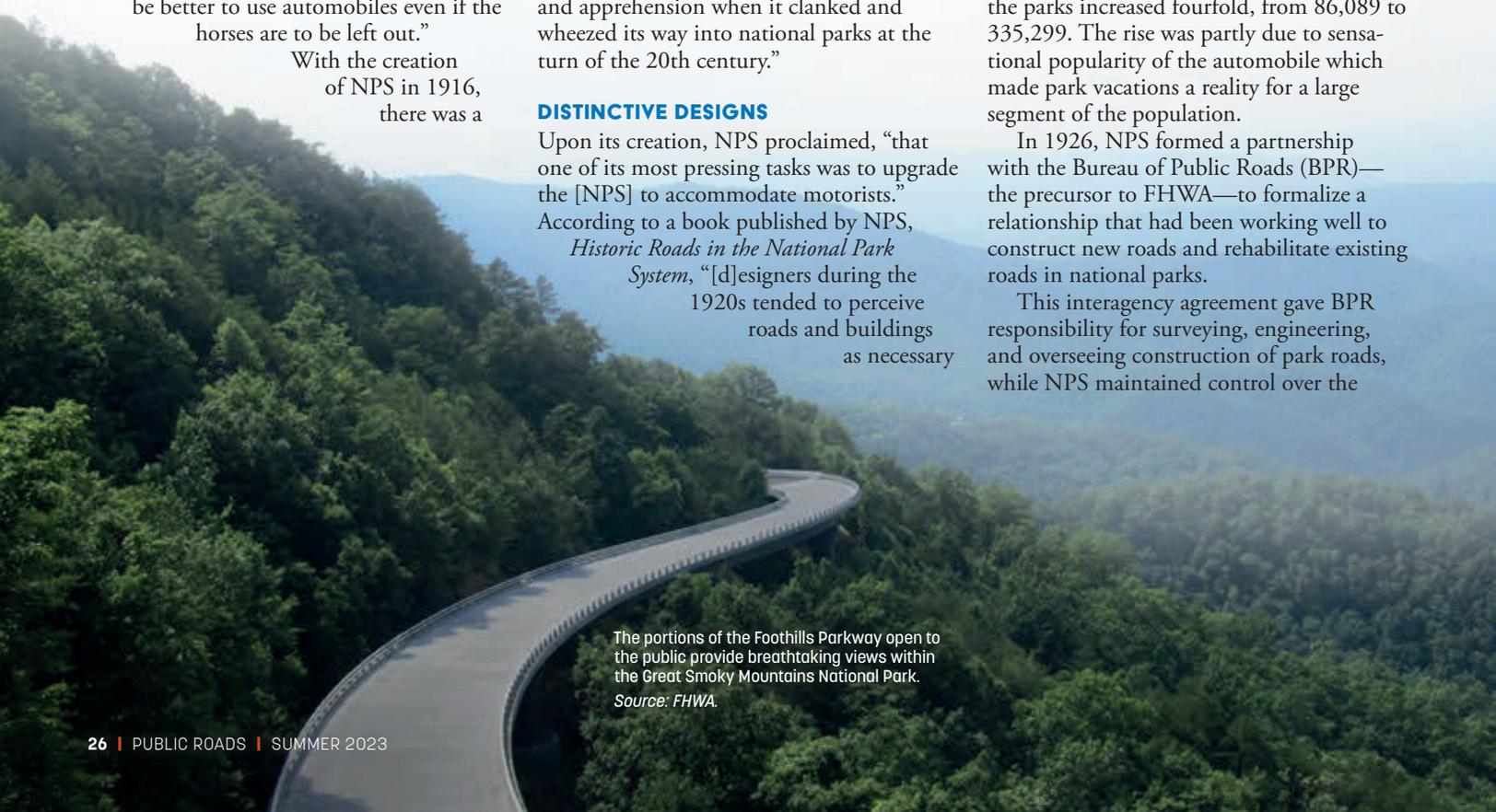
Between 1909 and 1915, visitorship to the parks increased fourfold, from 86,089 to 335,299. The rise was partly due to sensational popularity of the automobile which made park vacations a reality for a large segment of the population.

In 1926, NPS formed a partnership with the Bureau of Public Roads (BPR)—the precursor to FHWA—to formalize a relationship that had been working well to construct new roads and rehabilitate existing roads in national parks.

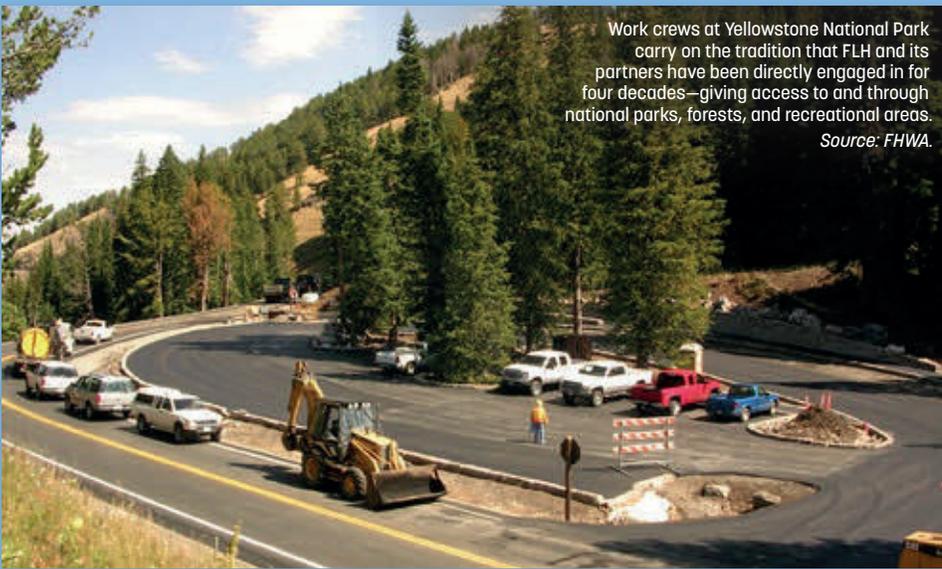
This interagency agreement gave BPR responsibility for surveying, engineering, and overseeing construction of park roads, while NPS maintained control over the



A driver, attempting to navigate the Natchez Trace Parkway in Mississippi, gets stuck in a muddy section of the unpaved roadway.  
Source: FHWA.



The portions of the Foothills Parkway open to the public provide breathtaking views within the Great Smoky Mountains National Park.  
Source: FHWA.



Work crews at Yellowstone National Park carry on the tradition that FLH and its partners have been directly engaged in for four decades—giving access to and through national parks, forests, and recreational areas. Source: FHWA.

aesthetic and day-to-day management of road construction. Also, according to the 1995 online publication, *Historic Roads in the National Park System*, “[t]he roads constructed through this working arrangement included some of the best examples of road engineering and the most scenic roads in the United States.”

#### THE JOY OF PARK ROADS

In the decades that followed, BPR built park roads while their State counterparts constructed roads to connect to or access them. Park roads were so well-designed that the joy of driving one became an integral part of the national park experience. For the last 40 years, the FLH Program has continued to uphold that legacy of excellence.

Driving on park roads has evolved into one of the recreational experiences that visitors relish most in parks. Few visitors go to

Glacier National Park in Montana without driving on the Going-to-the-Sun Road, or to Rocky Mountain National Park in Colorado without driving on Trail Ridge Road.

As reliance on the U.S. government for road maintenance and construction grew, so did its financial needs. President Ronald Reagan enacted the Program in the Surface Transportation Assistance Act of 1982, signed on January 6, 1983. Nearly a century after Roosevelt signed the Antiquities Act, Reagan’s signature gave FHWA its mandate to build, preserve, and protect roads and bridges on all Federal lands.

“FHWA has a long and successful history of interagency partnership with Federal land management agencies,” says Hess.

Even now, more than a century after the creation of the first national parks and monuments, the high-quality roads and bridges that make visits to them so enriching remain the highest priority for

the FLH Program. Each year, its hundreds of workers—alongside NPS, BLM, USFS, BOR, USACE, and USFWS—labor in scenic, but remote, locations, enduring difficult conditions, bad weather, rockfalls, and occasional encounters with bad drivers and wildlife. Nonetheless, the FLH Program is united by a central purpose: to ensure a safe and scenic travel experience for the millions of people who depend on them each year.

With its motto, “We work where you play,” FHWA’s FLH Program brings America’s natural and cultural heritage within reach.

“Federal agencies working together to carry out their missions, and to leverage each other’s expertise to fulfill those missions, is what this is all about,” Hess adds. “The over 700 people working in [the] FLH [Program] are proud to support our interagency partners by building transportation facilities which give the American people access to their national parks, forests and recreational areas in a manner that balances access with resource protection. This ensures our national treasures can be enjoyed not only by current generations but by future ones as well.”

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**DOUG HECOX**, deputy administrator for FHWA’s Oregon Division, has a journalism degree from the University of Wyoming. He has authored two books, and taught journalism and public relations writing at American University for 20 years.

**SCOTT JOHNSON** is the director of Federal Lands Programs within FHWA’s FLH Headquarters.

For more information, see <https://highways.dot.gov/federal-lands/about>.



Beartooth Highway in Yellowstone National Park—acknowledged as one of the most scenic roadways in the Nation—is one of the many picturesque highways and parkways designed and constructed under the Federal Lands Highway Program. Source: FHWA.



# Making Healthy Connections in Transportation

Transportation infrastructure plays a key role in health outcomes.

Access to safe, clean, and hazard-free environments can lead to better outcomes for all users, including pedestrians, bicyclists, and those with disabilities.

@ adamkaz / iStock.com.

by **JHOSET BURGOS-RODRÍGUEZ, VICTORIA MARTINEZ, ELLIOT SPERLING, ANTHONY NICOME, and WENDY HEAPS**

**T**ransportation and health are interconnected. Beyond moving people and goods, transportation plays a key role in improving physical, mental, social, environmental, and economic health. Through programs, policies, and infrastructure investment, the U.S. Department of Transportation and its Federal partners, such as the U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control and Prevention (CDC), are working together to improve the connection between transportation and health, underscoring the vital importance of making equitable investments in our communities.

Building and strengthening partnerships will help leverage Federal programs and funding opportunities, including programs established by the Bipartisan Infrastructure Law (BIL) (Pub. L. 117-58, enacted as the Infrastructure Investment and Jobs Act) and the Inflation Reduction Act (IRA) (Pub. L. 117-169). These programs and funding opportunities, such as the Reconnecting Communities Pilot (RCP) Program and the Thriving Communities Program (TCP) can empower communities in the transportation decisionmaking process and continue moving the Nation toward a safer, healthier, and more equitable transportation system.

## Transportation and Health Connections

Safe and reliable transportation is fundamental to the health of people, communities, and economies, making it a social determinant of health. The factors that influence health

outcomes—including overall health status and individual and community quality of life—are known as social determinants of health. The places where people live, learn, work, and play have a large effect on an individual's health outcomes. Transportation has the potential to negatively affect communities by limiting opportunities for safe physical activity, increasing exposure to pollution, and impacting community design. Increasing transportation connections can improve access to health-supporting activities, medical services, recreational facilities, and healthy food, as well as other destinations including schools, jobs, and community centers.

Efforts to improve health outcomes through transportation investments can help address the leading causes of U.S. deaths, many of which can be directly or indirectly attributed to transportation. According to the National Highway Traffic Safety Administration's (NHTSA) estimates, 42,915 people died in motor vehicle traffic crashes in 2021, including 7,342 pedestrians and 985 cyclists. Enhanced safety measures, such as speed control management strategies and properly designed lighting deployment, can reduce traffic deaths and serious injuries. Also, less vehicle traffic can improve air quality and reduce chronic lower respiratory diseases. According to the CDC, chronic lower respiratory diseases claimed a total of 142,342 lives in 2021. Similarly, the U.S. Surgeon General reported that regular physical activity can reduce the risk of heart disease, diabetes, and certain cancers. These illnesses led to approximately 696,000, 103,000, and 605,000 deaths, respectively, in 2021.



Social determinants of health.

Source: FHWA.

Active transportation, including walking, biking, and rolling, positively contributes to people's physical activity.

Barriers that limit community access—such as arterials and highways that cut through communities—can discourage physical activity, exacerbate air and noise pollution exposure from roadways, and disconnect people from the places that matter most. In addition, socioeconomic inequities can contribute to (and can occur because of) disproportionate exposure to transportation-related negative impacts for underserved, overburdened, and disadvantaged communities. These communities can include people of color, people with disabilities, Native Americans, older adults, and people living in lower income neighborhoods.

### **Health and Equity Benefits of Safety for All Road Users: Working Together Toward Zero Deaths**

Increases in road fatalities and injuries persist even though vehicles have become safer to drive. The rate of roadway fatalities

per 100 million vehicle miles traveled has not substantially improved over the last 10 years, and increased significantly in 2020. In 2020, a pedestrian was killed every 81 minutes in traffic crashes according to NHTSA. The increasing rate of fatalities and injuries on the Nation's roadways disproportionately affect underserved, overburdened, and disadvantaged communities. For instance, higher risks of crash deaths are concentrated in lower income neighborhoods where exposure to traffic volume and speed may be higher because of factors such as inadequate road safety infrastructure and reduced community engagement in the transportation planning process. Fatal and injury statistics grow yearly, in part, because of roadway designs that prioritize speed over the safety of people inside and outside of vehicles.

Through the National Roadway Safety Strategy and the Safe System Approach, USDOT aims to address the unprecedented public health issue of deaths and serious injuries from road traffic. As part of an ambitious long-term goal to reach zero roadway fatalities and serious injuries, USDOT has committed to focusing its safety programs and resources on infrastructure, human behavior, speeds, responsible oversight of the vehicle and transportation industry, and emergency response. According to the National Roadway Safety Strategy, "No one will reach this goal acting alone. Reaching zero will require USDOT to work with the entire roadway transportation community and the American people to lead a significant cultural shift that treats roadway deaths as unacceptable and preventable."

### **Public and Active Transportation Can Provide Opportunities to Address Our Nation's Health Crises**

Active transportation, such as walking, biking, and rolling, is an essential component of safe multimodal networks. The resulting increased physical activity can lower rates of chronic diseases. Similarly, people who use public transit, including young adults, older adults, and disabled

### **Disproportionate Impacts**

Recent statistics show that:

- Black, Indigenous, and people of color are 38 percent of the total U.S. population but account for 48 percent of all pedestrian fatalities.
- Of the top 30 pedestrian crash locations in the United States, 75 percent are bordered by low-income communities.
- Hispanics, Asians/Pacific Islands, and people who speak a language other than English at home are more likely to live within 150 meters of a major highway, suggesting increased exposure to traffic-related air pollution and elevated risk for adverse health outcomes.
- Children, older adults, and people living in low socioeconomic communities are among those who are at higher risk for health impacts associated with living near busy highways, rail yards, and marine ports.



Adequate infrastructure improves active transportation safety.



Source: FHWA.

populations and those who do not drive or have access to a car, can improve their physical activity and health and increase their social connectivity, while meeting their mobility needs across their lifespan. In addition, motor vehicle-related injuries and fatalities are expected to decrease with fewer drivers on the roads. Activity friendly routes that include multimodal options decrease crash risk for people walking and biking the first and last mile to transit or all the way to their destinations. Safe multimodal transportation options and land-use policies can also increase community-wide access to everyday destinations and services, such as healthcare, which can help reduce health inequities. Transportation agencies and communities can enable safe, equitable, active, and public transportation access for all users by providing sidewalks and crosswalks, bike lanes, multiuse paths, and trails that connect people to essential daily destinations, like schools and grocery stores. Communities can also invest in more efficient and accessible transit options, such as new bus routes, ensuring existing transit routes are providing the levels of high-quality service for which they were designed. They can also support active transportation by installing streetlights and increasing green space.

High-speed, high-traffic roadways and other transportation infrastructure can act as community barriers and discourage active transportation because people do not feel safe walking, biking, or rolling along them. Barriers to active transportation and public transportation can lead to reduced physical activity and can affect access to jobs, healthcare, education, governmental services, and fresh and nutritious food.

A recent study published by the *Preventive Medicine Reports* journal, entitled “Traffic as a barrier to walking safely in the United States: Perceived reasons and potential mitigation strategies,” found that nearly one in four U.S. adults reported traffic as a barrier to walking where they live and 80% of these people cited speed as their most important concern. Lack of access to active transportation

infrastructure or public transit, including transit availability during nonpeak hours, can disproportionately harm underserved, overburdened, and disadvantaged communities. Barriers arising from land use patterns, historic discriminatory lending practices known as “redlining,” and community designs (e.g., urban sprawl, dispersion of job locations, and rapid rise of the cost of housing) exacerbate transportation inequity. Also, a report from the Society for Public Health Education, entitled *Interviews with Black Scholars in Transportation, Public Health, and Land Use*, identified overpolicing and fear of harm or harassment by law enforcement as another barrier to people feeling safe when using active transportation.

Investments that promote active and public transportation benefit people’s health, their quality of life, the environment, and the economy. In a letter published in the CDC report, *Step It Up! A Partners Guide to Promote Walking and Walkable Communities*, U.S. Surgeon General Vice Admiral Vivek H. Murthy described physical activity as “one of the most important things Americans can do to improve their health, and walking is an easy way to get moving.” USDOT supports active transportation through various programs and associated funding opportunities through the Federal Highway Administration, Federal Transit Administration (FTA), NHTSA, and the Office of the Secretary of Transportation (OST) as does its Federal partner, the CDC, through, for example, its website, “Active People, Healthy Nation (<https://www.cdc.gov/physicalactivity/activepeoplehealthynation/index.html>).

FHWA, for instance, provides a range of resources through its Bicycle and Pedestrian Program. Furthermore, the FTA’s competitive Pilot Program for Transit-Oriented Development (TOD) Planning focuses on improved access and provides funding to local communities to integrate land use and transportation planning with a new fixed guideway or core capacity transit capital investment, which can enhance the linkages between where people live, work, and play (Note: The Pilot Program for TOD Planning was originally enacted

**Emiko Atherton**, former director of the National Complete Streets Coalition, Smart Growth America, grew up in one of the most ethnically diverse parts of Seattle, WA. Her neighborhood shaped who she would become. Her neighborhood did not have sidewalks or streetlights. Her bus line was considered one of the most dangerous routes in the city. It was harder for her family and neighbors to get around, and they needed to drive outside the community to get fresh food or access to good-paying jobs. What she did not know, until decades later, was how those conditions impacted her health and the health of her family and neighbors. She

did not know people living in her neighborhood had poorer health outcomes than people living in other parts of the city. She also did not know that this was not an isolated problem, but an issue in neighborhoods throughout the country, whether in a city, small town, or rural place. In the Foreword to *The State of Transportation and Health Equity* ([https://smartgrowthamerica.org/wp-content/uploads/2019/12/The-State-of-Transportation-and-Health-Equity\\_FINAL-PUBLIC.pdf](https://smartgrowthamerica.org/wp-content/uploads/2019/12/The-State-of-Transportation-and-Health-Equity_FINAL-PUBLIC.pdf)), published by Smart Growth America, Atherton observed, “People’s ability to live healthy lives to their full potential was determined by their address.”

in Section 20005(b) of the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141) and amended by Section 30009 of BIL). This form of development can improve housing affordability, recreation, and mixed-use development along transit corridors and near bus and rail stops. Since 2014, FTA has provided \$104 million in TOD planning funding for 129 projects.

### **Air, Noise, and Greenhouse Gas Pollution Reductions Through Transportation Choice**

Air and noise pollution negatively impact health. The transportation sector emits air pollutants—such as nitrogen oxides, volatile organic compounds, particulate matter, and various air toxics—that negatively impact environment and public health. Elevated ozone and particulate matter levels increase the amount and seriousness of lung and heart disease. Breathing ozone can also trigger a variety of health problems, particularly for children and older adults. People who live, work, or attend school near major roads have an increased incidence and severity of health problems associated with air pollution exposures. In addition, people living in urban areas are at higher risk of developing neurological, reproductive, developmental, or respiratory disorders, given their prolonged exposure to higher levels of air toxics. As a stressor, air pollution can cause illnesses such as heart disease and cancer that are among the leading causes of death in the United States. Similarly, traffic noise can interfere with people’s quality of life and is associated with negative health outcomes, including activity interference, sleep impacts, and cognitive effects.

An EPA report found that transportation sources accounted for about 28 percent of the national greenhouse gas emissions in 2021, and greenhouse gases are a leading contributor to climate change. Socially vulnerable populations—including low income, older adults, and communities of color individuals—are more likely to experience impacts from climate change and extreme weather than other groups since they:

- Are likely already living in risk-prone areas or exposed to poor environmental conditions (e.g., living in urban heat islands or within flood-prone areas).
- Are often excluded in planning processes.
- Typically have less access to climate change information and resources.

- Have limited financial resources to mitigate or rebound from climate-related disasters.

Air and noise pollution and climate change disproportionately impact the health outcomes of underserved, overburdened, and disadvantaged communities. These communities are overrepresented in areas with higher levels of air and noise pollution such as near ports, in dense urban areas, and within close proximity to highways and high-volume roadways. In

### **“Transportation has a profound impact on public health,”**

states Jeffrey Tumlin, director of transportation of the San Francisco Municipal Transportation Agency, in “Transportation for a New Urban Century,” on YouTube’s True Story Document Channel (<https://www.youtube.com/watch?v=O36ZvA5EZng>). “In fact, my physician friends routinely complain to me that I as a transportation professional have more impact on public health outcomes than they do as doctors. Their job is to clean up the problem once it’s already happened, but the transportation industry, we’re the ones responsible for delivering healthy places.”

Community engagement is critical for transportation planning.  
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many urban areas, these same communities are at greater risk for extreme heat and associated heat-related illness because, for example, they are less likely to have the resources to adapt to extreme heat (e.g., having or running air conditioning units), are more likely to have underlying chronic diseases that can be exacerbated by heat, are more likely to have jobs that require exposure to heat (e.g., construction and agricultural workers), and are less likely to be surrounded by green spaces.

Improving opportunities for safe, active, multimodal transportation can help reduce dependence on vehicles that produce air and noise pollution and greenhouse gas emissions. Including strategically placed trees, shade, and green space when building infrastructure may provide additional support to underserved communities and reduce skin cancer which is one concern for outdoor physical activity. USDOT and its partner agencies employ numerous programs to address air and noise pollution and reduce greenhouse gas emissions, including:

- Clean Air Act requirements for States' air quality planning efforts, including mobile source pollution reduction (42 U.S.C. 7401 et seq.).
- EPA-promulgated emissions standards for passenger and heavy-duty vehicles under the Clean Air Act (42 U.S.C. 7521(a)).

- Diesel Emission Reduction Act Program, which funds grants and rebates that protect human health and improve air quality by reducing harmful emission from diesel engines (42 U.S.C. 16132, 16133).
- Clean Air Act transportation conformity provisions to help integrate the air quality and transportation planning processes.
- Congestion Mitigation and Air Quality Improvement (CMAQ) Program to support transportation projects and programs that improve air quality and provide traffic congestion relief (23 U.S.C. 149).
- FHWA's Infrastructure Voluntary Evaluation Sustainability Tool (INVEST), which can be used by transportation agencies to assess and enhance the sustainability of their projects and programs.
- FHWA's National Electric Vehicle Infrastructure (NEVI) Formula Program to strategically deploy electric vehicle charging infrastructure and establish and interconnected network (BIL, Division J, Title VIII, Highway Infrastructure Program heading, paragraph (2)).

## All Hands: Partnerships to Support Health and Transportation Connections

Addressing health inequities in the transportation sector cannot be done by one agency or State alone. Transportation agencies may consider partnering and engaging with public health, housing, environmental, business, and community-based organizations—as well as the affected communities themselves—in promoting transportation connections that support the U.S. population's health. USDOT fosters partnerships among its Operating Administrations and with other Federal departments and agencies as well as encourages partnerships with Tribal, State, territorial, and local transportation agencies. As an example, FHWA developed a Framework for Better Integrating Health into Transportation Corridor Planning to provide action-oriented information that can assist transportation practitioner efforts to incorporate health into corridor planning processes.

Recognizing the need for multisectoral engagement to plan and implement safe and

Safe and accessible bike paths and community areas allow all road users, especially older adults, to enjoy the benefits of mobility and exercising outside.

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## HinT Working Group—A Decade of Progress

Recognizing public health as an integral part of transportation planning, program delivery, and decision making, FHWA created the agencywide Health in Transportation (HinT) working group (WG) in 2012. Since its inception, the HinT WG has worked to develop resources and expertise related to health and improve leadership and communication on the link between transportation and health. Because collaboration and partnerships are such an integral part of incorporating health considerations into transportation policies, programs, and investments, the HinT WG membership includes subject matter experts from OST and other USDOT operating administrations including FTA, NHTSA, and the Federal Aviation Administration. CDC and EPA have also joined the HinT WG, broadening the connections between health and transportation beyond USDOT.

In the past 11 years, the HinT WG has helped increase USDOT focus on, and awareness of, transportation initiatives on health outcomes and created resources to assist transportation practitioners in improving health through transportation. For example, the *Metropolitan*

*Area Transportation Planning for Healthy Communities* provides a framework for metropolitan planning organizations to successfully consider health throughout the transportation planning process. These and other related resources and case studies are available on the USDOT HinT website.

“The USDOT and FHWA encourage Federal, State, and local transportation agencies to prioritize the integration of health considerations throughout the transportation decisionmaking process. Through the HinT WG, the USDOT and FHWA have provided technical assistance, conducted research, facilitated conferences, and developed decision tools and frameworks that help State and local transportation agencies to put people first by incorporating health considerations into transportation planning, programming, and project delivery,” observes Emily Biondi, acting associate administrator of FHWA's Office of Planning, Environment, and Realty. “We hope that the HinT Working Group serves as a model to our partners, promoting multidisciplinary collaboration to achieve shared transportation and health goals.”

# Health in Transportation Corridor Planning Framework

Define Transportation Problems and Public Health Issues



Identify Transportation and Health Needs, Resources, and Priorities



Develop Goals and Objectives that Promote Health in the Community



Establish Evaluation Criteria that Include Public Health



Develop and Evaluate Alternatives and their Health Impacts



Identify Alternatives that Support Health in the Community



Source: FHWA.

equitable transportation programs, USDOT expanded its focus on public participation and community engagement. USDOT recently published *Promising Practices for Meaningful Public Involvement in Transportation Decision-Making* ([https://www.transportation.gov/sites/dot.gov/files/2022-10/Promising\\_Practices\\_for\\_Meaningful\\_Public\\_Involvement\\_in\\_Transportation\\_Decision\\_making.pdf](https://www.transportation.gov/sites/dot.gov/files/2022-10/Promising_Practices_for_Meaningful_Public_Involvement_in_Transportation_Decision_making.pdf)), which provides practices that can promote a shared understanding of meaningful public involvement. The guide is intended to support practitioners of all modes of transportation in various roles, including policy, planning, engineering, operations, civil rights, environmental justice, and public involvement. It also contains promising practices

that can help USDOT funding recipients meet the requirements of meaningful public involvement and participation under Federal statutes, such as Title VI of the Civil Rights Act of 1964 and the National Environmental Policy Act of 1969.

USDOT recently rolled out two community-focused programs that highlight transportation and health connections:

- The RCP provides Planning Grants and Capital Construction Grants, with the purpose of reconnecting communities by removing, retrofitting, or mitigating transportation facilities, like highways or rail lines, that create barriers to community connectivity, including to mobility, access, or economic development (BIL Section 11509).
- The TCP funds Capacity Builder teams to provide technical assistance, planning, and capacity building to disadvantaged communities. The program aims to ensure that disadvantaged communities adversely or disproportionately affected by environmental, climate, and human health policy outcomes have the technical tools and organizational capacity to comprehensively plan for and deliver quality infrastructure projects and community development projects that enable their communities and neighborhoods to thrive (Consolidated Appropriations Act, 2022 (Pub. L. 117-103, Division L, Title I)). The TCP Program is part of a larger Federal initiative in which USDOT, in coordination with other Federal agencies, such as the EPA, the Department of Housing and Urban Development, and the Department of Energy, created a Federal Interagency Thriving Communities Network (TCN) to guarantee that communities can access Federal resources, including those under the BIL and the IRA.

Results-driven collaboration with other Federal agencies produces more holistic programs that benefit communities and provide agencies an opportunity to leverage funding resources to broaden the impact of those programs within communities. USDOT has partnered with key Federal agencies focused on health, including CDC and EPA.

A constellation of recent events helped to accelerate collaborations between CDC and USDOT. These events include, but are not limited to, policies established under BIL directing cross-agency collaboration; the Coordinating Council on Access and Mobility (CCAM) 2023–2026 Strategic Plan, which includes metrics for multisector collaborations and equitable transportation; and memorandums of understanding (MOU) between USDOT and CDC. One such MOU was between the CDC National Center for Injury Prevention and NHTSA to prevent motor vehicle crash-related injuries and deaths, including among vulnerable road users (VRUs). Programmatic activities such as





This street includes multiple safety countermeasures to create safe and comfortable corridors and facilities for all road users, including a wide sidewalk with street furniture, separate bike lanes, wide crosswalk, and on-street parking.  
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## Opportunity to Make Bigger Strides Toward Healthy and Equitable Transportation: BIL and IRA

The historic 2021 BIL and 2022 IRA provide funding to foster safer, healthier, and more equitable transportation and to change the current car-dependent transportation network that has exacerbated the issues described in this article. BIL provides transformative transportation investments, including those for improving public safety and climate resilience, allowing for the creation of jobs, and delivering a more equitable future. IRA provides investments in a range of areas, including environmental programs, and aims to improve public health, reduce pollution, and revitalize marginalized, underserved, and overburdened communities. Programs under both statutes can help to reconnect communities divided by existing infrastructure, mitigate negative impacts of transportation facilities, support equitable transportation planning, and make our existing transportation system cleaner by providing healthier and more sustainable transportation options, including walking, biking, and using public transportation.

Health-related programs created or reauthorized by BIL or IRA include the following:

- **Highway Safety Improvement Program (HSIP)**—BIL provided this existing formula program approximately \$15.6 billion for FY 22–26. The purpose of HSIP is to achieve significant reductions in traffic fatalities and serious injuries on all public roads (23 U.S.C. 148(b)(2)) and funds highway safety improvement projects and specified safety projects to achieve this goal (23 U.S.C. 148(e)). Specified safety projects allow HSIP funds to be used on certain noninfrastructure safety projects (e.g., education and emergency response programs), and States can spend up to 10 percent of their HSIP apportionment each fiscal year on specified safety projects (23 U.S.C. 148(a)(11), 148(e)(3)). Every State can use HSIP funds for bicycle and pedestrian highway safety improvement projects, but, depending on their total annual VRU fatalities, certain States are required to obligate at least 15 percent of their HSIP funds on highway safety improvement projects to address the safety of VRUs (23 U.S.C. 148(g)(3)).

CDC participation in the FHWA National Complete Streets Assessment and the Vision Zero peer exchange have furthered information exchange between transportation and public health professionals. Together, these efforts can help improve data collection, strengthen evidence for policies to protect VRUs, synergize programs and research, and promote evidence-based interventions, particularly related to equity.

Similarly, for the Fiscal Year (FY) 2022 RCP Notice of Funding Opportunity, USDOT and Federal interagency partner staff, including staff from the EPA, conducted the grant evaluation process. EPA staff and subject matter experts served as advisors to USDOT's application review teams, advising USDOT on topics including environmental justice, strategies for equity, community engagement and stewardship, equitable development, and

revitalization strategies. USDOT and EPA carried out a similar effort with the TCP Program. These efforts are reflective of USDOT and EPA past collaborations to bring communities together and foster new opportunities for both agencies to more regularly work together to protect public health and the environment.

### **A Whole-Government Approach to Improve Transportation Access**

Led by FTA, the Federal interagency CCAM is an example of multisector collaboration among 11 Federal agencies to improve the efficiency and reliability of transportation networks across the country for low-income individuals, older adults, and people with disabilities. This type of partnership could be replicable at the State and territorial level.

- **Safe Streets and Roads for All (SS4A)** discretionary grant program—A new BIL program that provides more than \$1 billion in annual grants from FY 22–26 to fund regional, local, and Tribal initiatives to prevent roadway deaths and serious injuries through the creation and implementation of safety action plans (Section 24112). SS4A can support projects such as developing comprehensive safety action plans and conducting safety analyses to transform a high-injury network into a Complete Street with safety improvements to control speed, separate users, and improve visibility. A Complete Street is safe, and feels safe, for everyone using the street.
- **Carbon Reduction Program (CRP)**—A new BIL formula program that provides more than \$1.2 billion annually from FY 22–26 to reduce transportation emissions defined as carbon dioxide emissions from on-road highway sources (23 U.S.C. 175). Multimodal projects that help reduce dependence on single-occupancy vehicles are eligible for this funding such as public transportation projects and the construction, planning, and design of facilities for pedestrians, bicyclists, and other nonmotorized forms of transportation.
- **CMAQ Improvement Program**—BIL provided this existing formula program over \$2.5 billion annually from FY22-26. CMAQ provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act in areas with air quality problems (23 U.S.C. 149). Eligible projects include fostering increased use of public transportation and bicycle and pedestrian transportation, retrofitting or replacing diesel trucks fleets to reduce emissions, funding shared micromobility projects, expanding zero-emission vehicle fleets and infrastructure, and improving traffic flow. CMAQ Program funds can also be used for any transit capital expenditures otherwise eligible for FTA funding, as long as they have an air quality benefit.

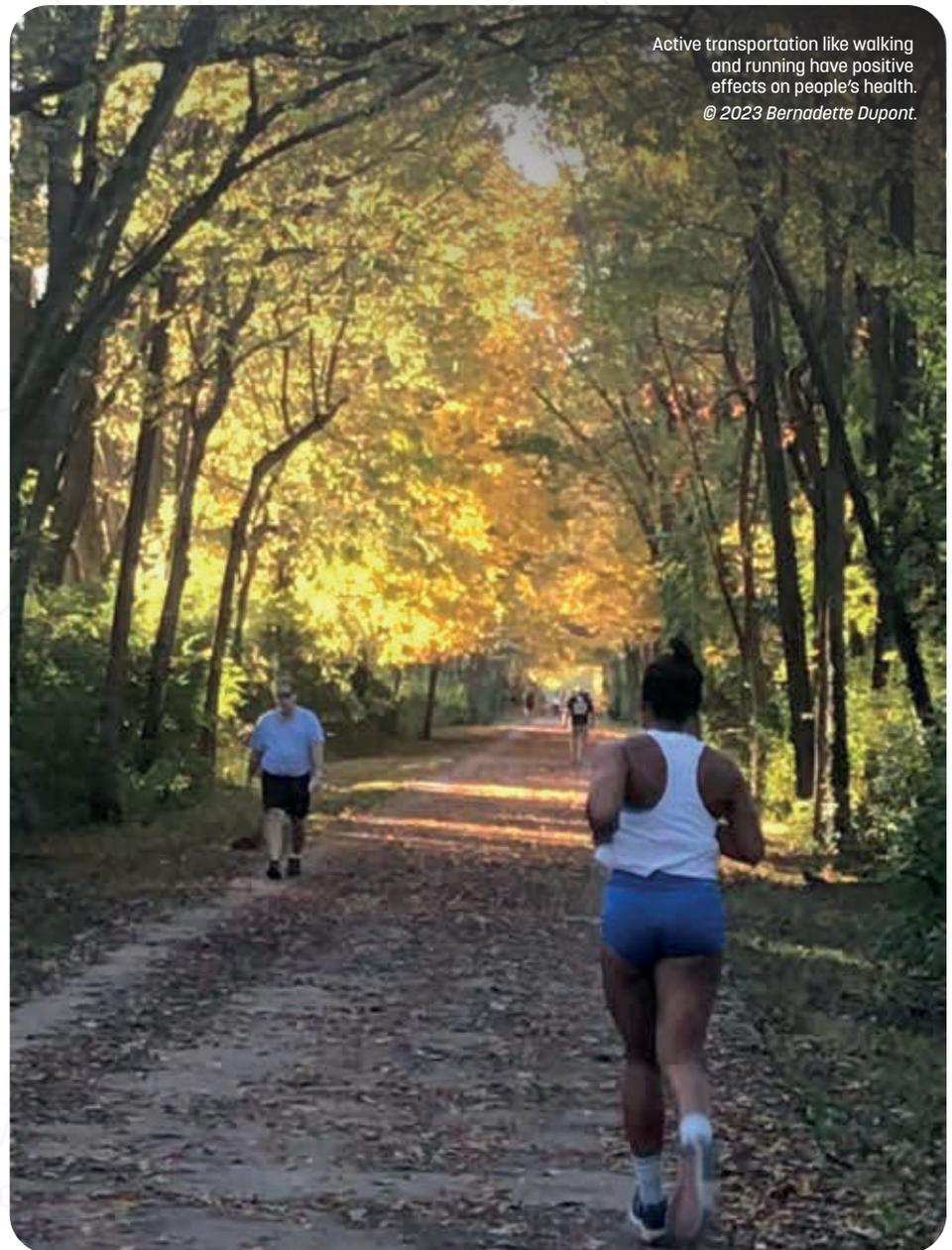
With these and other programs, BIL and IRA provide a once-in-a-generation opportunity for Federal agencies, Tribes, States, territories, local governments, and communities to use formula and discretionary funds

to support an active, multimodal, resilient, and accessible transportation system to improve health outcomes of individuals and communities. BIL and IRA allow State and local transportation agencies to further consider public health in its projects and planning.

Several States have transformed project scoring processes to ensure health considerations are embedded in their planning processes. For instance, in Kentucky, “Building a safer, more equitable transportation system that serves all community members is a priority here in the Commonwealth, and that includes creating more options for bicyclists and pedestrians,” says Mikael Pelfrey, Kentucky Transportation

Cabinet Division of Planning director. “The SHIFT [Strategic Highway Investment Formula for Tomorrow] scoring process takes all of these components into consideration to help us plan for the future and the generations of Kentuckians who will rely on our infrastructure for their daily needs.”

States may also develop new policies to ensure that all road projects include public-health-oriented corridor designs that are safe and accessible for users of all ages and abilities. New York enacted legislation to increase the State share of funding for municipalities incorporating such approaches as Complete Streets. The Washington State Department of Transportation issued a policy (Project Delivery Memo No. 22-03), requiring



Active transportation like walking and running have positive effects on people's health.  
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certain transportation projects greater than \$500,000 to be screened and to incorporate Complete Streets design features. The Louisiana Department of Transportation & Development changed the requirement of the CDC-funded Louisiana High Obesity Program by reducing local match funding and removing local responsibility for design, construction, engineering, and inspection to make it easier and more equitable for communities under 50,000 population to apply.

### USDOT and EPA Collaborate on Programs Established in New Infrastructure Legislation

The BIL, IRA, and American Rescue Plan Act of 2021 (Pub. L. 117-2) all have provided a wealth of new opportunities for USDOT and EPA to work together to support public health in transportation infrastructure investments. An example of this collaboration includes TCN. DOT and EPA are co-chairs of this Federal Government program. TCN is designed to

help Federal agencies coordinate strategy, collaborate across initiatives, and target deployment of a full range of Federal place-based technical assistance and capacity-building resources to urban, rural, and Tribal communities experiencing a history of economic distress and systemic disinvestment. This effort includes resources to help disadvantaged communities with grant and financial management, predevelopment assistance, community engagement, planning, and project delivery support. Each TCN partner agency is committed to coordinating and collaborating between their technical assistance programs, especially within regional or field offices that often serve as front doors and key points of contact to support communities. By working alongside and within communities, technical assistance programs can better support the locally identified needs and priorities.

### Conclusion

While government agencies have made progress in bringing together transportation and health in the planning, programming, development, and maintenance of infrastructure investments, agencies still have a long way to go to secure a healthy and equitable transportation system. “There is nothing sacred about the status quo,” said U.S. Secretary of Transportation Pete Buttigieg in his remarks on the launch of the RCP Program in Birmingham, AL. “These highways, roads, and railways are not rivers, lakes, or mountains. They are not divinely ordained. They are decisions. And we can make better decisions than what came before.” Better transportation decisions benefit from putting people first, making health a transportation priority, and strengthening partnerships to help leverage Federal programs and funding opportunities, including the historically transformative ones under BIL and IRA.

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Micromobility options such as bikes increase active transportation opportunities.

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(Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.)

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For more information, see [https://www.fhwa.dot.gov/planning/health\\_in\\_transportation/](https://www.fhwa.dot.gov/planning/health_in_transportation/) or contact Victoria Martinez, 787-771-2524, [victoria.martinez@dot.gov](mailto:victoria.martinez@dot.gov).

## To learn more:

- Active People, Healthy Nation (<https://www.cdc.gov/physicalactivity/activepeoplehealthynation/index.html>)
- American Rescue Plan (<https://www.whitehouse.gov/american-rescue-plan/>)
- Bicycle and Pedestrian Program ([https://www.fhwa.dot.gov/environment/bicycle\\_pedestrian/funding/funding\\_opportunities.cfm](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm))
- Bipartisan Infrastructure Law (<https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf>)
- Carbon Reduction Program ([https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp\\_fact\\_sheet.cfm](https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp_fact_sheet.cfm))
- CDC Health Equity (<https://www.cdc.gov/healthequity/whatis/index.html>)
- CDC Physical Activity (<https://www.cdc.gov/physicalactivity/about-physical-activity/what-cdc-is-doing.html>)
- Clean Air Act (<https://www.epa.gov/laws-regulations/summary-clean-air-act>)
- Complete Streets (<https://highways.dot.gov/complete-streets>)
- Congestion Mitigation and Air Quality Improvement Program ([https://www.fhwa.dot.gov/environment/air\\_quality/cmaq/](https://www.fhwa.dot.gov/environment/air_quality/cmaq/))
- Coordinating Council on Access and Mobility (<https://www.transit.dot.gov/coordinating-council-access-and-mobility>)
- Coordinating Council on Access and Mobility 2023–2026 Strategic Plan (<https://www.transit.dot.gov/regulations-and-programs/access/ccam/about/2023-2026-coordinating-council-access-and-mobility>)
- Diesel Emission Reduction Act (<https://www.epa.gov/dera>)
- Federal Interagency Thriving Communities Network (<https://www.transportation.gov/federal-interagency-thriving-communities-network>)
- Framework for Better Integrating Health into Transportation Corridor Planning ([https://www.fhwa.dot.gov/planning/health\\_in\\_transportation/planning\\_framework/](https://www.fhwa.dot.gov/planning/health_in_transportation/planning_framework/))
- Funding Opportunities for Ports and Near-Port Communities (<https://www.epa.gov/ports-initiative/funding-opportunities-ports-and-near-port-communities>)
- Health in Transportation ([https://www.fhwa.dot.gov/planning/health\\_in\\_transportation/](https://www.fhwa.dot.gov/planning/health_in_transportation/))
- Highway Safety Improvement Program (<https://highways.dot.gov/safety/hisp>)
- Inflation Reduction Act (<https://www.congress.gov/117/plaws/publ169/PLAW-117publ169.pdf>)
- Infrastructure Voluntary Evaluation Sustainability Tool (<https://www.sustainablehighways.org/>)
- National Complete Streets Assessment (<https://highways.dot.gov/research/projects/fhwa-national-complete-streets-assessment>)
- National Electric Vehicle Infrastructure Program (<https://www.fhwa.dot.gov/environment/nevi/>)
- National Environmental Policy Act of 1969 (<https://ceq.doe.gov/laws-regulations/regulations.html>)
- National Roadway Safety Strategy (<https://www.transportation.gov/NRSS>)
- Ports Initiative (<https://www.epa.gov/ports-initiative>)
- Reconnecting Communities Pilot Program (<https://www.transportation.gov/grants/reconnecting-communities>)
- Safe Streets and Roads for All ([https://www.fhwa.dot.gov/bipartisan-infrastructure-law/docs/ss4a\\_fact\\_sheet.pdf](https://www.fhwa.dot.gov/bipartisan-infrastructure-law/docs/ss4a_fact_sheet.pdf))
- Safe System Approach (<https://www.transportation.gov/NRSS/SafeSystem>)
- The U.S. National Blueprint For Transportation Decarbonization (<https://www.energy.gov/sites/default/files/2023-01/the-us-national-blueprint-for-transportation-decarbonization.pdf>)
- Thriving Communities Program (<https://www.transportation.gov/grants/thriving-communities>)
- Title VI of the Civil Rights Act of 1964 (<https://www.justice.gov/crt/fcs/TitleVI>)
- Transit-Oriented Development (<https://www.transit.dot.gov/TOD>)
- USDOT Technical Assistance (<https://www.transportation.gov/grants/dot-navigator/technical-assistance-resources>)
- Vision Zero Community (<https://highways.dot.gov/safety/zero-deaths/vision-zero>)

## ALONG THE ROAD

*Along the Road is the place to look for information about current and upcoming activities, developments, trends, and items of general interest to the highway community. This information comes from U.S. Department of Transportation sources unless otherwise indicated. Your suggestions and input are welcome. Let's meet along the road.*



A 6-foot deep pretensioned bridge girder arrives at the Turner-Fairbank Highway Research Center Structures Laboratory.

Source: FHWA

## Public Information and Information Exchange

### UHPC Pretensioned Bridge Girders Begins New Chapter for Structures Laboratory's Research

The Turner-Fairbank Highway Research Center Structures Laboratory is a state-of-the-art facility that specializes in developing and testing designs, materials, and construction processes for bridges across the Nation. One key aspect of the laboratory focuses on bridge durability and constructability over time, which supports one of the Federal Highway Administration's strategic goals of improving the safety, reliability, and cost effectiveness of bridge construction.

Modern advances surrounding the knowledge and mixture of concrete materials have led to the development of ultra-high performance concrete (UHPC). Research into the structural behavior of UHPC has begun a new chapter with the recent arrival of a 6-foot (1.829-meter) deep pretensioned bridge girder—or beam—that is used to provide structural support to smaller beams of a bridge. The girder's delivery to the laboratory will provide researchers opportunities to gain specific insight into the performance of narrow web, which increases buckling strength and helps eliminate the need for vertical stiffeners while being more economical and visually appealing, and other optimized elements being considered for future use in the construction of bridges.

For more information, visit <https://highways.dot.gov/research/laboratories/structures-laboratory/structures-laboratory-overview>.

### Reviewing New Ideas: The NCHRP Highway IDEA Program Committee

During the November 2022 National Cooperative Highway Research Program (NCHRP) Innovations Deserving Exploratory Analysis (IDEA) Highway Program's committee meeting, staff from the Federal Highway Administration's Research and Technology program volunteered their time and expertise to evaluate and score proposals describing innovative concepts that will significantly advance the Nation's highway systems. The committee—consisting of technical experts from industry, academia, and State and Federal transportation agencies—reviews proposals twice a year (in the summer and winter) and selects the most promising ones.

Though there are three separate IDEA programs—highway, rail safety, and transit—the intent for each one is the same: to capture the unexpected concept that challenges conventional thinking. Established in 1992, the NCHRP Highway IDEA program seeks advances in construction, safety, maintenance, and management of highway systems; pavement and bridge performance; and environment and resource conservation. The proposals selected are awarded start-up funding.

Since its inaugural year, the NCHRP Highway IDEA Program has received over 2,500 proposals, awarding 240 projects with more than \$35 million in funding for research. During 2022, the 57th cycle of the NCHRP Highway IDEA Program, 28 proposals were received. Proposals are due March 1 and September 1 and each NCHRP IDEA Program is open to all, including foreign nationals living and working outside of the United States.

For information on current and completed projects, committee members, proposal selection criteria, and the 2023 Highway IDEA Program announcement, visit <https://www.trb.org/IDEAProgram/IDEAHighway.aspx#>.

### FHWA Participates in Workplace Event for Kids

The Federal Highway Administration once again hosted Take Your Child to Work Day (TYCWD)—known formerly as Take Our Daughters and Sons to Work Day—at Turner-Fairbank Highway Research Center (TFHRC) on April 27, coinciding with the national annual TYCWD.

FHWA's TYCWD is designed to allow children to witness a segment of the American workforce and explore the scientific, technological, engineering, and mathematical (STEM) applications of their parents' work that could inspire them to consider a STEM-based and/or transportation-related career.

FHWA hosted several different activities throughout TYCWD. The last observance, held in April 2019, featured more than 40 workshops and exhibits, including “The Drone Experience” where children could learn to fly small consumer drones; mentoring sessions; hands-on experiments; and a crash test at TFHRC's Federal Outdoor Impact Laboratory—a demonstration that is usually a hit with the young visitors. This year's event was also filled with other fun, interesting, useful, and educational activities relating to science, engineering, and transportation.



A scientist in the Chemistry Laboratory teaches a staffer's daughter how to safely use a torch during the TFHRC Take Your Child to Work Day event.

Source: FHWA

## USDOT Selects Johns Hopkins to Lead Search for Climate-Focused Transportation Solutions

The U.S. Department of Transportation invests in the future of transportation through its University Transportation Centers (UTC) Program, which advances state-of-the-art research and technology in transportation. In March 2023, Johns Hopkins University announced its \$10 million award from USDOT to lead a consortium research project focused on preserving the environment through transportation solutions. UTCs have traditionally served as the Department's research arm since the late 1980s, informing transportation policy and practice at the local, State, and Federal level.

The Johns Hopkins University's Center for Climate-Smart Transportation will collaborate with a group of experts from other higher learning institutions including the Massachusetts Institute of Technology, Morgan State University, University of Texas at Austin, University of Utah, and Diné College, a public Tribal land-grant college serving the Navajo Nation. The consortium will explore viable methods to mitigate climate change in the transportation sector, with an emphasis on equity and environmental justice, as well as how alternative fuels can be used in transportation. Other focal points involve discovering ways to achieve net-zero emissions and ways to advance other net-zero emissions policies, such as reducing per-capita vehicle miles traveled.

For more information, visit <https://publichealth.jhu.edu/2023/johns-hopkins-selected-by-us-department-of-transportation-to-lead-new-10-million-center-for-climate-focused-transportation-solutions>.



## USDOT Intersection Safety Challenge Begins with \$6 Million Prize Competition

To help address growing concerns regarding the safety of vulnerable road users at intersections and as part of the National Roadway Safety Strategy (NRSS) call to action, the U.S. Department of Transportation launched the Intersection Safety Challenge on April 25, 2023. The Challenge aims to transform safety through the development of innovative intersection safety systems (ISS) that identify, predict, and mitigate unsafe conditions involving vehicles and vulnerable road users. It anticipates the use of emerging technologies, such as machine vision, machine

perception, sensor fusion, real-time decisionmaking, artificial intelligence, and vehicle-to-everything communications, to transform intersection safety and ensure equity among all road users.

The Challenge includes a multi-stage prize competition—Stage 1A: Concept Assessment and Stage 1B: System Assessment and Virtual Testing—to encourage teams of innovators and end-users to develop and test their ISS solutions to compete for up to \$6 million in prizes. If sufficiently compelling candidate solutions are identified, the USDOT may choose to fund follow-on projects through a procurement mechanism.

To participate in the first stage of the prize competition, submit an ISS Concept Paper (by 5:00 pm EDT on September 25, 2023) at <https://www.challenge.gov/?challenge=us-dot-intersection-safety-challenge>. Up to 10 prizes of up to \$100,000 each may be awarded for Stage 1A.

## 2023 LTIP Student Data Analysis Contest Accepting Entries through August 1

The Long-Term Infrastructure Performance (LTIP) team invites undergraduate and graduate students to submit technical papers that use the extensive data in InfoPave™ or InfoBridge™.

Authors of the first- and second- place papers in each category will be sent to the Transportation Research Board Annual Meeting and the papers will be published by the Federal Highway Administration.

To enter the contest, university students are to use data from either of the following Web portals: InfoPave for Long-Term Pavement Performance (LTPP) data, or InfoBridge for Long-Term Bridge Performance (LTBP) data. Students who enter the competition will gain the experience of using quality performance data, applying that data by using appropriate research methods to derive recommendations, and ultimately, using that data to make informed decisions.

Students are encouraged to develop their own ideas to investigate topics that may advance long-term pavement or bridge performance. Recent winning entries were: “Correlation of Bridge Deck Deterioration With Truck Load Spectra Based on Weigh-in-Motion Data” and “Key Climatic Factors Affecting Asphalt Pavement Roughness Differ in Different Climate Regions: Exploratory Analyses.”

The deadline to enter is August 1, 2023, enter today!

For more contest information, visit: [https://infobridge.fhwa.dot.gov/Content/Documents/LTIP\\_Student\\_Data\\_Analysis\\_Contest.pdf](https://infobridge.fhwa.dot.gov/Content/Documents/LTIP_Student_Data_Analysis_Contest.pdf)

For information on LTPP InfoPave: <https://infopave.fhwa.dot.gov/>

For information on LTBP InfoBridge: <https://infobridge.fhwa.dot.gov/>

## Internet Watch

### STEAP: Version 2.0 Enhancements

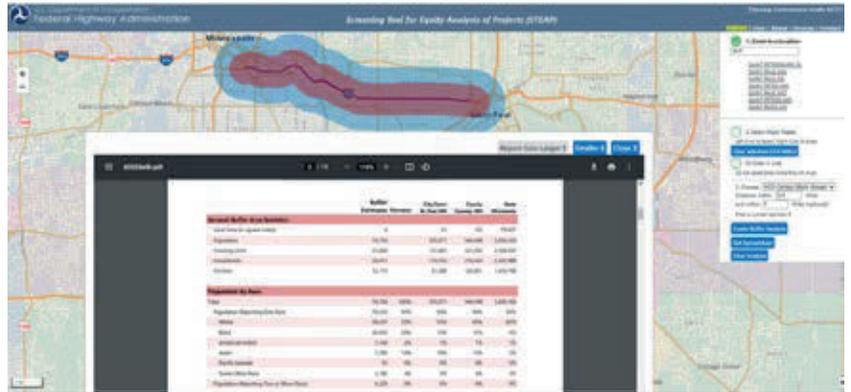
In January 2023, the Federal Highway Administration updated the Screening Tool for Equity Analysis of Projects (STEAP), which supports transportation project prescreening, assists in the effective use of Federal resources, assesses impacts on environmental justice (EJ) populations, and helps to develop meaningful public engagement plans. By using this interactive web tool, transportation planners, engineers, and civil rights officials can select existing highway segments, sketch-in or insert roadways, and assess EJ impacts by analyzing U.S. Census data for selected areas. The tool, an extension of FHWA's Office of Planning,

Environment, and Realty (HEP) geographic information systems (HEPGIS) web application, permits rapid screening of potential project locations anywhere in the United States 24 hours a day, 7 days a week.

STEAP was designed to have a simple interface. Enhancements in STEAP version 2.0 reflect this simplicity and help generate better buffer analysis reports by adding three new columns corresponding to city, county, and State statistics and a function to evaluate if a project disproportionately affects disadvantaged populations. Updates also include data from the 2020 Decennial Census, which helps to investigate Title VI of the Civil Rights

Act of 1964 complaints using more accurate data from smaller areas of geography and full population counts, and the 2015–2019 and 2016–2020 American Community Surveys as well as improved user interface. Users can now find project locations based on city/town name and download buffer analysis reports in a spreadsheet format.

For more information about STEAP, visit <https://hepgis.fhwa.dot.gov/fhwagis/buffertool/> or contact Supin Yoder ([supin.yoder@dot.gov](mailto:supin.yoder@dot.gov)).



A screenshot of a buffer analysis report for the Minneapolis, MN, area that is available through STEAP. Source: FHWA.

## Technical News

### Iowa DOT Uses VR to Connect Project Ideas with Public Involvement

Virtual public involvement (VPI)—digital means of enhancing engagement by making participation more convenient, affordable, and enjoyable—is gaining popularity among organizations like State agencies that seek to enhance current public involvement practices or require it based on statute, regulation, or executive order. Virtual reality (VR), a form of VPI, helps transportation professionals communicate their ideas and engage with the public in unique and creative ways.



A screenshot of the virtual reality demonstration used to inform and solicit public involvement for the Interstate 74 Mississippi River Bridge replacement project. © Iowa Department of Transportation.

The Iowa Department of Transportation, for example, collaborated with Iowa State University to develop a VR demonstration of the Interstate 74 (I-74) Mississippi River Bridge replacement project with the aim of attracting more citizens to observe, advise, and provide feedback on the project. Via the VR experience, users were able to view the placements of the old I-74 bridge crossing the river on two separate structures alongside the proposed twin arch bridge delivering four lanes in each direction. Additionally, users were able to:

- Drive and fly over the bridge.
- Walk along the bridge's pedestrian path.
- Observe the view from the bridge's scenic deck.
- Dive into and view educational information about the Mississippi River's environment.

In conjunction with public meetings and presentations, the VR demonstration was also available through a headset at multiple locations across the local communities and posted on social media to garner comments and suggestions from residents. The new I-74 bridge, fully opened in December 2021, was designated as the top bridge of 2022 by a leading trade publication. Demolition of the old bridge has begun and will continue through mid-2024.

For more information on this and other VR demonstrations, visit [https://www.fhwa.dot.gov/innovation/innovator/issue89/page\\_02.html](https://www.fhwa.dot.gov/innovation/innovator/issue89/page_02.html).

## Policy, Programs and Regulations

### What is HSIS?

The Highway Safety Information System (HSIS) is a multistate database developed by the Federal Highway Administration in support of its safety research program. HSIS contains quality data on crash, roadway, and traffic volume for a select group of States, including California, Illinois, Maine, Minnesota, North Carolina, Ohio, and Washington, as well as Charlotte, NC, an urban area.

HSIS is available to transportation professionals, analysts, researchers, and policymakers involved in making informed highway safety-related decisions. HSIS data are acquired annually from liaisons and prepared for analysis. Each HSIS liaison serves as an initial single point of contact at the participating State department of transportation (DOT), and generally is the manager of safety data at the State DOT. Though the information collected varies slightly from State to State, HSIS receives data on crashes, roadway inventory, traffic volume, intersections, interchanges/ramps, curves and grades, and guardrails/barriers. Two new



The Highway Safety Information System contains quality highway safety data on crash, roadway, and traffic volume.

Source: FHWA.

databases were recently added: Motorcycle Crash Causation and Roadway Lighting.

In addition to the databases, FHWA also manages other HSIS-related activities, including a virtual HSIS laboratory and an annual Excellence in Highway Safety Data Award student competition (which encourages university students to use HSIS data with the intent of introducing future highway safety professionals to good quality safety data).

For more information, visit: <http://www.hsisinfo.org/index.cfm> or see the HSIS Excellence in Highway Safety Data Award ad in this issue of *Public Roads*.



Source: NHI.



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## Three-Day, In-Person Training on Urban Drainage Design

by **STAN WORONICK** and **SABRINA SYLVESTER**

**U**rban drainage design facilitates safe passage for vehicles during a storm event to support a sustainable, resilient, and reliable transportation network. Although it can be challenging, urban drainage design strives to maintain compatibility and minimize interference with existing drainage patterns; control roadway surface drainage; and minimize potential environmental impacts from highway-related stormwater runoff.

In a highway environment, urban drainage design includes the collection of stormwater runoff from the roadway surface, conveying it along the right-of-way, and then discharging it into an adequate receiving water body without causing adverse onsite or offsite impacts. The rapid collection and removal of stormwater from pavement surfaces ensure the safety of the traveling public by minimizing the conditions that can cause hydroplaning. Stormwater conveyance systems (e.g., storm drain piping, ditches, channels, pumps) provide an efficient mechanism for conveying flows from inlet locations to the discharge point without surcharging inlets or otherwise causing surface flooding.

To support the design of safe and reliable transportation networks, the Federal Highway Administration's (FHWA's) National Highway Institute (NHI) has updated its training to provide a detailed introduction to urban roadway drainage design that will enable participants to solve basic water-related problems.

### Achieving Urban Drainage Design Success with NHI

NHI now offers the *Urban Drainage Design* (3-Day) (FHWA-NHI-135027) course as an Instructor-led Training (ILT) or as a virtual option (FHWA-NHI-135027V). Referencing and building on the procedures and methodologies in the FHWA publication, *Hydraulic Engineering Circular No. 22 (HEC-22), Third Edition: Urban Drainage Design Manual*, this ILT helps individuals with roadway and drainage design responsibilities.

This training includes an overview of urban drainage design along with the fundamental hydrology and hydraulics principles most used. The ILT emphasizes the primary importance of ensuring safety among the traveling public and reviews pavement drainage and hydroplaning. This training also provides

introductions to the concepts of and methods for analyzing and designing gutters and a variety of inlet types, including grate, curb-opening, and specialty inlets. Overall drainage system design is also addressed, including inlet spacing, storm drain layout and pipe sizing, and computing hydraulic and energy grade lines. The course concludes by describing the interactions between roadway geometric and drainage design.

To create a dynamic and engaging environment, the training instructor encourages and facilitates the sharing of knowledge about and personal experiences with drainage design practices among participants. "This course allows for the exchange of information and best practices between designers and practitioners that deal with roadway drainage design. Participants will learn a lot from the instructors but also from each other," says FHWA hydraulics engineer Ryan Lizewski.

### Recommended Courses

If you are a beginner in hydraulics or want to refresh your skills, NHI also offers the following courses in highway hydraulic training:

- *Introduction to Highway Hydraulics* (FHWA-NHI-135065).
- *Practical Highway Hydrology* (FHWA-NHI-135067).

### How to Attend or Host a Course

NHI invites all transportation professionals interested in a course to visit <https://www.nhi.fhwa.dot.gov/> to learn more information on how to register or host a course. The course catalog lists over 350 courses in 18 program areas.

NHI is an approved Accredited Provider by the International Accreditors for Continuing Education and Training (IACET). As an IACET Accredited Provider, NHI offers continuing education units for its programs that qualify under the American National Standards Institute/IACET Standard.

**STAN WORONICK** is a training program manager for NHI.

**SABRINA SYLVESTER** is a senior marketing contractor for NHI.



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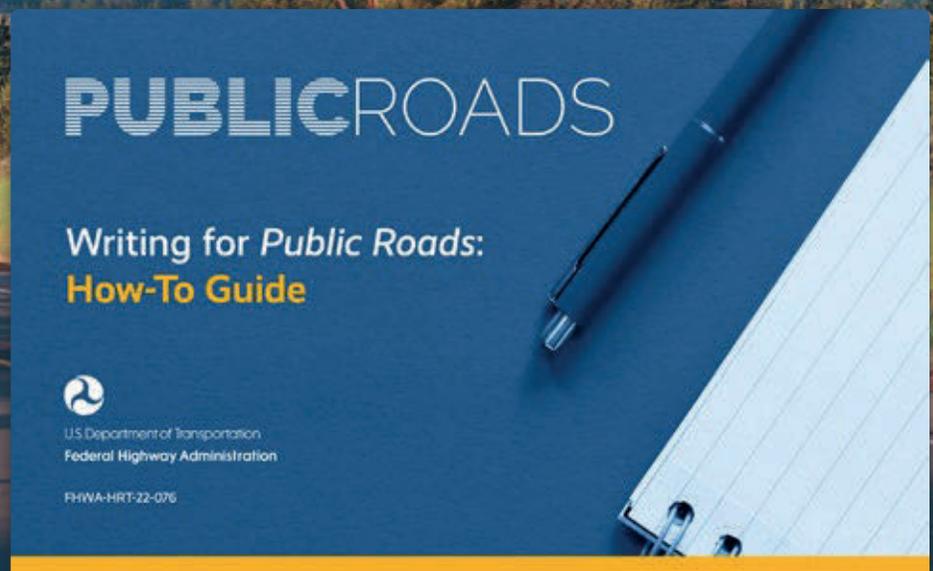
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