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Winter 2025

U.S. Department of Transportation
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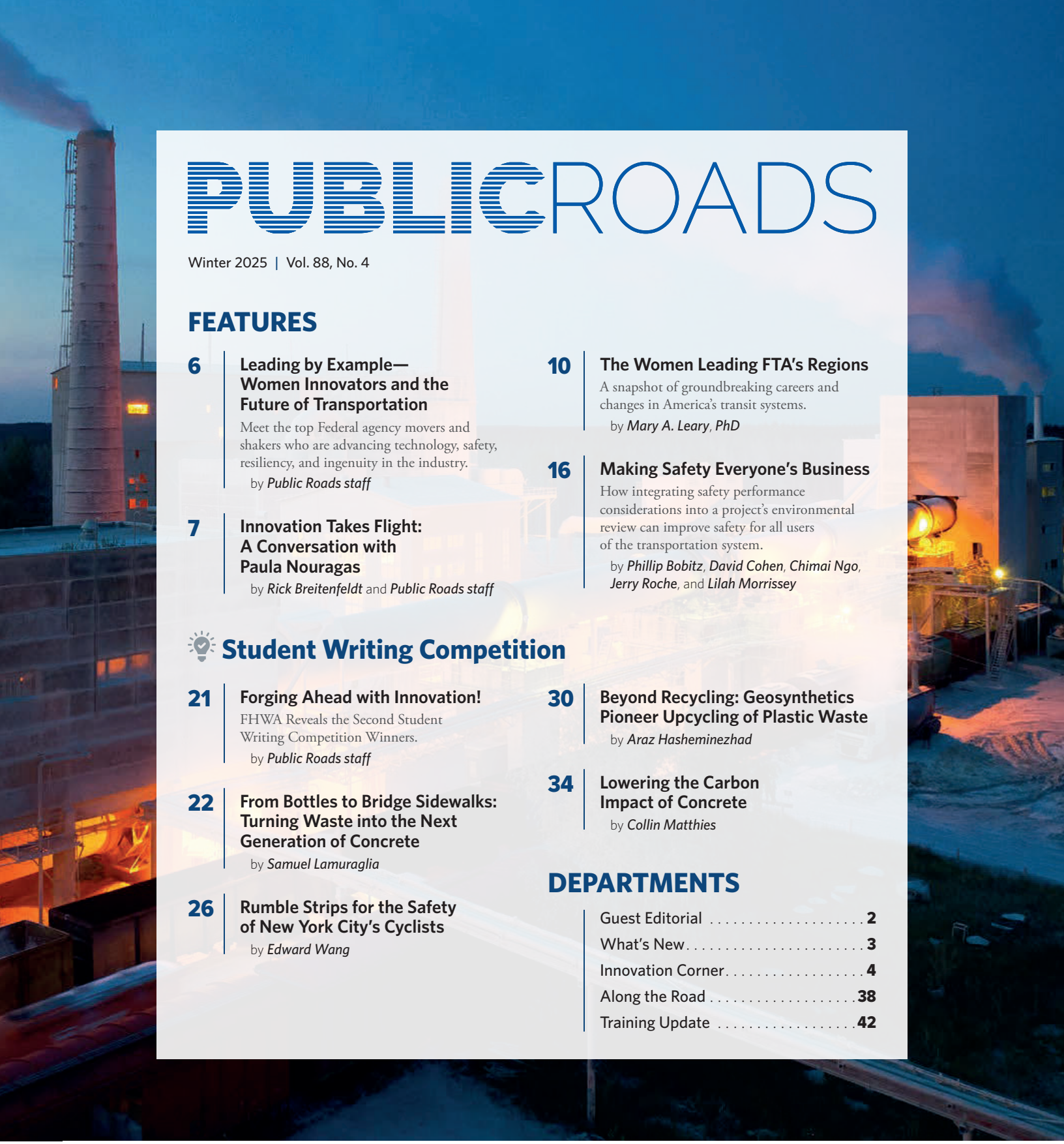

PUBLIC ROADS

Winter 2025 | Vol. 88, No. 4

FEATURES

Student Writing Competition

DEPARTMENTS

ABOVE: Concrete-making is a round-the-clock type of operation to keep supplies high.

COVERS: The second Public Roads Student Writing Competition was another great success. Look inside this issue to read the top four winning articles from around the country.

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The electronic version of *Public Roads* can be accessed through the Turner-Fairbank Highway Research Center home page (https://highways.dot.gov/research).

Advancing FHWA Projects Through Environmental Reviews

In 2021, Congress passed the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (BIL), which reauthorized surface transportation programs. This legislation allocated approximately $350 billion over a 5-year period to Federal highway programs with a focus on repairing roadways and bridges, with the opportunity to create jobs, boost the economy, and enhance transportation safety and resilience of the Nation's transportation infrastructure. In addition to these funded programs, BIL provides funding through competitive discretionary grants. To date, thousands of projects have been awarded in communities across all 50 States, Washington, D.C., and U.S. territories.

The Federal Highway Administration is required by the National Environmental Policy Act (NEPA) to evaluate the environmental impacts of transportation projects proposing to use Federal funding. FHWA is focusing on several key additional BIL authorities to improve the environmental review and permitting process for transportation infrastructure projects. For major projects, FHWA can use a provision that enables the One Federal Decision (OFD) process. This process establishes environmental review schedules with a 2-year agency-wide average for NEPA decisionmaking, followed by the necessary permits and authorizations within 90 days. With the OFD approach, FHWA can complete NEPA requirements with a single, joint environmental impact statement or environmental assessment developed in collaboration with Federal resource agencies. This collaborative effort synchronizes the NEPA and permitting processes, ensuring a thorough evaluation of environmental considerations while reducing the time needed to move projects from conception to ground-breaking—from planning to implementation.

Efficiencies in environmental reviews are not just limited to major projects. FHWA has established a list of categorical exclusions (CEs) in its NEPA procedures (23 CFR 771) for actions that normally do not have a significant impact on the human environment. As a result, these actions do not require the preparation of an environmental assessment or environmental impact statement if no extraordinary circumstances exist. CEs account for more than 95 percent of FHWA-authorized projects per year, with completion times varying from one to a few months, depending on the type of project. In addition, the Fiscal Responsibility Act of 2023 enables a Federal agency to "adopt" or use another agency's CEs, which allows FHWA to adopt the U.S. Department of Energy's CEs for electric vehicle charging stations in its regulations.

FHWA also implements best practices to improve project delivery regardless of the project's size. This includes partnering with Federal resource agencies at the national and local levels to reduce duplication and expedite project delivery. FHWA established programmatic agreements with several resource agencies, like the U.S. Fish and Wildlife Service, to significantly reduce the time required to obtain necessary permits and authorizations. These agreements create a streamlined process for meeting routine environmental requirements for common project types.

State departments of transportation and public entities receiving FHWA funding can leverage the increased infrastructure funding provided in BIL by using existing authorities to establish transportation liaison agreements with resource agencies. These agreements use FHWA funds to accelerate and streamline Federal-aid project reviews and approvals within their State.

FHWA is committed to successfully facilitating transportation projects through BIL implementation programs by providing useful tools and new resources, informational fact sheets, and targeted technical assistance to guide entities receiving funding. We continue to assess the entities' needs and explore other opportunities where FHWA can help with project delivery. I have highlighted only a handful of resources in the FHWA toolbox, but I encourage you to access more information about advancing FHWA projects through environmental reviews via the FHWA websites below:

- FHWA - Homepage: https://highways.dot.gov/.
- BIL: https://www.fhwa.dot.gov/bipartisan-infrastructure-law/.
- Environmental Review Toolkit: https://www.environment.fhwa.dot.gov.

Damaris Santiago
Director
Office of Project Development and Environmental Review
Federal Highway Administration

TOP: © PixelPlace / AdobeStock.com.

TOP RIGHT: Source: FHWA.

Distributed Testing 101: Expanding New Methods of Virtual Quality Assurance

by **STEVE NELSON**

The increasing adoption of distributed testing (DT) systems—where multiple interconnected systems can execute tests interactively in real time—presents a powerful opportunity for intermodal collaboration. U.S. Department of Transportation's Highly Automated Systems Safety Center of Excellence (HASS COE) recently launched a series of webinars and workshops dedicated to increasing knowledge about DT across USDOT. But what are DT systems and how can USDOT "plug in" together?

Overview of DT

A HASS COE-hosted DT 101 workshop in May 2024 defined DT as the practice of systematically connecting and testing live or simulated geographically dispersed actors simultaneously. Distributing the testing process across multiple virtual and physical locations or nodes can leverage the strength of each of these dissimilar systems in combination to improve test performance, coverage, and possibly scale. By connecting disparate testing resources, DT allows for more efficient and nimble test execution, supports a wide range of software and hardware platforms and configurations, and enhances the ability to identify and address issues in complex, large-scale systems. All these advantages support USDOT's efforts to increase safety in the Nation's transportation systems through more comprehensive verification and accelerate safety-related technology advancements.

Impact of DT on Current Testing Protocol

The transition to DT is not a whole-scale redesign of USDOT verification processes; rather, DT complements, builds upon, and expands the utility of systems widely in place across USDOT today.

"Fundamentally, DT does not replace traditional full-system verification," says Dr. Joshua Every, senior scientist at HASS COE. "But it does enable us to get information on system of systems interactions earlier in the process. We get testing data before deployment, so we can gain experience before the final event. Rather than spending months at a test site, DT allows for faster, more nimble data collection, and prioritization of our time in the field."

Current Status of DT at USDOT

USDOT has the technology building blocks in place to implement DT—for example, existing hardware-in-the-loop systems, full-scale vehicle testing capabilities, infrastructure systems, and human-in-loop simulators—that are all valuable tools in isolation. The initial challenge for wider adoption of DT is to standardize the way teams communicate about DT and to align on key terminology across USDOT.

"Our goal is to establish organizational alignment," says Dr. Every. "We want to standardize organizational norms and build consensus on key terms up front."

Case Study of USDOT DT

The Federal Highway Administration recently deployed DT processes in its Pilot-2 project. FHWA worked with seven external research partners, each with their unique test systems and organizational knowledge.

"The logistics of coordinating and connecting so many research partners in realtime was a challenge," says Danielle Chou, a program manager for enabling technologies at FHWA's Office of Safety and Operations Research and Development (R&D). "But the potential return was invaluable: the collective research team demonstrated how DT enabled us to connect a trove of testing resources that we otherwise would not have been able to access or fully fund ourselves, including a physical chassis dynamometer test stand at Argonne National Lab, a physical test track at the University of Michigan, and five independent simulated vehicle models. This kind of testing enables us to collectively maximize our use of existing R&D investments across government, industry, and academia."

Next Steps for DT at USDOT

With DT pilot programs already in place at USDOT, organizational-level direction will continue to empower the teams within USDOT adopting new technology and will likely lead to the discovery of programs and systems in place today that could benefit from DT methodologies. HASS COE's DT workshops and webinars were held from July to October 2024 and will continue into 2025.

STEVE NELSON is a communications director at a consulting group and is currently working with USDOT HASS COE. He is responsible for writing and editing original content for the HASS COE communication channels. He received his M.F.A. in fiction from Columbia University and his B.S. in psychology from Vanderbilt University.

For more information, contact Denise Bakar, HASS COE communications manager at *denise.bakar@dot.gov* or go to *https://www.transportation.gov/hasscoe*.

ABOVE: USDOT is expanding research into new methods of virtual automated testing.
© Fokke Baarssen / AdobeStock.com.

Digital Innovations for Constructing Tomorrow's Infrastructure

by **CAROLYN SCHMID**

The Federal Highway Administration's Every Day Counts initiatives and digital as-builts (DABs) have catalyzed transformation in the construction industry. These technologies have revolutionized construction project management by replacing traditional paper-based plans with electronic records. DABs serve as a comprehensive virtual record of the constructed condition, which is searchable, extractable, and durable throughout an asset's life cycle. This feature streamlines the construction close-out process, reduces delays in project completion, and enhances the efficiency of compiling and organizing as-built records.

The implementation of these technologies has brought substantial benefits to the construction industry, enabling project managers to streamline the construction process, reduce delays, and enhance efficiency. Furthermore, DABs have replaced traditional paper-based plans with electronic records, resulting in greater convenience and improved accuracy. These advancements have facilitated the transition from outdated modes of construction management to more modern and efficient practices.

Ensuring Longevity with Precise Asset Management

DABs provide a precise and well-organized record of a construction project, which proves beneficial to those who are responsible for managing, operating, and maintaining assets after construction is complete. The format and content of DABs vary (e.g. drawings and plans, photographs, and visual documents), depending on the agency's specific requirements and asset classes.

By providing a reliable source of information, DABs serve as an excellent reference point for those tasked with the upkeep of assets, providing a comprehensive and highly detailed overview of the construction project. DABs are meticulously organized and structured, making it easy for stakeholders to identify specific aspects of the project that require attention. It is imperative to note that the effectiveness of DABs is dependent on their accuracy and completeness. As such, it is essential that they are prepared with the utmost care and attention to detail. This careful attention to detail ensures that they provide a reliable record of the construction project, which can be of immense value in subsequent phases of the asset life cycle.

DABs have become an integral part of the construction process, providing a valuable resource for those tasked with the upkeep of assets. They are an essential tool for ensuring that assets are maintained effectively and efficiently, remaining in optimal condition throughout their life cycle.

Harnessing the Potential of DABs for Sustainable Infrastructure

"In today's construction industry, digital as-builts have become more than just a technological trend; they are now a necessity. Digital as-builts are essentially virtual replicas of physical assets, which provide a single source of current and reliable information," said former Senior Engineer David Unkefer, P.E., from the FHWA Resource Center's Construction and Project Management Team who attended the Fast Forward Your Digital Roadmap event in March 2024.

DABs provide a virtual representation of physical assets, capturing data throughout the construction process and beyond. By integrating as-built information into project information models, construction projects can streamline the process of capturing and updating records, eliminating the need for manual documentation and reducing error. This integration not only improves the efficiency of managing as-built records but also ensures that asset information remains current and easily accessible throughout the asset's life cycle. Overall, leveraging DABs for storing as-built information is a powerful strategy for enhancing project efficiency and maintaining accurate asset data.

For more information and training materials on DABs, visit *https://www.fhwa.dot.gov/construction/dabs/overview.cfm*.

ABOVE LEFT: An engineer works at home designing architecture plans by digitizing blueprints with innovative technology.

ABOVE RIGHT: An engineer works on a digitized blueprint from a construction site.

Photos: © Jasmina / Adobe Stock.

CAROLYN SCHMID is a senior communications specialist contractor supporting FHWA's Office of Innovation and Workforce Solutions.

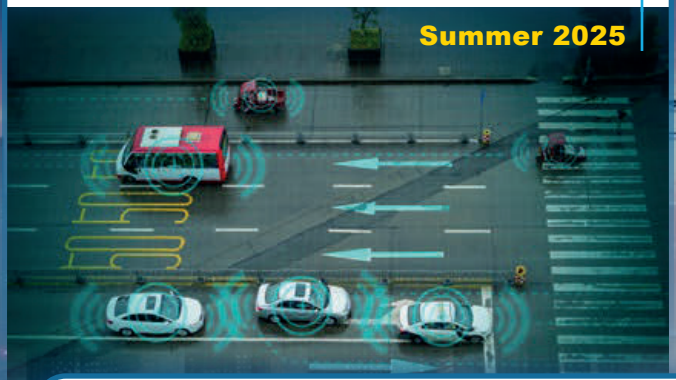
How Will Artificial Intelligence Impact the U.S. Transportation Network?

The U.S. Department of Transportation's Highly Automated Systems Safety Center of Excellence (HASS COE) and PUBLIC ROADS will partner on four original articles about the future of highly automated technologies in the U.S. transportation network. Drawing on expert input from government, industry, and academia, HASS COE will explore four key topics in the automation landscape and outline the safety implications of these emerging technologies.

TRAFFIC SAFETY

Evaluating policy research on highly automated systems.

Summer 2025



TECHNOLOGIES FOR CITIES

Examining distributed testing in surface automation.

Autumn 2025

ARTIFICIAL INTELLIGENCE ASSURANCE

Assessing an interagency case study for Federal highway systems.

Winter 2026

COOPERATIVE DRIVING AUTOMATION

Appraising enabled communication and cooperation between automated vehicles.

Spring 2026

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HASS
Highly Automated Systems Safety Center of Excellence

Leading by Example—

Women Innovators and the Future of Transportation

Meet the top Federal agency movers and shakers who are advancing technology, safety, resiliency, and ingenuity in the industry.

by **Public Roads Staff**

From the Federal Highway Administration to the Federal Aviation Administration (FAA) and Federal Transit Administration (FTA), women in transportation and transportation research make history every day with their innovative insights, skillful leadership, and passionate drive to make true transformative change.

Women in transportation forge partnerships nationally and around the world to further collaborations and expand shared ideas, while focusing on the success of their teams and advancing programs that produce meaningful benefits to the public. These strong, forwarded-minded pioneers are also serving as role models to young women entering the world of transportation in a variety of fields.

However, according to the most recent statistics from the Mineta Transportation Institute, women account for approximately 15 percent of the Nation's 14.8 million transportation overall workforce. In 2020, the U.S. Department Bureau of Labor and Statistics show that women make up just over 24 percent of jobs in the "Transportation and Utilities" category, which includes women in the field in trucking, rail, and air transportation. In the transit industry, that number jumps to 35 percent. The U.S. Census Bureau also reports that women still lag behind men in STEM industries (science, technology, engineering, and mathematics). The latest Census numbers from 2019 indicate that 27 percent of women are in STEM fields, up from a meager 8 percent in 1970.

While the gains were not seen in areas such as computers and engineering, female leaders at FHWA, FTA, and FAA are aiming to change that.

FHWA Leader's Parting Words

Women play an integral role in advancing research, technology, and engineering at FHWA and FHWA's Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA. They are highly respected leaders in the field, including Executive Director Gloria Shepherd and Dr. Kelly Regal, the former Associate Administrator for Research, Development, and Technology at TFHRC. In 2023, Shepherd became the first woman, first African American, and the 11th individual to hold the position. Similarly, in 2020, Dr. Regal became the first woman in the agency's 58-year history to lead TFHRC.

During her time at TFHRC, Dr. Regal took her position as a leader and role model very seriously, and she hopes that young women interested in transportation find their passion, as she did, and seize every opportunity available.

"I have been a longtime advocate for young women to not only venture into this industry but to thrive in it, too," Dr. Regal notes. "While men may still dominate this field in terms of numbers, the women in our industry—and especially at Turner-Fairbank—are changing the face of transportation research. Where they lack in numbers, they excel at talent and acumen. Their contributions to advancing innovations and programs focusing on FHWA's core values lead to safer roads, stronger infrastructure, and a better Nation. Their dedication is unparalleled and valued here in the States and around the world."

Though Dr. Regal retired in October 2024, her stewardship and insight will continue to foster growth and innovation as highway research and development continues to advance. As for the future, Dr. Regal sees the strengthening of partnerships, nationwide and around the world, as a critical step in the secureness and resiliency of our transportation network.

"I have worked at FHWA, FAA, and FMCSA [Federal Motor Carrier Safety Administration], and I have seen firsthand the power of collaboration and partnerships," Regal says. "When great minds come together to tackle a challenge or set goals, nothing seems impossible. Sharing knowledge will always benefit the transportation network and the traveling public. They deserve our best, and those partnerships ensure they get just that."

"And while I will no longer be part of the day-to-day activities at FHWA, I will always be a vocal proponent of their efforts in ensuring that the Nation's roadways are safe, sustainable, and resilient, and in securing lasting partnerships that will create new avenues of opportunity for years to come," she continued.

As Dr. Regal notes, collaborations are powerful tools in realizing FHWA's mission of advancing a strong and safe transportation system. Read on for more insight into resiliency, leadership, and the reach transportation has, from notable women at FAA and FTA.

Innovation Takes Flight: A Conversation with Paula Nouragas

by **Rick Breitenfeldt** and **Public Roads Staff**

Women continue to lead transportation research at Federal agencies around the Nation and that includes senior leadership at the Federal Aviation Administration (FAA).

Paula Nouragas is the chief scientist and technical advisor for the FAA William J. Hughes Technical Center for Advanced Aerospace, the Nation's premier Federal aviation laboratory for advancing the U.S. National Airspace System and sustaining its continued safe and efficient operations. She manages the center's Science and Technology Integration Office, which advises, guides, and integrates applied research, development, test, and evaluation activities.

Initially, she dreamed of becoming a veterinarian, but the field of computer science was growing and her passion for science and math was undeniable. Somehow, the stars began to align; a conversation with her brother-in-law over 39 years ago led to the first step in her career path. Given Nouragas' pursuit of a bachelor's degree in information systems and sciences, he informed her about an open house at the FAA Technical Center. She decided to attend, was interviewed, and was hired as an intern assigned to the aircraft hangar working in the communication, navigation, and surveillance area. The internship also involved flight testing.

> *"Pursue your career. Pursue your passion. It's your journey. Make the most of it. This is for you."*

Back then, everything was done by hand as artificial intelligence (AI), chatbots, and other similar tools weren't around to build, for instance, an algorithm; the staff created and used flowcharts. At any rate, Nouragas' managers allowed her to work on multiple projects and develop software, which fed her curiosity and appetite for learning and led her to be creative.

As a result of such curiosity, throughout her nearly 40 years of Federal service, Nouragas has managed, led, and conducted aviation research, development, and test and evaluation activities in surveillance, navigation, avionics, weather, emerging operations, and air traffic management. Because of her appetite for learning, she continued her education, earning a master's degree in aeronautical science with a human factors specialization. As a result of her creativity—her love of sharing ideas and insights with peers to create solutions—she became a member of several professional organizations, including the Air Traffic Control Association, International Test and Evaluation Association, and South Jersey Human Factors Society.

Nouragas wholeheartedly believes in partnerships and collaborations—whether organizational-wide, interagency, international, or interpersonal. For her and her staff, it's in their DNA to work together, as many of them grew up together, went to school together, worked in the community together, and shared in watching their children play sports together.

Rick Breitenfeldt, an FAA public affairs specialist, recently interviewed Nouragas; what follows are excerpts from their discussion.

What is the biggest difference in transportation you have seen from the time you began your career until now?

The evolution of technology and its application in transportation is the biggest change I've seen since I started my FAA career as a computer science intern in 1985; then, reliance on the hardware

Nouragas is the chief scientist and technical advisor for the FAA Technical Center and manages the center's Science and Technology Integration Office.
Source: FAA.

platform for computing power was key. That continuum has changed over time, including the pace at which technology is deployed. I think the complexity of the transportation system has grown over time, especially with interconnected systems of systems architecture, the wealth and abundance of data exchanged digitally, and the sharing of information across the transportation ecosystem. With all that comes a stronger emphasis on securing the enterprise, what we call cybersecurity resiliency.

Today, we have a whole new paradigm of software engineering and development—between agile development practices and dev-sec ops (development, security, and operations) roles—as well as more automated tools and computing capabilities that allow us to scale accordingly. In addition to that, we are able to support rapid development and deployment of new capabilities. We also have some great algorithms with AI. It goes on and on in terms of where we're at today and in terms of computer science. It's our job to keep pace with emerging technology and to see how best we can safely adopt it and apply it within our transportation system.

What technology do you think holds the greatest impact and promise for the future of transportation?

I don't think it's one technology that holds the greatest impact and promise. It's more a portfolio of emerging technologies in a "fit-for-purpose" construct that will be necessary for the modernization and transformation of transportation. For example, it's the application of data science; AI and machine learning (ML) and the adherence to an assurance framework; secure digital communications, cloud computing, Internet of Things and sensor fusion; immersive technology [i.e., virtual reality, extended reality, and mixed reality]; and more. These are the "building blocks" that, when combined properly, will provide the greatest impact on transportation.

What I am encouraged about is the sharing of technology solutions and applications across transportation modes. I look at the prospects and opportunities of a portfolio of emerging technologies and how they can work, interact, and integrate together. I always use the term, "fit-for-purpose." That's important in terms of the mindset of how you look at the emerging technology and the various use cases: Make sure it fits the purpose or the intended function. There's a lot of technology around, but there's also a disciplined approach to really understand it and use it effectively in our environment.

For example, our research portfolio shows that we're doing a lot with cybersecurity data science and AI/ML. In a lab environment, we use immersive technology to set up an enabling environment for research and testing; our technical staff have shown other viable use cases of immersive technology for a wide range of functions. When you look at the multi-missions that are performed across the FAA Tech Center, you can see how developments in one mission and domain can be directly analogous to other domains and by just bringing the building blocks together in a different fashion you can achieve results.

Additionally, we're starting to look at secure command and control communication and how devices communicate with each other. Along with secure digital communications, technological devices are going to help better connect aircraft and pilots and support the evolution of levels of automation toward autonomous flight operations.

Are there any particular partnerships that have proven highly impactful and have led to great change at FAA?

They all bring a unique perspective, a level of expertise and experience. I can't pick just one. The academic community brings a wealth of knowledge and cutting-edge, boundary-pushing research. Along with industry, these partnerships positively impact and shape the future of aviation.

The coming together of different perspectives and expertise to solve problems is the power and strength and the reason behind having partnerships. It's about working together to solve problems, share our experience, and share our expertise. FAA, and especially the Tech Center, has good, working relationships with our partners at NASA (the National Aeronautics and Space Administration), the Department of Defense (DOD), Department of Homeland Security, and others.

ABOVE LEFT: Nouragas welcomes participants to the FAA's 2023 Aviation Cyber Rodeo, held at the Technical Center in conjunction with its Aviation Cyber Initiative partners.

ABOVE RIGHT: Nouragas visits the Tech Center Tuesday exhibit booth of FAA's National Air Space Animated Storyboard team.

Source: FAA.

Throughout my 39-year career at the Tech Center, I've worked very closely with the DOD. I value that partnership. DOD has provided lots of understanding about how they've incorporated some of the dev-sec ops, software engineering, and new principals, and even using the cloud. What they've done has shaped FAA's understanding of where we're going with our automation evolution strategy.

The work that the DOT HASS COE (U.S. Department of Transportation's Highly Automated Systems Safety Center of Excellence) team is doing to connect the operational architecture and DOT (Department of Transportation) modals, and especially to integrate the Federal labs to examine multi-modal concepts and the various emerging technology use cases can really impact FAA. They have an initiative called Connect-X that's working hard to bring the department's modals together in an effort to collaborate, to integrate our labs, like our robust LVCE (live, virtual, constructive environment)—a distributed research testbed we created—to connect and explore some multi-modal concepts and various use cases.

Given the complexity and pace of change, we realize we can't do it alone. The coming together of different perspectives and expertise to solve problems and identify the realm of possibilities is the core strength of partnerships. So, FAA values partnerships and collaboration with other government, industry, academia, and our international aviation partners.

Working together, seeing how the technological advancements can be infused across these various modals is going to be important for the future of transportation.

What is your top advice to a young woman thinking about a degree or career in STEM?

First and foremost, pursue your passion and explore the wide range of careers in the STEM field, including aviation (the field of transportation). I don't think anyone can go into a STEM field without a passion for science, technology, engineering, or math.

Another bit of important advice: Find a mentor. Honestly, if it weren't for the mentors I had, and the guidance they provided in the aircraft hangar where I first started working, I would not have stayed in computer science. The mentors allowed me as an intern to really excel, to do hands-on work. That drove my passion for writing software, which I found intriguing and creative. Therefore, find a mentor who is willing to invest in you. Today, at the FAA Tech Center, we mentor our interns that way. We match the next generation workforce with someone who will challenge them, guide them, and make sure their work assignments contribute to the organization's goals and, most importantly, are a good fit for them to develop and learn.

Paula has three children, including one set of twins. Every year, for 10 days, all three are the same age.

Thirdly, there's a wide range of careers in STEM; explore your options. The Tech Center's AvSTEM program promotes careers in aviation like air traffic control as well as pilots, engineers, scientists, researchers, and all types of specialties. We even hire psychologists, especially in the human systems integration area, to maximize human performance and study how the human operates and interacts with technology. The AvSTEM team also holds career panels. They do outreach to promote careers in aviation in classrooms and at community events. In my career, I've worked just about every aspect of the system development acquisition life cycle–from research to testing, from concept development to deployment—the whole spectrum of it. It's important for you to expand your career and continue to learn and grow. It will challenge you as a person and at the same time, you're able to give back. I also tell those coming in, make sure you have a good work-life balance.

So, my best advice to women going into STEM is to diversify yourself. Be comfortable being a little uncomfortable. Know yourself. Have confidence. You'll be handed opportunities you never thought you could handle, but you will be able to do it.

For more information, visit *https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc*.

For more on HASS COE, see the What's New article in this issue of Public Roads.

ABOVE LEFT: Nouragas and FAA senior manager John Frederick pose at the agency's 2023 Verification and Validation Summit, an annual event that brings together testing and evaluation professionals from across the world.

ABOVE RIGHT: Nouragas addresses local aviation stakeholders during an Advanced Air Mobility event at the Atlantic City International Airport.

Source: FAA.

The Women Leading FTA's Regions

A snapshot of groundbreaking careers and changes in America's transit systems.

by **MARY A. LEARY**, PHD

As part of its mission to improve American communities through public transportation, the Federal Transit Administration (FTA) emphasizes and promotes diversity in the people who pursue that mission. Fifty-three percent of FTA's workforce are people of color, making it the most diverse mode in the U.S. Department of Transportation. FTA is also committed to gender equity. The agency is currently led by Deputy Administrator Veronica Vanterpool, the latest in a series of women appointed to lead FTA for 10 consecutive years. Vanterpool succeeded FTA Administrator Nuria Fernandez, who served from 2021 to 2023 and often highlighted FTA's diversity in her public events.

Vanterpool shared her perspectives on women in leadership in an article, "Engines of Change, Celebrating Women in Transit," released in March 2023 during Women's History Month. Per the article, women, "for decades, have been driving forces behind advancing equity in our public transportation systems. Whether it be drivers, conductors, maintenance staff, engineers, or planners, women have paved the path to more inclusive transportation services, ensuring millions of people have equal access to be able to get where they need to go." A former chief innovation officer, Vanterpool remains a champion for innovation, often noting that FTA is an "innovation investor."

In 2024, FTA celebrated the 60th anniversary of the Federal transit program (*https://www.transit.dot.gov/FTA60*), which came into being on July 9, 1964. For nearly six decades, the program has helped transform transit in America from scattered bus systems and a small number of high-capacity systems to a diverse network of transit providers in thousands of communities. FTA's leadership, past and present, has worked to remove barriers, improve outreach to underserved communities, and encourage an inclusive culture that celebrates diversity in FTA and the communities it serves.

> *"There are so many paths to the field, and there is something for everyone, whether it's your passion or your skill set or just something you're really good at."*
>
> FTA's Jamie Pfister

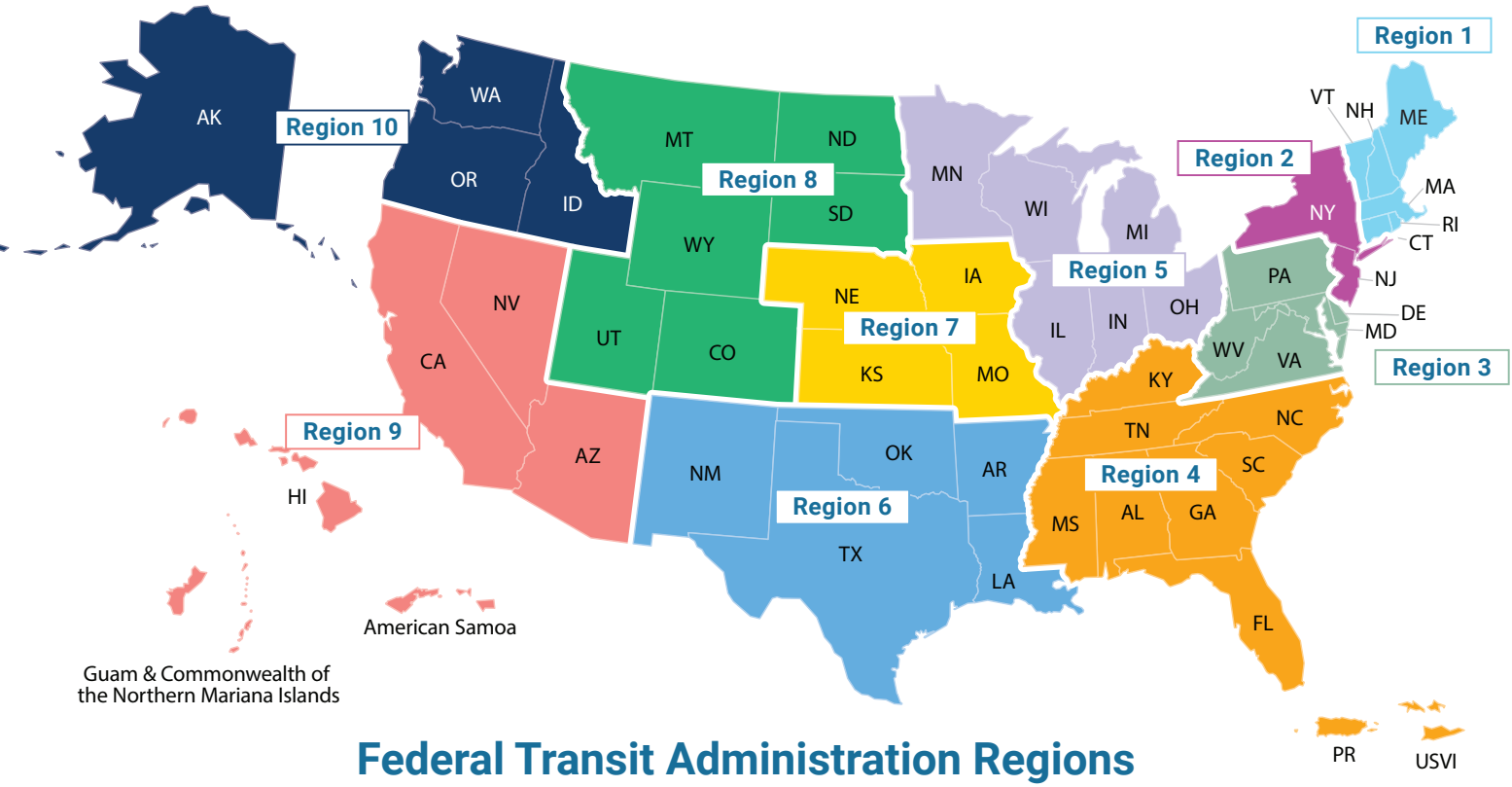
FTA's 10 regional offices link these communities to the Federal support for transit, administering a large part of the agency's $20 billion annual investment for more than 3,500 transit agencies. This includes Federal support for buses, subways, light rail, commuter rail, streetcars, and ferry programs.

Seventy-three percent of senior executives leading FTA's regional offices are women, including Jamie Pfister, the associate administrator who leads the Transit Regional Services (TRS) team in Washington, D.C. TRS staff helps manage regional issues. Carrie Butler, the newest member of the regional administrator (RA) cohort, leads Region 7. Butler joined FTA following the completion of the interviews; however, you can learn more about her through the FTA website. (See information at the end of this article.) Together, these women are making a difference in the lives of people who rely on public transit around the country.

When asked about their careers, the seven FTA leaders interviewed for this article said that public transportation is

ABOVE: FTA is committed to gender equity and promotes diversity among its staff. *All headshots source: USDOT; Background: © CHUKBOK_id/AdobeStock.com.*

RIGHT: On a recent site visit to Region 10, Pfister, Associate Administrator for Regional Services, saw first hand the impact of the Region's work supporting FTA's investment in transit infrastructure programs. *Source: FTA.*



Federal Transit Administration Regions

a welcoming world for women and has provided many amazing career opportunities. Along with Pfister, six RAs were interviewed for this article:

- **Terry Garcia Crews**, Region 3 (Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia).
- **Yvette Taylor**, Ph.D., Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands).
- **Kelley Brookins**, Region 5 (Illinois, Indiana, Minnesota, Michigan, Ohio, and Wisconsin).
- **Gail Lyssy**, Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas).
- **Cindy Terwilliger**, Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming).
- **Susan Fletcher**, Region 10 (Alaska, Idaho, Oregon, and Washington State).

Leading FTA's programs from offices in Philadelphia, PA; Atlanta, GA; Chicago, IL; Fort Worth, TX; Denver, CO; and Seattle, WA; each RA relies on a deep well of expertise and experience that has shaped their careers in public transit.

The conversations highlighted below delve into the evolution of their careers in transportation, major changes they have witnessed in transit during the last 20 to 30 years, and the important partnerships they forged to effect positive change. They also shared personal insights on how they unwind and rejuvenate after work (e.g., their hobbies), and advice they give to other women considering a career in public transit.

Getting Started: Pathways to Transit Careers

FTA's regional leaders hail from a variety of backgrounds. Pfister, Fletcher, and Lyssy are engineers; Taylor began in business; Garcia Crews comes from the banking and marketing sector; and Terwilliger rose through the ranks of public policy and urban planning. For many of these leaders, transit became essential to their early lives. Growing up outside Washington, D.C., Fletcher experienced the roll out of the Washington Metropolitan Area Transit Authority (WMATA) subway system and became an avid transit rider. Upon moving to Seattle, she quickly learned to use the city's bus system.

ABOVE: FTA's 10 regional offices work with local transit officials to develop and manage grants. *Source: FTA. Modifications made by FHWA.*

LEFT: Former FTA Administrator Nuria Fernandez and Deputy Administrator Vanterpool helped celebrate FTA's 60th anniversary at an event in July. *Source: FTA.*

Fletcher, Region 10 RA, visiting a ferry transit terminal in Washington State. *Source: FTA.*

Fletcher started her career as an engineer with Washington State Ferries. For many in the Puget Sound region, ferries are a primary mode of transportation, particularly those living on the San Juan Islands. During that time, she seized an opportunity to join FTA, which supported the ferry system. As an FTA engineer, she loved the magnitude and complexity of the projects she oversaw. Fletcher also watched the birth of Seattle's light rail system; she had already seen much of WMATA's growth, but this time was as a professional. Fletcher saw that moment in history as the opportunity of a lifetime. Twenty years in, she says the weight of the world is often on her shoulders as an RA, but notes, "We are here to provide the best technical assistance and funding to our transit partners to make our arteries like there's no cholesterol!"

Pfister started her 22-year Federal career at FTA in Region 4, then moved into leadership positions at the agency's headquarters in the Office of Program Management and the Office of Research. Her career also included time working at the National Highway Transportation Safety Administration. When the office of regional services (TRS) was created in 2021, she became its first associate administrator. With regional leadership, Pfister facilitates collaboration, knowledge sharing, and communication across FTA's headquarters and regional offices.

Lyssy's began in the private sector as a civil engineering consultant working on major infrastructure projects for municipal city governments and medical facilities in Texas. Her Federal career began 28 years ago at FTA when she joined Region 6 as the regional engineer.

As part of her portfolio, she wrote transit feasibility studies that gathered community input and assessed the potential for implementing or expanding transit services. Lyssy says, "It was fun to step out of roads and the municipal side of things to focus on how best to move people. This was a shift from a focus on ensuring cars can get from point A to B quickly and with enough parking spaces. The shift ignited a passion for helping people and making a difference."

Growing up in Chicago with a mother who didn't drive, Brookins took transit. As she grew older, transit enabled her to access her community while avoiding the expenses of owning a car. In 1986, Brookins got a job at the Chicago Transit Authority (CTA) to supplement her college scholarship, receiving free rides as a perk. Brookins was elated. She thought at the time, "What could be better than this? They're going to pay me to work, and they're going to give me the opportunity to continue to ride the trains for free." What seemed like a brief stop at CTA became a career in transportation, where she has had opportunities to make a difference. Thirty-eight years later, she is a senior executive at FTA. Given her time in transportation, Brookins stresses the importance of exemplary customer service, so riders have the same positive transit experience that shaped her life. For her, "Transit has been a life connector."

RIGHT: Brookins, Region 5 RA, taking an inaugural ride on the Laker Line Bus Rapid Transit line in Grand Rapids, MI. *Source: FTA.*

Witnessing Transformations: 30 Years on the Path

On average, these FTA leaders have worked in public transportation for more than 30 years. During their careers, there have been incredible positive changes in public transportation around the Nation. Garcia Crews has worked in transit since the mid-1980s. She started as a marketing director in Tucson, AZ, and later held leadership positions in Poughkeepsie, NY; Lexington, KY; Austin, TX; and Cincinnati, OH. One of her accomplishments include witnessing a double-digit growth in ridership under her leadership.

Garcia Crews praises the technologies that have transformed transit, whether operationally through automatic vehicle locator systems or live-feed cameras installed on buses to enhance security. "Unfortunately, our society has changed quite dramatically, and [surveillance measures] and bus compartment barriers help to protect our employees and our transit operators," says Garcia Crews. She also is anticipating the evolving role of artificial intelligence (AI) in transit.

In overseeing Region 3, Garcia Crews observes how transit systems like WMATA and the Southern Pennsylvania Transportation Authority in Philadelphia experiment with with AI technologies to support operations. She's interested in seeing how AI can aid rider choices, such as route options or whether there's enough time to grab a cup of coffee before the next train arrives.

Garcia Crews, Region 3 RA, delivering congratulatory remarks at a local celebration for a bus grant in Pennsylvania. *Source: FTA.*

In her region, Garcia Crews and her team support innovation through a rigorous strategic planning process they implemented in 2015. Every 2–3 years, the process repeats, ensuring that regional transit goals align with FTA and USDOT goals—but more importantly—that they are "always pushing the envelope," she says. "We're always pushing forward to make sure that we are in sync with what our stakeholders want and with Federal programs." Those Federal programs also give Garcia Crews an opportunity to get back to her roots. True to her marketing background, she loves to support ribbon cuttings and outreach events where she can connect with riders and other stakeholders.

Terwilliger has worked with FTA since 1991 in offices within Regions 2, 7, and 9, overseeing FTA's investment in a wide range of transit systems. Her experiences have led to interacting with large transit agencies in New York and Los Angeles and small transit systems in Iowa. Her current role, leading Region 8, finds her in the Mountain West region and the Dakotas. She views recent transit delivery models, such as microtransit (i.e., an on-demand service), as having a positive impact on transit operations, including maintenance and transit asset management.

As an example, Terwilliger referenced the Utah Transit Authority (UTA) based in Salt Lake City. UTA serves a large area, including less populated and denser urban locales. Last year, UTA established a mobile application through which riders can reserve on-demand rides. Ridership tripled, as shared rides (multiple riders headed in a similar direction sharing a single vehicle) allowed for quick, efficient trips. Mobility options improved by UTA's initiative, which was

LEFT: Terwilliger, Region 8 RA, delivering remarks at a ribbon cutting to mark the opening of a new transit line in Ogden, UT. *Source: FTA.*

well-received by both riders and operators. Terwilliger credits one thing for the success: strong partnerships. "Strong partnerships at the local, State, and Federal levels are the key ingredients to successfully delivering public transportation in general and delivering infrastructure projects," she says.

Building infrastructure remains key to community development. Terwilliger describes another example of strong partnerships and development while discussing the new bus maintenance facility in Grand Forks, ND. Federal funds were needed for the project. For the transit authority to apply for such funds, the city council and county government needed to support the project and identify local funding. Fostering those partnerships reinforced for Terwilliger that the key to success for any major transit project is that everyone must row in the same direction, working toward the same goal.

Like many transit employees, Terwilliger did not set out to work in public transit. As a graduate student, she worked part-time for the Permanent Citizens Advisory Committee to the Metropolitan Transportation Authority (MTA) in New York City. The committee was created as a voice for users of the MTA system, including the Long Island Railroad and Metro North commuter rail systems. The position allowed her to focus on urban planning. She learned more about public transportation and its important role in moving commuters and supporting jobs.

Taylor, Region 4 RA, speaking at an event announcing FTA funding for a new bus transit center in Nashville, TN. *Source: FTA.*

Walking the Transit Path Together

During Taylor's tenure as an RA, she also was part of technological transformations in transit; Taylor refers to the electric ferries planned for Savannah, GA, as transformational. Their new propulsion technology will be more sustainable and produce fewer greenhouse gas emissions. Taylor recently presented Chatham Area Transit (CAT) with nearly $8 million in Federal funding for the project. CAT is part of a new focus nationwide to reduce transit's carbon footprint by transitioning to zero-emission transit fleets. With a Federal goal to completely reduce emissions by 2050, transit agencies are considering the best ways to convert their fleets. This requires significant operational planning: training technicians, planning routes, and developing agreements with electric utilities. FTA is providing significant resources to assist this transition, with its regional offices playing a major role.

While working at the Environmental Protection Agency (EPA) in Washington, DC, Taylor was intrigued by FTA's mission and wanted to return to the South, where she grew up. For nearly 19 years, Taylor has managed Region 4, a large and diverse area spanning the southeastern United States. For her decades of work supporting transit, Taylor recently received the Presidential Rank Award—one of the highest civil service awards.

As part of her portfolio, Taylor oversees Region 4's work with Puerto Rico to address complex transit needs. To support this diverse environment, encourage collaboration, and share best practices, Region 4 leads the One DOT Puerto Rico Forum. Recently, Taylor suggested rotating the forum's leadership across the different USDOT modes and Federal agencies so the Federal Highway Administration, Federal Aviation Administration, Federal Lands, Federal Motor Carrier Safety Administration, and other agencies will have an opportunity to shepherd the forum.

Balancing Career and Personal Paths

Supporting transit agencies can be demanding. The work involves an array of responsibilities, including addressing agencies' technical assistance needs, ensuring prompt disbursal of funds, leading employees, and providing regional oversight. For work-life balance, each RA has her unique way of focusing on self-care. Lyssy, a member of a dog-training club, likes to train her pets and certifies other dogs to serve as emotional support animals.

Garcia Crews likes to shop for antiques, such as vintage toys and household items like old-fashioned farmhouse Hoosier cabinets. She also enjoys looking at houses. Years ago, when she moved to Austin, TX, Garcia Crews looked at more than 50 houses before settling on a new home.

Taylor, a mom of two kids, plays tennis and enjoys cheering her son at baseball games. Her favorite way to relax is by visiting a spa. Her response each year to "Mom, what do you want for Mother's Day?" is always the same—a spa day.

As an avid bicyclist, Fletcher enjoys cycling around her community. She often uses transit to travel to an outlying area and then cycles to see new sights. Pedaling around new places gives her insights into how different neighborhoods rely on transit and other mobility options (or the lack thereof). In 2024, she cycled around Belgium and the

Lyssy, Region 6 RA, spoke at the groundbreaking for a transit center garage in Baton Rouge, LA, funded through FTA's investment.
Source: FTA.

Netherlands, meeting new friends, taking in new sites, and generating new ideas.

Pfister also finds balance in mixing her personal and professional pursuits; she uses her process improvement skills as an industrial engineer and experiences as a mother to solve the logistical challenges that come with her family. "I probably use my degree a little bit more at home than at work!" Pfister jokes. She coordinates her schedule with those of her husband and three children. She and her husband also advocate for safe bike and pedestrian-friendly roadways around their Alexandria, VA, home.

Likewise, Brookins mixes her professional and personal interests with creativity. She likes to embroider transit scenes. As the ultimate transit aficionado, she enjoys combining craft activities that reflect her love of trains and buses.

Terwilliger loves live music, especially rhythm and blues, and travels to musical events like the New Orleans Jazz and Heritage Festival. She collects vinyl records and follows the new vinyl releases of blues musicians from one of the best-known music venues in New Orleans.

Finding One of the Many Paths to Transit

As mentioned earlier, FTA's regional leadership team members come from different occupational and educational backgrounds such as engineers, urban planners, policy experts, former business leaders, marketers, and bankers. This diversity is a reason they recommend a career in public transit to everyone, including women. For Brookins, Garcia Crews, and Fletcher, transit was a vital resource during their early years, and it developed into a passion and career. For Pfister, Lyssy, Terwilliger, and Taylor, transit was a job opportunity that developed into a passion and career. Pfister's advice to everyone is the same: "Plan it, design it, build it, ride it, study it, innovate about it, fund it, oversee it. Whether you go straight to public transportation, study planning or environment or engineering or policy, or have a master's degree, there are so many paths to the field, and there is something for everyone, whether it's your passion or your skill set or just something you're really good at."

Lyssy agrees that there are limitless opportunities in public transportation. Transit agencies need good people to make their systems run. She views a career in transit as a way of helping other transit employees, transit system users, and communities.

Pfister also believes that getting involved in the field, the attraction of helping others access education, healthcare, and jobs is magnetic. Lyssy finds similar fulfillment in her career, "Where else can you … play in the sandbox with these major projects and have some influence in how a community moves their programs forward? It is fun!" Her advice to girls and women is to seek out a career in transit.

Brookins advises, "Look at transit opportunities and the possibilities, then have discussions with transit agencies to see where there's an alignment and where those careers connect with your interest in making a difference in the lives of other people."

Taylor hopes that women pursue their passions and consider a career in transportation, as it is critical to the fabric of the United States and its economy: "Transportation is one of those industries that really has no limit. Anywhere you go, you're going to need transportation."

MARY A. LEARY, Ph.D., served as the FTA associate administrator for the Office of Research, Demonstration, and Innovation (TRI), retiring in January 2025. TRI leads FTA's innovative research investments, training, workforce development, transit bus testing, and technical assistance programs. During her tenure leading TRI, its portfolio of projects has doubled to more than $200 million in transformative projects. Prior to joining FTA, Mary served in executive leadership roles in the nonprofit and private sectors. She has a doctorate in public policy from George Mason University and specialties in human services transportation, accessible mobility, aging in place, team building/leadership development, organizational informatics, and enterprise business solutions.

Throughout her 35-year career in the public and private sectors, Leary has led national programs and initiatives in transportation workforce development, outreach, and more.
Source: FTA.

For more information about FTA, see *https://www.transit.dot.gov/* or contact *FTAPressOffice@dot.gov*.

For more information about Carrie Butler, visit *https://www.transit.dot.gov/about/officials/biographies/carrie-butler*.

Making Safety Everyone's Business

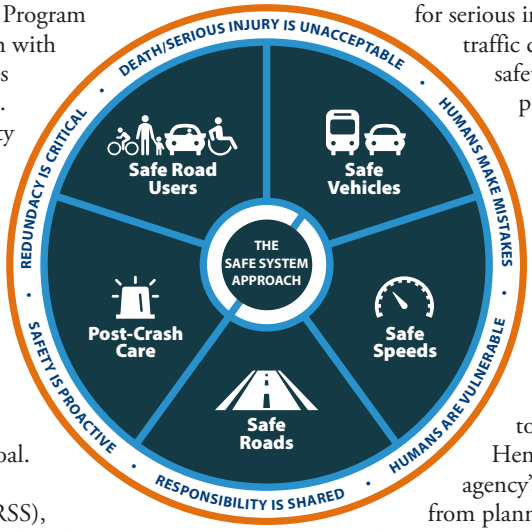
How integrating safety performance considerations into a project's environmental review can improve safety for all users of the transportation system.

by **PHILLIP BOBITZ**, **DAVID COHEN**, **CHIMAI NGO**, **JERRY ROCHE**, and **LILAH MORRISSEY**

Currently, the country faces a crisis on its roadways. In 2023, an estimated 40,990 people across the Nation—113 people per day—lost their lives in motor vehicle crashes. As a result, a key priority at the U.S. Department of Transportation and Federal Highway Administration is making the Nation's transportation system safe for all users.

The Highway Safety Improvement Program (HSIP) is the core Federal-aid program with the purpose of reducing traffic fatalities and serious injuries on all public roads. However, this dedicated source of safety funds is relatively small, representing only about 6 percent of the total annual Federal-Aid Highway Program. While FHWA and its Federal, State, local, and Tribal partner agencies have advanced the expertise of highway safety through HSIP, the funding available through it alone will not entirely achieve the goal of zero fatalities on the Nation's roadways—an ambitious, long-term goal.

In 2022, USDOT released the National Roadway Safety Strategy (NRSS), a comprehensive roadmap to significantly reduce severe injuries and deaths on highways, roads, and streets.



ABOVE: USDOT and FHWA are focused on developing and operating equitable streets and networks that prioritize safety.

RIGHT: Applying the Safe System Approach continues the core mission of improving safety for all users.

Source: FHWA.

The roadmap was an important step in working toward the elimination of roadway fatalities. As part of NRSS, USDOT adopted the Safe System Approach as the guiding paradigm to address roadway safety. The Safe System Approach focuses on both human mistakes and human vulnerability and designs a redundant system to prevent crashes and reduce the potential for serious injury or death. A commitment to zero traffic deaths means addressing all aspects of safety by following the six Safe System principles and addressing the five Safe System elements that create a holistic safety approach for road users.

The Safe System Approach involves a paradigm shift to improve safety culture; ensure equity; increase collaboration between multiple stakeholders; refocus transportation system design and operation on anticipating human mistakes; and lessen impact forces to reduce crash severity and save lives. Hence, safety should be considered in an agency's transportation investment decisions, from planning and programming to project design, construction, operations, and maintenance. More specifically, every transportation project provides an

opportunity to improve safety; transportation-related agencies, practitioners, stakeholders, and advocates can work together to identify and incorporate changes to improve safety throughout the project development process.

Among the many opportunities to consider safety in project development is the environmental review process, as required by the National Environmental Policy Act (NEPA). NEPA is a procedural statute requiring Federal agencies to assess the environmental effects of their proposed actions before making decisions. However, safety is often one of many tradeoffs (such as environmental stewardship, traffic operations, right-of-way constraints, costs, etc.) that transportation agencies must review and balance during transportation decisionmaking.

In 2011, FHWA published the *Integrating Road Safety into NEPA Analysis: Practitioner's Primer* to help practitioners understand the noteworthy practices for analyzing and addressing project safety issues during each stage of the NEPA process. Since the development of the primer, crash data collection has improved, data-driven tools and strategies for assessing safety performance have become more sophisticated, and safety planning processes have advanced.

There are many tools, methods, policies, and procedures to assess and analyze the safety performance of roadways and other transportation projects. They include:

- Predictive methodologies such as the Highway Safety Manual (HSM).
- Systemic approach.
- Safe System Approach frameworks.
- Road safety audits (RSAs) and other formal qualitative examinations.

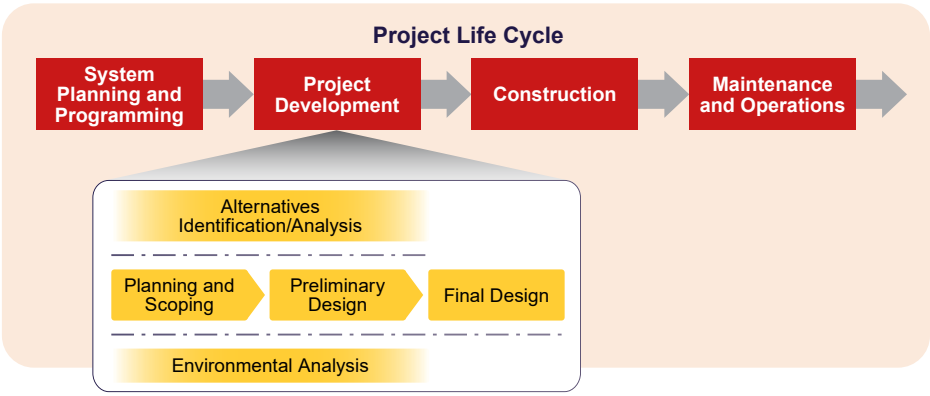
Integrating Safety into NEPA Reviews

Based on 23 U.S. Code 109(h), it is FHWA policy to "assure that possible adverse economic, social, and environmental effects relating to any proposed project on any Federal-aid system have been fully considered in developing such project, and that the final decisions on the project are made in the best overall public interest, taking into consideration the need for fast, safe and efficient transportation, public services, and the costs of eliminating or minimizing such adverse effects." Since transportation agencies differ in how they characterize the project development process, the phases in the process, and the functions performed in each phase, a generalized process, or project life cycle, is an opportunity for professionals to evaluate the environmental impacts and integrate safety and efficiency considerations alongside their own agency's approach.

Safety performance considerations can inform transportation decision-making during a project's planning and environmental review processes for all NEPA classes of action and at each stage of the NEPA process. Such considerations include:

- Safety analyses prior to the NEPA process, particularly during project planning.
- Input from safety stakeholders during public outreach and project scoping.
- RSAs and safety analysis techniques to identify and address substantive safety problems and compare project alternatives.
- Transportation system users, including those likely to be more vulnerable in crashes (i.e., pedestrians, bicyclists, wheelchair.... and transit users).
- Opportunities for safety mitigation and going above and beyond required mitigations to enhance safety for all roadway users.

Improving safety performance and environmental protection should not be regarded as competing public interests during highway project development and environmental review. It is



ABOVE: Every transportation project provides an opportunity to improve safety.

LEFT: Each phase in the project life cycle presents transportation agencies—across varying project development processes—an opportunity to evaluate environmental impacts and integrate safety and efficiency considerations alongside their own approach.

Source: FHWA.

possible to plan, design, and implement roadway projects that improve both safety and environmental outcomes.

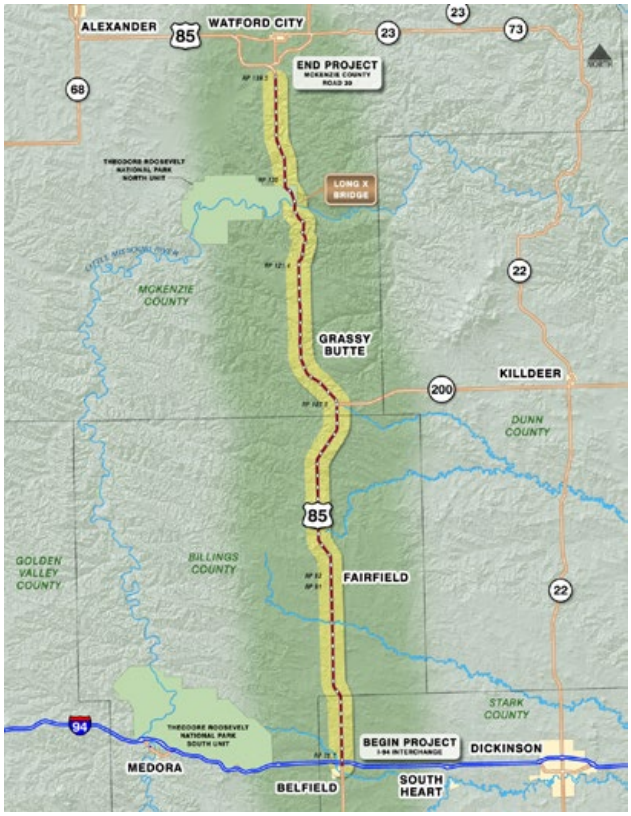
While there are practical and statutory connections between NEPA and the roadway safety management process, these connections are not always implemented at an institutional level. In 2023, FHWA developed a series of four case studies that present examples from around the United States of how safety can be incorporated into NEPA reviews. The following case studies exemplify roadway projects where Federal investments have improved safety for all users of the transportation system and achieved better environmental outcomes.

North Dakota's U.S. Highway 85 (U.S. 85) Project Environmental Impact Statement (EIS)

In the early 2010s, North Dakota experienced an economic boom due to the expansion of the oil and gas industry in the western part of the State. This economic engine spurred population and traffic growth (including heavy truck traffic) throughout North Dakota, but these impacts have strained rural communities and their transportation infrastructure. In response, the North Dakota Department of Transportation (NDDOT) proposed widening the 62-mile corridor of U.S. 85 and replacing the Long X Bridge to meet the needs of the growing and shifting traffic patterns on this economically critical connection.

NDDOT and FHWA, as joint lead agencies, issued a Notice of Intent to prepare an EIS in October 2015. Safety was a core component of the U.S. 85 project early on, from a key consideration in project scoping to preparing the EIS.

Public engagement revealed numerous first-hand accounts, primarily from individuals who have observed improper passing, speeding, wildlife-vehicle collisions, and other near-miss incidents along the corridor. These revelations allowed NDDOT to address safety proactively and accommodate other stakeholder needs rather than waiting for crash data to reflect the emerging conditions.



The goal of the U.S. 85 project was to minimize potential impacts on environmental, socioeconomic, and human-made resources to the maximum extent practicable.

© 2019 North Dakota Department of Transportation.

By incorporating safety early in the process through public and stakeholder involvement, NDDOT developed a defined need for safety as part of the expansion project, encouraging the data-driven evaluation of project alternatives. As part of the alternatives analysis, NDDOT used the Interactive Highway Safety Design Model (IHSDM) software, a decision-support tool that applies the predictive models of the American Association of State Highway Transportation Officials' HSM, to evaluate the safety performance of design decisions. The results of the analysis helped justify an alternative that considered safety as part of the environmental review. Although IHSDM is not yet widely used by NDDOT, the agency's experience showed its potential for multi-disciplinary planning. NDDOT plans to use IHSDM and the HSM in future project development.

Matt Linneman, NDDOT's deputy director for engineering, shared the benefits of this approach, noting that "Safety is our priority at NDDOT, and we build it into all of our infrastructure projects. Our approach to delivering projects and gathering meaningful public involvement, validated safety as a key need for the U.S. 85 project. The quantitative safety analysis was very beneficial and furthered our justification for alternative selection, which also paved the way for a smoother permitting process." Proactive planning allowed NDDOT to arrive at a design that accommodated both the safety and environmental needs of the project.

Kentucky's Second Street Corridor (U.S. Route 60) Complete Streets and Road Diet Project

Frankfort, Kentucky's capital city, received Transportation Investment Generating Economic Recovery (TIGER) funds in 2018 to implement Complete Streets elements along U.S. Route 60, including a road diet and streetscape enhancements. A road diet involves reducing the number of through lanes on an existing roadway and reallocating the remaining space to other uses (bicycle lanes, sidewalks, parking, etc.).

The corridor's pre-project conditions included a narrow four-lane roadway, high vehicle speeds, long crossing lengths, and limited multimodal facilities, which caused safety concerns for pedestrians, bicyclists, and transit users. Thus, the project's objective was to create a safer travel experience for all users as well as boost economic development in a distressed neighborhood and allow for placemaking opportunities.

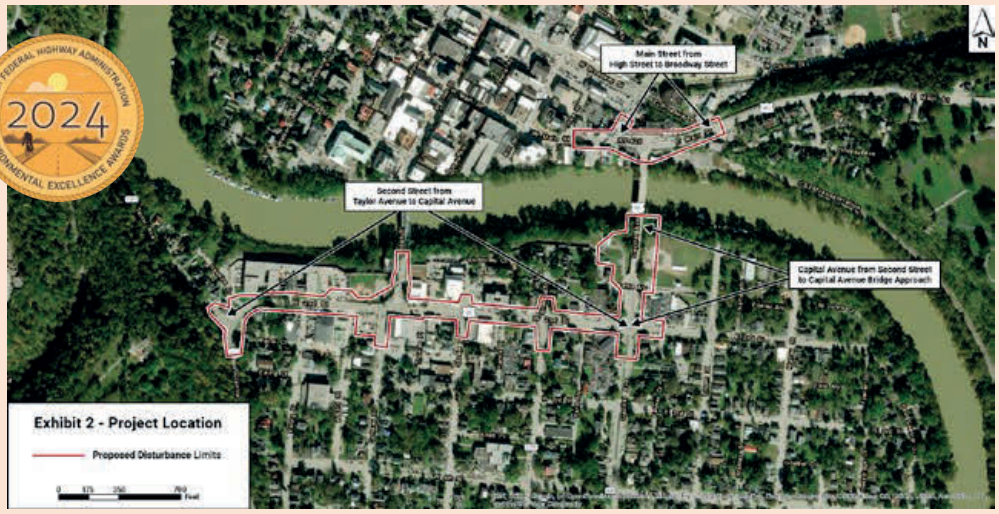
Public engagement was a key element early in the project development process. Such engagement included the visioning exercises associated with a corridor study completed as part of the U.S. Environmental Protection Agency's Greening America's Communities (formerly known as Greening America's Capitals) program grant, a series of 23 stakeholder meetings, and a robust email listserv to communicate over 40 project updates to community stakeholders.

The project's environmental documentation consisted of a categorical exclusion— "a class of actions that a Federal agency has determined do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither environmental assessment nor an environmental impact statement is normally required"—as allowed by a 2018 Programmatic Agreement between the Kentucky Transportation Cabinet and FHWA. The purpose and need statement, informed by input gathered through the planning process, addressed safety and environmental

2024 EEA Award

In May 2024, the Second Street Corridor TIGER Project received an FHWA Environmental Excellence Award in the Context Sensitive Solutions and Complete Streets category.

For more information on that project, visit: *https://www.fhwa.dot.gov/environment/environmental_excellence_awards/eea_2024/#a7*



The Second Street Corridor project's objective was to create a safer travel experience for all users as well as to provide public space and boost economic development in a distressed neighborhood.
© Kentucky Transportation Cabinet.

stewardship during the NEPA process by implementing a road diet—an FHWA Proven Safety Countermeasure known to be effective in reducing roadway fatalities and serious injuries on the Nation's highways.

Jason Monroe, Frankfort's city manager, shared his enthusiasm for the project: "We take great pride in the Second Street Corridor Project. Safety, equity, and environmental concerns were given the utmost attention at the beginning of the project and were continuously prioritized throughout the process. Currently, we are in the process of planning Complete Streets projects for two additional main arteries in the city, and we will be following the same approach for these projects." City officials also hope to implement various forms of public art to encourage community ownership of the corridor. Moreover, the positive momentum around this project has helped the city secure a Rebuilding American Infrastructure with Sustainability and Equity (or RAISE) discretionary grant for a nearby two-mile corridor that will also implement Complete Streets concepts, furthering the mission of a safe, connected, and equitable city roadway network.

Key Themes

The *Safety and NEPA: Case Studies and Noteworthy Practices* report (*https://highways.dot.gov/sites/fhwa.dot.gov/files/2023-02/Safety%20NEPA_Introductory%20Document_FINAL_508.pdf*) summarizes lessons learned from these and other case studies, including:

- Safety and environmental considerations should not be considered "either/or" in project development.
- Clear, well-developed guidance can benefit the incorporation of safety in NEPA.
- Meaningful public involvement and engagement is critical in understanding specific safety concerns within a project footprint.
- Documenting safety concerns and assessing safety performance from pre-NEPA processes, particularly through a Planning and Environment Linkage or feasibility study, provides a foundation for prioritizing safety throughout the project development process.

Reaching the goal of zero deaths and serious injuries requires all stakeholders to take collective, interdisciplinary and interagency actions, and ownership in safety. NEPA reviews can provide a forum for FHWA and project sponsors to facilitate transportation decision-making in the "best overall public interest," according to FHWA's Environmental Review Toolkit. Safety and NEPA practitioners can work together to highlight the public interest in safety while balancing the needs for environmental and other transportation considerations.

PHILLIP BOBITZ is a safety engineer in FHWA's Office of Safety, responsible for Proven Safety Countermeasures and various safety integration initiatives. He has a B.S. in civil engineering from Pennsylvania State University and is a registered professional engineer (P.E.) in Pennsylvania.

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CHIMAI NGO is a transportation specialist in FHWA's Office of Safety, where she leads efforts to promote safety culture and the Safe System Approach, including Vision Zero and integrating safety in the transportation planning process. She holds a bachelor's in architecture from the Catholic University of America and a master's in planning from the University of Virginia.

JERRY ROCHE is a lead transportation specialist in FHWA's Office of Safety, where his team provides safety policy and program support in such areas as pedestrians, motorcyclists, Complete Streets, local and rural roads, Proven Safety Countermeasures, and incorporating safety in all projects. He holds B.S. and M.S. degrees in civil engineering from Iowa State University and is a registered P.E. in Iowa.

LILAH MORRISSEY is a communications and outreach specialist who manages the marketing needs of FHWA's Office of Planning, Environment, and Realty. She has over 15 years of professional experience in project management and marketing and a master's degree in community and regional planning from the University of Oregon.

For more information on safety and NEPA, visit FHWA's Environmental Toolkit (*https://www.environment.fhwa.dot.gov/*) and Zero Deaths and Safe System (*https://highways.dot.gov/safety/zero-deaths/resources*) pages.

Acknowledgment

The authors thank Colleen Vaughn, the project development team lead in FHWA's Office of Project Development and Environmental Review, for her contribution to this article.

Opportunities, Challenges of Safer Speeds and Speed Management

Spring Special Issue Coming in April

As a public on the go, we all play a role in roadway safety, especially when it comes to the speed of our vehicles. In the next issue of Public Roads, we'll do a deeper dive into the critical nature of managing safer speeds and advancing strong speed management programs from the Federal and local perspective.

In the issue, we will highlight:

- Data and how it's used across several Federal agencies.
- Speed limit design and engineering.
- Behaviors of motorists and enforcement.
- New technology to combat speeding.
- Implementation of processes on the State and local level.

Visit the Public Roads website in April 2025 to view the issue, or sign up now to get the issue right in your mailbox, https://public.govdelivery.com/accounts/USDOTFHWA/subscriber/new.

Forging Ahead with Innovation!

FHWA Reveals the Second Student Writing Competition Winners.

by **Public Roads STAFF**

When young transportation innovators think "big picture" and "how can I make this better?" they make some of the most amazing discoveries—not only in their professional careers but in the industry itself.

Transportation today is full of dedicated researchers, technology, programs, and ideas about how to make our roads, bridges, and infrastructure stronger and more resilient. The industry is also full of promise—with thousands of young men and women entering science, technology, engineering, and mathematics (STEM) careers—looking to make their mark here in the United States and around the world.

According to the National Center for Education Statistics, nearly 790,000 students graduated with an undergraduate or graduate degree in STEM in 2021-2022, the last year that statistics were released. It will be these minds that forge the new path forward in the world of transportation, and it is some of these minds that we recognize here in the pages of Public Roads.

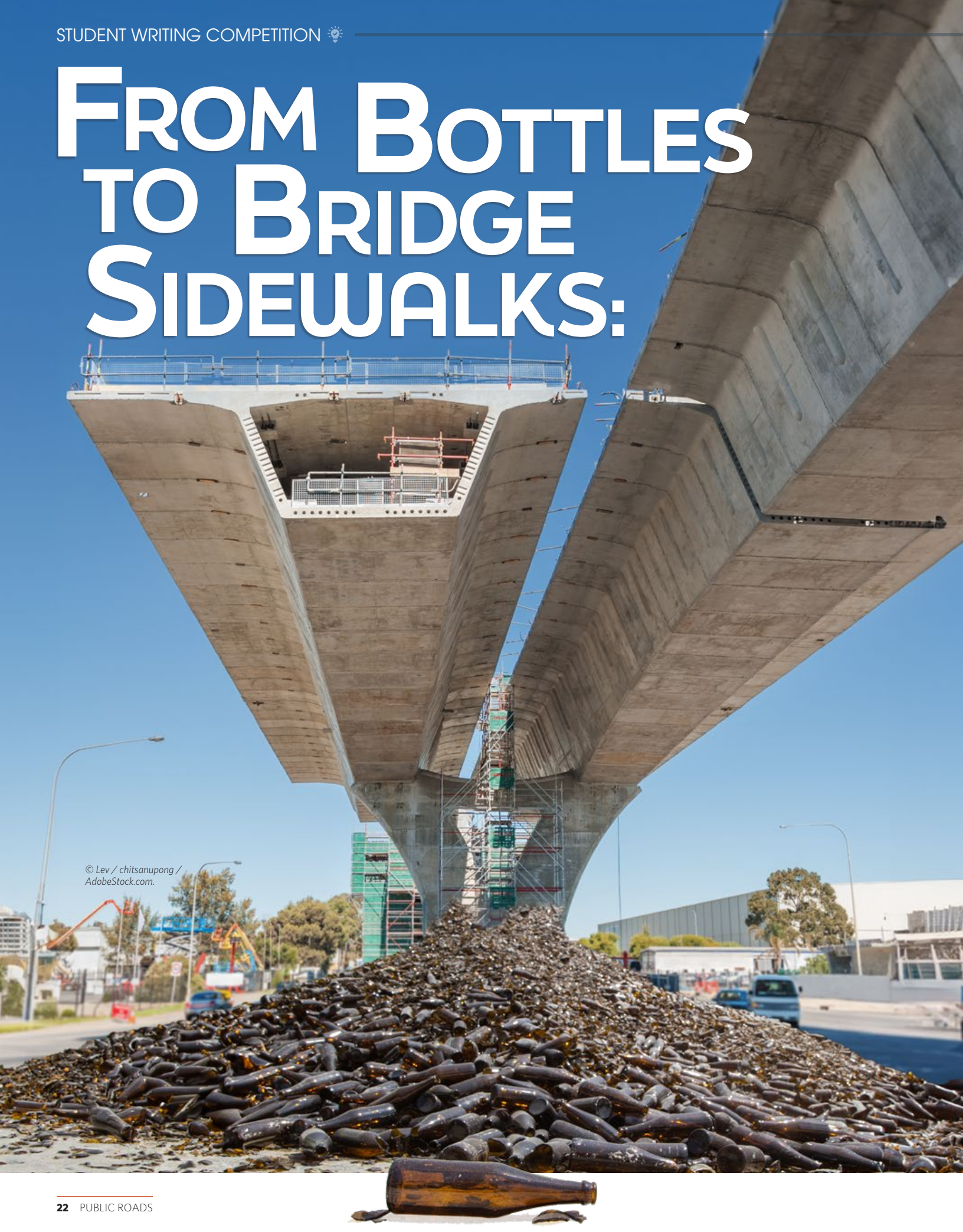
It is with great pleasure that the Federal Highway Administration and Public Roads present the winners of the second Student Writing Competition. As we did for its debut in January 2024, high school, undergraduate, and graduate students studying STEM submitted their articles during the spring of 2024, resulting in the winning articles that you are about to read. From the next generation of concrete and concrete alternatives to rumble strips and geosynthetics, the four winning students offered insightful and implementable ideas valuable to transportation professionals who are working to solve today's—and tomorrow's—biggest challenges.

Thank you to all the students who participated in our sophomore effort and congratulations to the winners!

The following articles were written by students as part of the Public Roads Student Writing Competition. The views and opinions expressed in these articles are the authors and do not necessarily reflect those of FHWA or the U.S. Department of Transportation (USDOT). The contents do not necessarily reflect the official policy of the USDOT.

FHWA composition. Images © Gorodenkoff / Uwe / AdobeStock.com.

From Bottles to Bridge Sidewalks:



Turning Waste into the Next Generation of Concrete

by **SAMUEL LAMURAGLIA**

There's a little-known secret about recycling—it often doesn't work, at least not in the way we usually think. According to the Environmental Protection Agency (EPA), more than 7.55 million tons of glass intended for recycling end up in landfills each year. This represents almost all the glass waste in the United States. The main issue with recycled glass is contamination from paper, plastic, and metal, which renders the glass unusable for making new bottles.

In response, the New York State Department of Transportation (NYSDOT) and the city of Binghamton are reimagining this problem. They are innovating to transform our infrastructure and meet the pressing transportation challenges of today.

The Problem

Cement manufacturing is responsible for 7 percent of global CO_2 emissions, encountering significant barriers in its path to decarbonization. These include high capital costs, unproven technologies, and a lack of local adoption. As environmental product declarations (EPDs) become more prominent in Federal and State funding opportunities, agencies must consider how their materials affect performance and sustainability when targeting funding.

For instance, the "New York State Buy Clean Concrete Guidelines," effective starting in 2025, will limit the global warming potential (GWP) of all concrete purchased with State funding. This includes infrastructure projects funded through NYSDOT.

The Role of SCMs

According to the Department of Energy's *Industrial Decarbonization Roadmap*, using novel supplementary cementitious materials (SCMs) is one of the most effective strategies to reduce the GWP in concrete mixes. These materials harness the pozzolanic reaction found in Roman concrete to replace a portion of cement and enhance performance.

The transportation industry has long been familiar with SCMs, having pioneered the use of fly ash from coal power plants and slag from steel foundries. However, with the decline of these industries—highlighted by the closure of New York's last coal power plant in 2020 and similar closures anticipated in New England by 2025 and 2028—the search for alternative SCMs has intensified.

Glass, rich in silica, has been identified as a superior SCM compared to fly ash and slag. Research by scientists from Eindhoven University of Technology, Ömer Halisdemir University, and the University of New South Wales has demonstrated that glass SCMs enhance compressive strength while avoiding the detrimental alkali–silica reaction. With ASTM C1866, *Standard Specification for Ground-Glass Pozzolan for Use in Concrete*, established in 2020, glass SCMs were technically viable but economically unfeasible until recent advancements in glass processing

PAVING THE FUTURE: The city of Binghamton unveiled its pioneering glass SCM concrete projects in 2022, marking a significant step toward sustainable urban infrastructure and innovative material use.

SUSTAINABLE CONSTRUCTION IN ACTION: Crews employ glass SCM concrete on Court Street, Binghamton, showcasing the city's commitment to innovative, low-carbon infrastructure solutions.

technology and the scale-up of production facilities. These developments have made glass SCMs cost-competitive with traditional materials, especially in regions logistically isolated from fly ash and slag suppliers.

Small-Town Innovations

In 2022, the city of Binghamton in New York began incorporating glass SCMs into all curb and sidewalk projects, reducing the cement content by 20 percent and cutting more than 1,000 pounds (453.6 kilograms) of CO_2 emissions per ready-mix concrete truck. These $1.7 million upgrades brought advanced, low-carbon concrete solutions to the city, including disadvantaged communities on the east side of Binghamton.

The initiative aimed to harness purpose-driven innovation to tackle current challenges in the transportation system while addressing a major waste issue. City engineers revised mix designs and secured support from the local ready-mix producer and contractor.

The project proved to be a resounding success, validating the use of glass SCMs in real-world applications. It demonstrated how strategic partnerships and adherence to existing standards can rapidly decarbonize transportation infrastructure. Supported by all levels of the industry, these projects continued into 2023 and 2024, with plans to maintain the use of glass SCMs in all future projects. This local initiative not only bolstered supply chain resilience and economic strength but also created three new jobs.

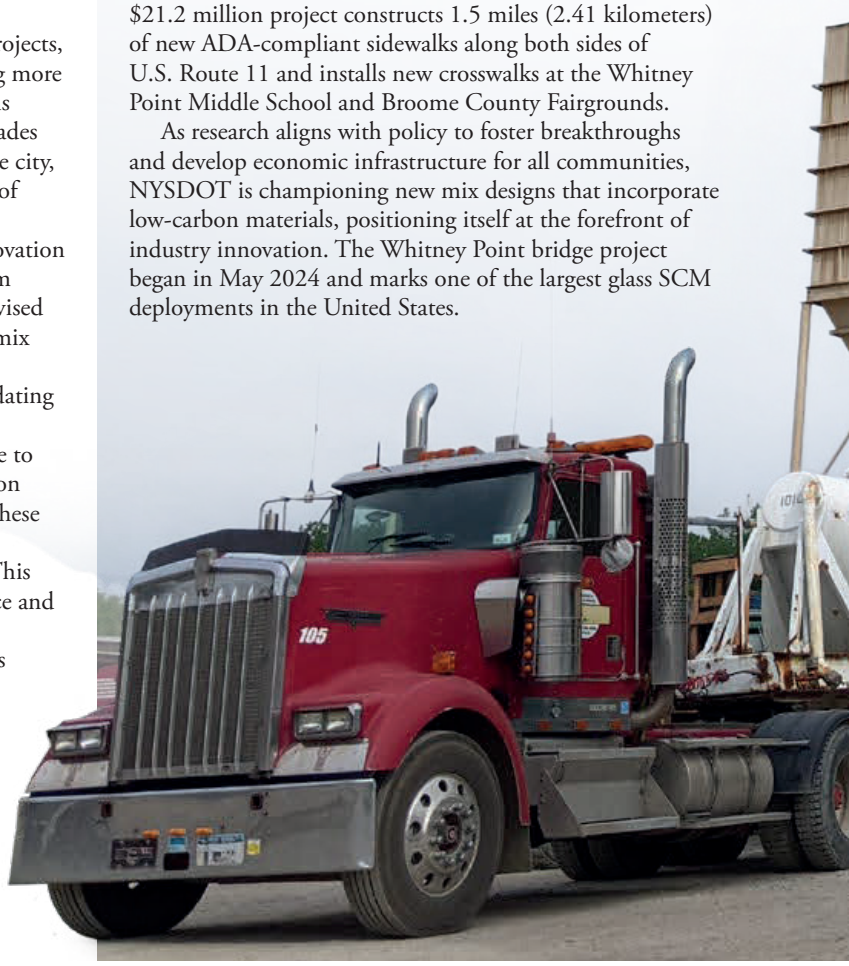
As a significant step in climate action, Binghamton's efforts drew national attention from the EPA, capturing the interest of local NYSDOT members and setting a precedent for other municipalities across the Nation.

From Bottles to Bridge Sidewalks

NYSDOT developed Standard 711-15, Miscellaneous Supplementary Cementitious Materials, and initiated testing of glass SCMs. This development is part of NYSDOT's shift toward performance-engineered mixtures, which offer producers greater flexibility in material choices and foster grassroots innovation at the local level.

Building on Binghamton's success, NYSDOT specified glass SCMs in a Whitney Point, NY, bridge project, mandating its use for all curb and sidewalk placements. The $21.2 million project constructs 1.5 miles (2.41 kilometers) of new ADA-compliant sidewalks along both sides of U.S. Route 11 and installs new crosswalks at the Whitney Point Middle School and Broome County Fairgrounds.

As research aligns with policy to foster breakthroughs and develop economic infrastructure for all communities, NYSDOT is championing new mix designs that incorporate low-carbon materials, positioning itself at the forefront of industry innovation. The Whitney Point bridge project began in May 2024 and marks one of the largest glass SCM deployments in the United States.



INNOVATIVE MATERIALS ON THE MOVE: A shipment of a glass SCM arrives at a ready-mix concrete plant, poised to be part of NYSDOT's Whitney Point project.

The Future of Concrete for Transportation Infrastructure

The collaborative efforts of NYSDOT, the city of Binghamton, partnering universities, and private enterprises demonstrate how State transportation agencies and the Federal Highway Administration can build resilient supply chains, implement cross-cutting solutions, and enhance system reliability. These initiatives strengthen local economies and elevate global competitiveness. The future of concrete in transportation will harness new materials to construct the systems the Nation will rely on for years to come. While there may not be a single solution to the challenges of climate change and material shortages in the concrete industry, New York's approach offers a blueprint for how collaboration can lay the groundwork for a more robust future.

SAMUEL LAMURAGLIA is an undergraduate at State University of New York at Binghamton. Samuel is currently studying environmental studies and will graduate in 2026.

FROM WASTE TO WORTH: A handful of glass SCM stands out against the backdrop of discarded waste glass, symbolizing the leap from landfill to leading-edge infrastructure.

Resources

- **"Facts and Figures about Materials, Waste, and Recycling"** (*https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/glass-material-specific-data#:~:text=The%20amount%20of%20recycled%20glass,with%20energy%20recovery%20that%20year*)
- **"Bendable concrete and other CO2-infused cement mixes could dramatically cut global emissions"** (*https://theconversation.com/bendable-concrete-and-other-co2-infused-cement-mixes-could-dramatically-cut-global-emissions-152544*)
- **"NYS Buy Clean Concrete Guidelines"** (*https://ogs.ny.gov/nys-buy-clean-concrete-guidelines-0*)
- **Industrial Decarbonization Roadmap** (*https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf*)
- **"New York State Profile and Energy Estimates"** (*https://www.eia.gov/state/analysis.php?sid=NY*)
- **"The Last Coal-Fired Power Plants in New England Are to Close"** (*https://www.nytimes.com/2024/03/28/climate/new-england-coal-plants.html*)
- **"Waste glass as binder in alkali activated slag–fly ash mortars"** (*https://link.springer.com/article/10.1617/s11527-019-1404-3*)
- **"Comparison of Glass Powder and Fly Ash Effect on the Fresh Properties of Self-Compacting Mortars"** (*https://iopscience.iop.org/article/10.1088/1757-899X/245/3/032036/pdf*)
- **"Mitigation Effect of Waste Glass Powders on Alkali–Silica Reaction (ASR) Expansion in Cementitious Composite"** (*https://ijcsm.springeropen.com/articles/10.1186/s40069-018-0299-7*)
- **Standard Specification for Ground-Glass Pozzolan for Use in Concrete, ASTM C1866** (*https://www.astm.org/c1866_c1866m-20.html*)
- **"KLAW Industries teams up with the City of Binghamton"** (*https://www.binghamtonhomepage.com/news/local-news/klaw-industries-teams-up-with-the-city-of-binghamton/*)
- **"Mayor Kraham Announces Partnership with KLAW Industries"** (*https://www.binghamton-ny.gov/Home/Components/News/News/229/15*)
- **"EPA's SBIR Circular Economy Projects Reduce Waste and Slow Climate Change"** (*https://www.epa.gov/sbir/epas-sbir-circular-economy-projects-reduce-waste-and-slow-climate-change*)
- **"New York State Department of Transportation Approved Materials, Equipment, Methods, and Procedures"** (*https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/alme/NYSDOT_Approved_List.pdf*)
- **"Notice to Prospective Bidders"** (*https://www.dot.ny.gov/portal/pls/portal/MEXIS_APP.BC_CONST_NOTICE_ADMIN.VIEWFILE?p_file_id=70367&p_is_digital=N*)
- **"D264920"** (*https://www.dot.ny.gov/doing-business/opportunities/const-contract-docs?p_d_id=D264920*)

Rumble Strips for the Safety of New York City's Cyclists

Cycling in a busy place like New York City can be challenging and dangerous.

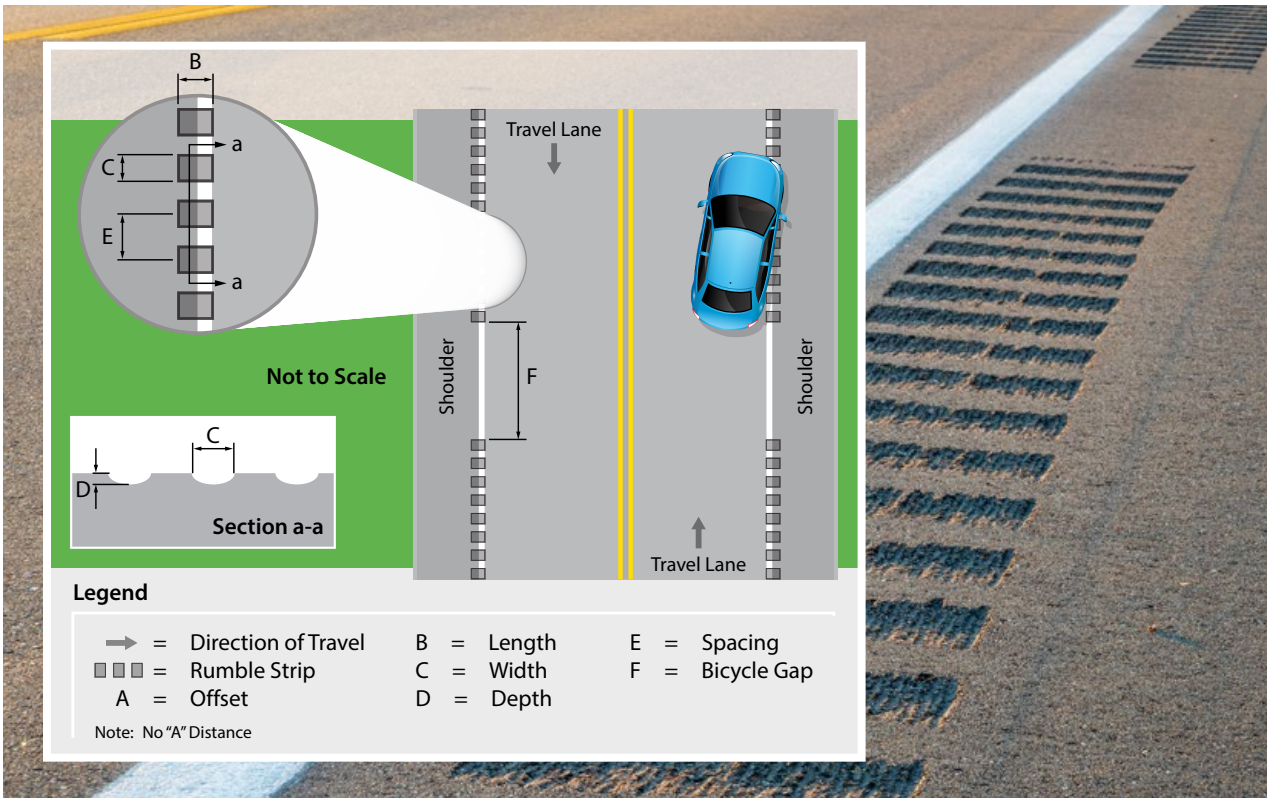
© Sam Edwards/ KOTO / AdobeStock.com.

by **EDWARD WANG**

Cycling is an efficient form of transportation that improves a person's health and their surrounding environment, helping to reduce air and noise pollution over time. However, cycling comes with its risks, especially in urban areas, where there is a higher chance of vehicle-cyclist accidents, not to mention cyclists coming in contact with parked vehicles and other obstructions blocking the bike lane. Take New York City (NYC), for example; despite being the largest city in the United States, NYC has more than 1,525 miles (2,454.21 km) of bike lanes as of 2022, 644 of which are protected (either by street parking spaces or rigid posts). Although NYC is relatively biker-friendly, with more than 30 percent of adult New Yorkers riding a bike, accidents still occur. According to 2022 data from the New York City Department of Transportation (NYC DOT), there were 5,621 vehicle-cyclist crashes, 4,676 cyclist injuries, and 15 cyclist fatalities. To help increase the safety of current NYC cyclists and promote ridership in busy city areas, implementing edge line rumble strips for unprotected bike lanes is a strong, viable solution.

Rumble strips, tiny grooves, or bumps on the road alert drivers when drifting out of their current lane, producing a vibrating sensation and rumbling noise. They can help minimize the number of bicycle accidents due to distracted driving or on narrower streets when drivers may not be aware they are crossing into the bike lane. In addition, rumble strips can discourage drivers from intentionally blocking the bike lane to park or stall their vehicles. According to the Federal Highway Administration, there are multiple kinds of rumble strips, including centerline rumble strips, shoulder rumble strips, and edge line rumble strips. While centerline rumble strips are placed in the middle of the roadway, shoulder rumble strips are placed outside the shoulder; edge line rumble strips are a specific type of shoulder rumble strip. Since edge line rumble strips can be directly installed on the edge of the bike lane, they can also be painted with a bright, reflective coating for nighttime driving when visibility is limited.

Compared to typical milled rumble strips that have a depth of 0.5 inches (1.27 cm), a width of 5 to 7 inches (12.7 to 17.78 cm) (compared parallel to the flow of traffic), a length of 12 to 16 inches (30.48 to 40.64 cm) (compared perpendicular to the flow of traffic), and a 12-inch (30.48 cm) spacing between each other, edge line rumble strips must also account for the cyclist's ability to maneuver across the rumble strips safely. FHWA suggests narrowing the rumble strip on narrower roads to give more shoulder space to cyclists and adding occasional "bicycle gaps" to allow cyclists to leave the bike lane in case of an emergency. Therefore, a solution for cycling safety is using



Edge line rumble strips can be directly placed on the shoulder (or bicycle lane) to alert drivers when they are drifting out of their lane.

Inset source: FHWA.

Photo: © MarekPhotoDesign.com / AdobeStock.com.

ABOVE: Signage is critical to the safety of cyclists on city streets. *© ako-photography / AdobeStock.com.*

bicycle-friendly rumble strips with a modified depth of three-eighths of an inch (.95 cm), a width of 4.5 inches (11.43 cm), a length of 5.5 inches (13.97 cm), and a spacing of 8 inches (20.32 cm) between each rumble strip. In addition, having a bicycle gap every 50-75 meters (164.04-246.06 ft; placed strategically and determined on a case-by-case basis) could further improve safety for riders.

The cost of installing rumble strips depends on the rumble strip's dimensions, spacing, and the pavement material. The price of installing milled rumble strips ranges from $500 to $6,000 per mile. In NYC, most roads are made of asphalt, which is less rigid and durable than concrete and cheaper to mill because asphalt produces two to three times less wear on the mill head. Altogether, it is estimated that installing rumble strips would cost around $2,000 per mile, on the lower end. Since rumble strips would have to be placed on both sides of the road next to the bike lanes, the cost would be $4,000 per mile. For the 881 miles (1,417.83 km) of unprotected bike lanes in NYC, the cost would be $3,524,000. However, this estimate does not consider bike lanes on one-way streets—meaning the actual price for implementation may be lower.

Using data from the NYC DOT, the average number of motor vehicle-bicycle accidents in NYC for the past five years is 5,773, and the average number of injuries from these accidents is 4,677. Including lost wages and medical bills, around $77,308 is lost for every severe bicycle accident. In total, that would amount to a cost of $361,569,516 for bicycle-related injuries annually. However, the NYC DOT data does not specify the severity of their injuries. The total expenses lost to bicycle injuries would have to be lower. Comparing the cost of installing edge line rumble strips to the amount of money lost from cyclist injuries, the benefit-to-cost ratio of this proposal would range from 26.67:1 to 47.19:1.

In summary, although biking in NYC can help reduce traffic congestion and air pollution while improving physical health, there are also risks. Being one of the most densely populated cities, NYC harbors heavy traffic congestion; drivers may ignore bike lanes and signs for cyclist safety or fail to yield to cyclists. Every year, it is inevitable that a few thousand people will be injured in a cyclist-vehicle accident. To improve ridership safety and make NYC "greener," installing edge line rumble strips with a white reflective coating on the sides of unprotected bike lanes may save lives. The implementation of edge-line rumble strips will alert drivers and cyclists when drifting out of their intended travel lane and discourage cars from intentionally blocking the bike lane to park or stall. This proposal seeks to build on existing bicycle-friendly infrastructure in NYC and create a safer environment for cyclists and drivers.

EDWARD WANG is a student at Tenafly High School in Tenafly, NJ. Edward will graduate in June 2026.

Mathematical Reasoning

- Average number of bicycle accidents annually involving motor vehicles for the past five years (2018–2022), according to data from the NYC DOT.

  2018: *5,502 accidents*

  2019: *5,846 accidents*

  2020: *6,343 accidents*

  2021: *5,553 accidents*

  2022: *5,621 accidents*

- Average of motor vehicle and bicycle accidents for the past five years:

$$\frac{5502+5846+6343+5553+5621}{5} = 5{,}773 \text{ accidents annually}$$

- Average number of bicycle accidents annually with injuries involving motor vehicles for the past five years (2018–2022), according to data from the NYC DOT.

  2018: *4,304 injuries*

  2019: *4,611 injuries*

  2020: *5,175 injuries*

  2021: *4,618 injuries*

  2022: *4,676 injuries*

$$\frac{4304+4611+5175+4618+4676}{5} = 4{,}676.8 \approx 4{,}677 \text{ injuries annually}$$

Benefit-to-cost Ratio of the Proposal

- According to data from the NYC DOT, milled shoulder and edge line rumble strips reduced accidents by 26 to 46 percent on two-lane roads.
- Including lost wages and medical bills, around $77,308 is lost for every severe bicycle accident.
- Low-range calculation:

  Out of the 4,677 bicycle accidents with injuries in NYC, 1,216 could be prevented by installing edge line rumble strips to currently unprotected bike lanes.

  Benefits (money saved):
  (1,216 accidents)($77,308/accident)

  Cost (edge line rumble strips): *$3,524,000*

  Benefit-to-cost ratio:

$$\frac{(1216 \text{ accidents})(\$77{,}308/\text{accident})}{\$3{,}524{,}000} = 26.67{:}1$$

- High-range calculation:

  Out of the 4,677 bicycle accidents with injuries in NYC, 2,151 could be prevented by installing edge line rumble strips to currently unprotected bike lanes.

  Benefits (money saved):
  (2,151 accidents)($77,308/accident)

  Cost (edge line rumble strips): *$3,524,000*

  Benefit-to-cost ratio:

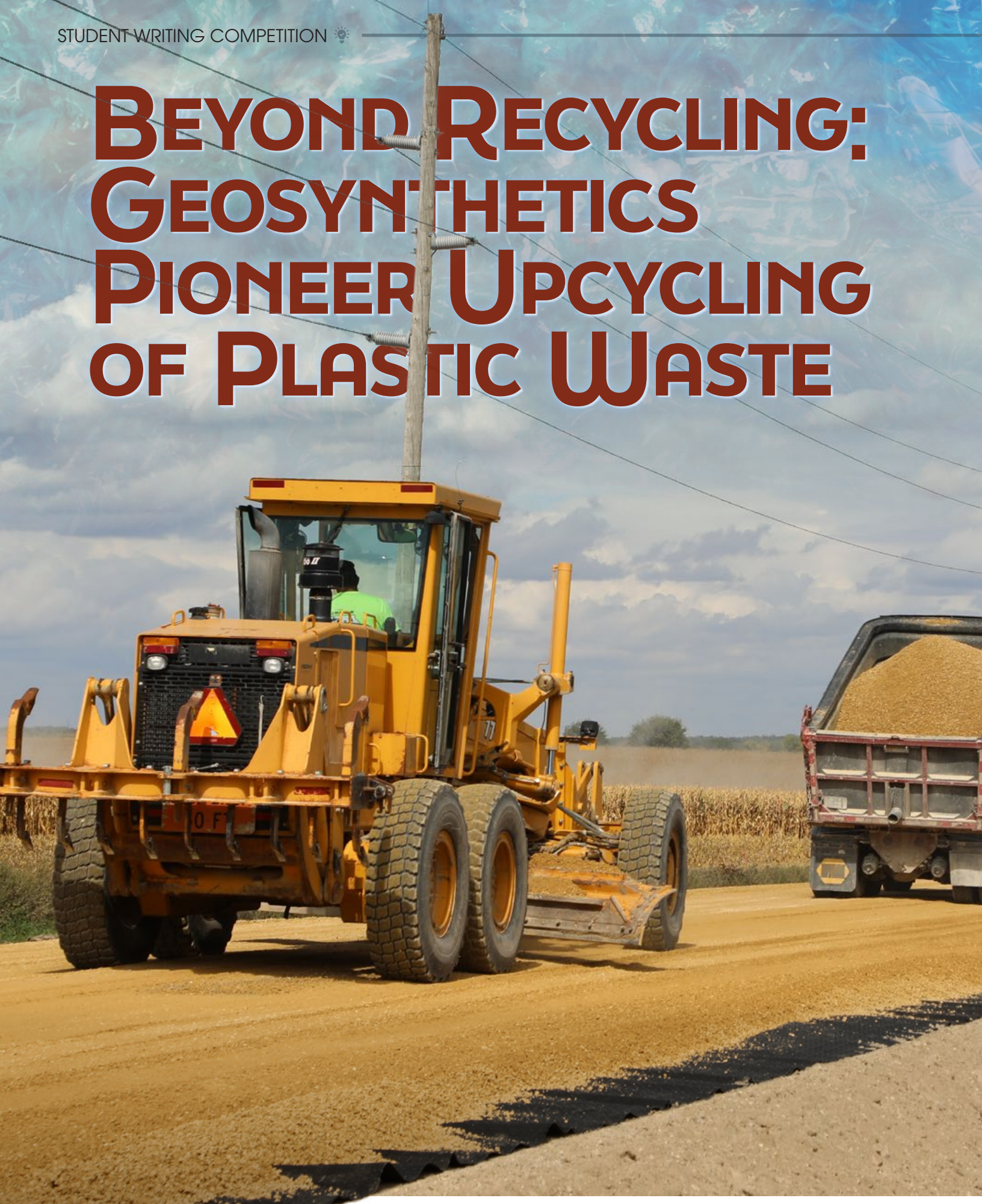
$$\frac{(2151 \text{ accidents})(\$77{,}308/\text{accident})}{\$3{,}524{,}000} = 47.19{:}1$$

Resources:

- "Cycling in the City" https://www.nyc.gov/html/dot/html/bicyclists/cyclinginthecity.shtml
- "Bicycle Crash Data Report 2022" https://www.nyc.gov/html/dot/downloads/pdf/bicycle-crash-data-report-2022.pdf
- "Long-awaited NYC Congestion Pricing Finally Has A Start Date" https://www.nbcnewyork.com/traffic/transit-traffic/congestion-pricing-nyc-start-date/5357389/
- "Rumble Strips and Rumble Stripes: T 5040.39, Revision 1" https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/t504039/
- "Rumble Strips and Rumble Stripes: T 5040.40, Revision 1" https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/t504040/
- "Rumble Strips and Rumble Stripes: Design and Construction" https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/design-and-construction.cfm
- "Rumble Strip and Rumble Stripes: Frequently Asked Questions" https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/faqs.cfm
- "Rumble Strips: Frequently Asked Questions" https://highways.dot.gov/safety/rwd/keep-vehicles-road/rumble-strips/frequently-asked-questions#faq-bicyclesandmotorcycles
- "Bicycle Crash Data" https://www.nyc.gov/html/dot/html/bicyclists/bikestats.shtml#crashdata
- "The Cost of Bicycle Accidents: Why Bike Safety Pays Off" https://www.jdsupra.com/legalnews/the-cost-of-bicycle-accidents-why-bike-3371913/

Roadway pavement markings can protect cyclists but could benefit from rumble strips to enhance safety.

Beyond Recycling: Geosynthetics Pioneer Upcycling of Plastic Waste



by **ARAZ HASHEMINEZHAD**

Plastic waste pollution has become a major global concern, posing serious threats both to the environment and to human health. While traditional recycling methods have their limitations, there's a buzz about a new idea: turning plastic waste into geosynthetics. It's a fresh take on recycling that promises a sustainable solution beyond the usual practices.

Plastic is undeniably handy in our daily lives, but its rampant use comes at a cost to sustainability. Production and disposal of plastic not only releases greenhouse gas emissions but also creates hazardous waste. To make matters worse, plastic often breaks down into tiny particles called microplastics, polluting ecosystems and harming wildlife.

Believe it or not, we are now producing twice as much plastic waste as we did 20 years ago. Unfortunately, much of it ends up in landfills, gets burned, or finds its way into the environment, with only a fraction actually getting recycled.

Most of the plastics we use today are "virgin" plastics, meaning they are made from crude oil or gas. While there has been some increase in using recycled materials, it is still just a drop in the ocean compared to total plastic production.

So, what is the solution? Enter upcycling. Instead of just recycling, upcycling involves creatively repurposing waste to give it new life and value. And one exciting application is transforming plastic waste into geosynthetics—planar products that are generally manufactured from durable polyethylene or polypropylene polymer materials and are used in soil, rock, earth, or other geotechnical engineering-related applications.

Why geosynthetics? Well, while they are often used in road construction to reinforce weak subgrades—a common headache for engineers—most geosynthetics are made from new plastics, which aren't very sustainable or eco-friendly.

By upcycling plastic waste into sustainable geosynthetics, we could tackle two problems at once: plastic pollution and weak road foundations.

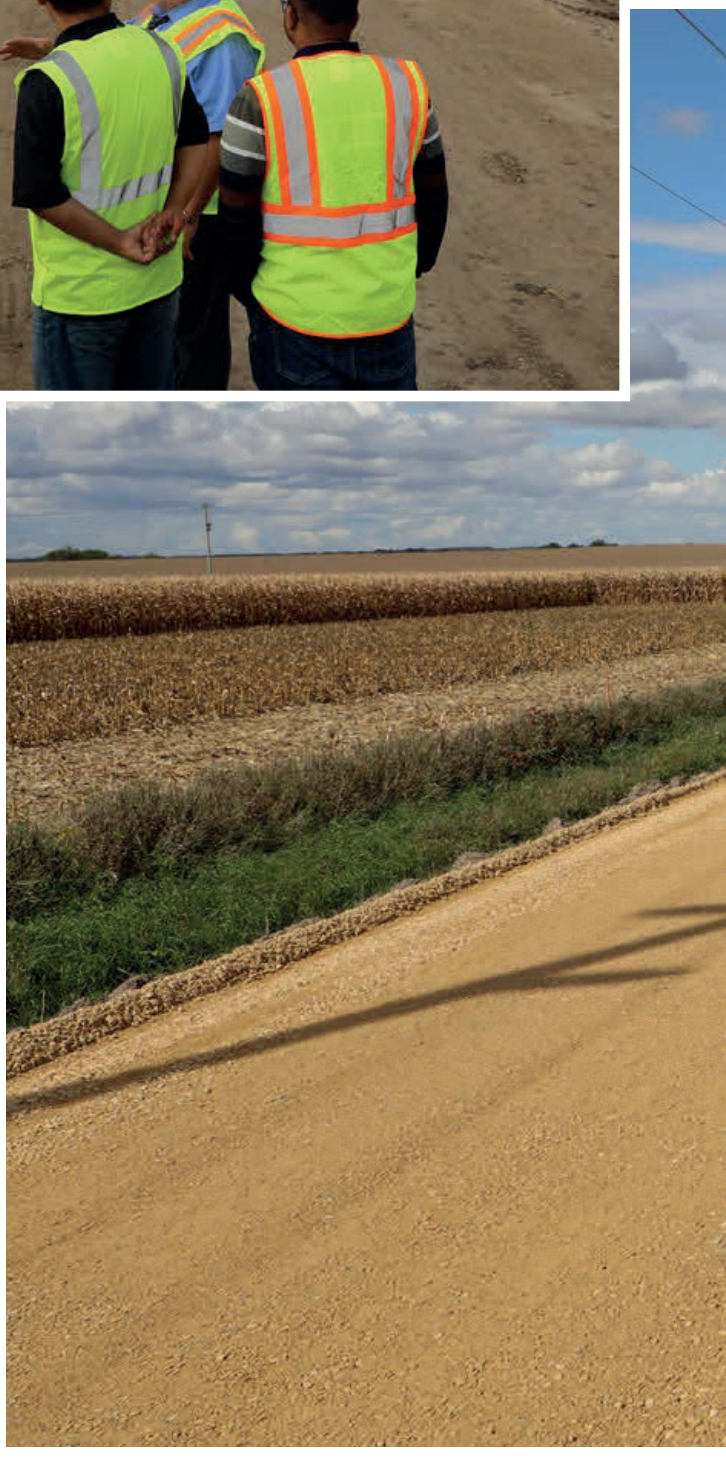
New Process Leading to Stronger Material

A newly developed composite geosynthetic manufacturing process utilizes advancements in material and manufacturing technology, particularly in the initial stages, to create a composite geosynthetic consisting of a geogrid made of 100 percent upcycled polypropylene bonded to a nonwoven geotextile. This process involves melting polymer beads and extruding them into a three-layered sheet with a white/black/white appearance through

INSET: Unpaved road with frost damage in Buchanan County, IA.

PREVIOUS PAGE AND LEFT: A newly developed composite geosynthetic installation in Buchanan County.

The research team visiting the field construction in Buchanan County, where a drone is taking photos and videos at the site. © Araz Hasheminezhad.



coextrusion. The three layers are extruded simultaneously, forming a single sheet without any joining.

Now, with regard to the practicality of using these sustainable geosynthetics in a real-world scenario, such as an unpaved road in the United States, the goal is bridging the gap between waste management and civil engineering, possibly leading to innovative solutions to meet both environmental and infrastructure challenges. It's a story of turning trash into treasure, with potential benefits that reach far beyond just one road.

Iowa's Groundbreaking Approach

The research project, TR-799: Base Stabilization of Iowa Granular Roads Using Recycled Plastics, is ongoing in Buchanan County, Iowa, and is funded by the Iowa Highway Research Board and the Iowa Department of Transportation (Iowa DOT). In the heartland of America, innovation meets infrastructure as Iowa pioneers a groundbreaking approach to unpaved road stabilization. Nestled in the rural landscape, three full-scale test road sections stand as testaments to progress, each poised to redefine road construction as we know it.

At the forefront of this endeavor lies a newly developed composite geosynthetic, poised to revolutionize road stabilization. Comprising a fusion of a geogrid crafted from upcycled plastic and a nonwoven geotextile, this innovative marvel promises durability with an eco-conscious edge.

Through rigorous testing, including exposure to real traffic loads ranging from trucks to farm equipment, the performance of these unpaved test sections was examined by an Iowa State University research team. Utilizing field tests such as the dynamic cone penetrometer (DCP) test and the lightweight deflectometer (LWD) test, the performance metrics were meticulously assessed. The DCP is a highly efficient and effective tool for testing soil strength onsite, monitoring

the condition of granular layers and subgrade soils in pavement sections over time, and uses a simple, easily portable instrument. The LWD test provides rapid determination of the elastic modulus—a key factor in mechanistic pavement design—and is used to assess the overall compaction quality of pavements.

The result, unpaved roads fortified with geocomposite, emerged triumphant, showcasing a significant reduction in permanent deformation over the evaluation period. These results underscore the transformative potential of the geocomposite in enhancing road performance, paving the way for a future where durability meets sustainability on every unpaved stretch.

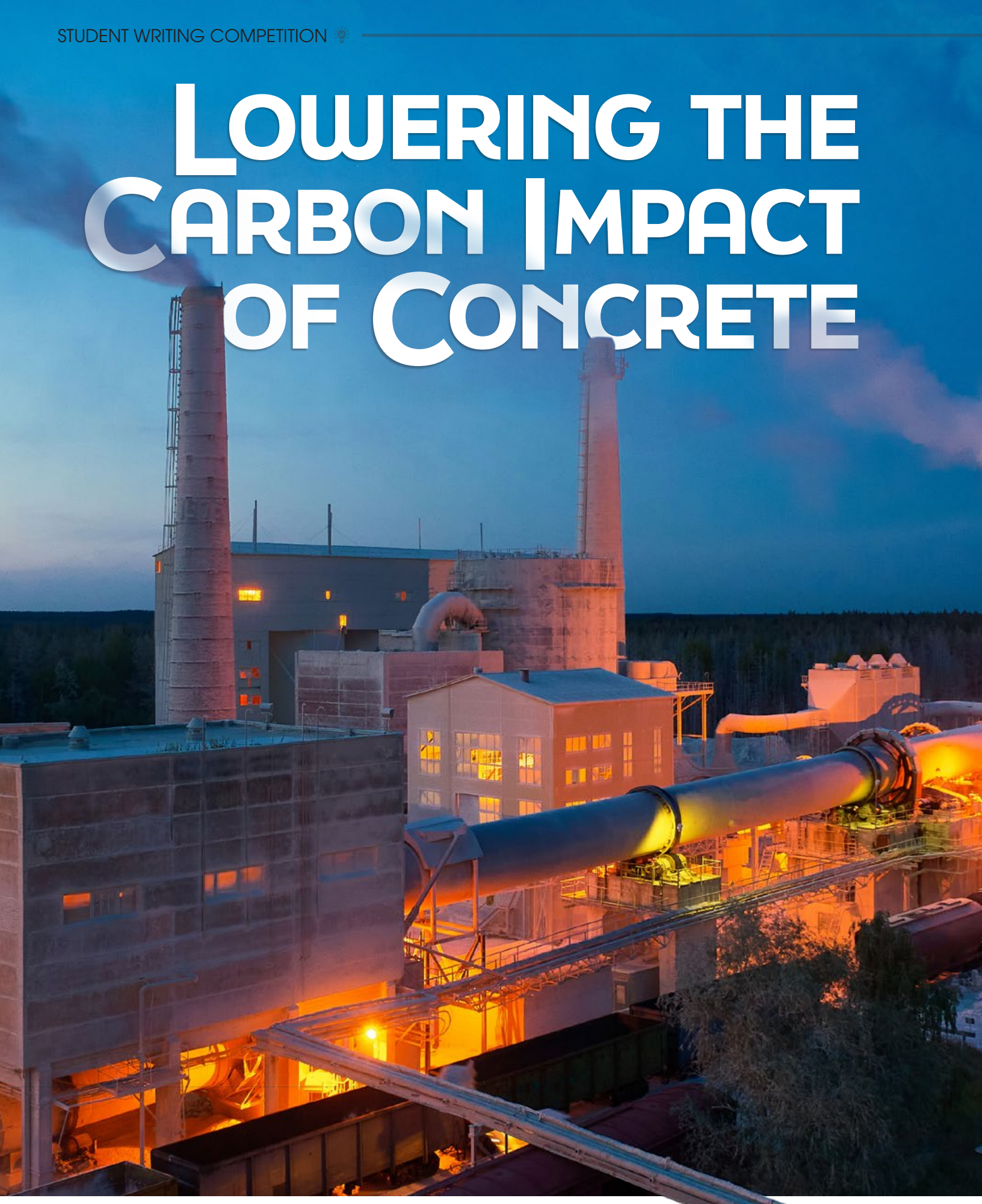
As the journey continues, the need for continuous monitoring and evaluation of these test sections over extended periods remains paramount. With each passing mile, the promise of a smoother, more sustainable road ahead beckons—a testament to the power of innovation in shaping the highways and byways of tomorrow.

ARAZ HASHEMINEZHAD is a graduate student at Iowa State University. Araz is currently studying geotechnical engineering and will graduate in 2026.

For more information on the TR-799 project, visit: *https://prosper.intrans.iastate.edu/research/in-progress/base-stabilization-of-iowa-granular-roads-using-recycled-plastics/*

Unpaved road monitoring by field tests (dynamic cone penetrometer test on the subgrade) in Buchanan County.

Lowering the Carbon Impact of Concrete

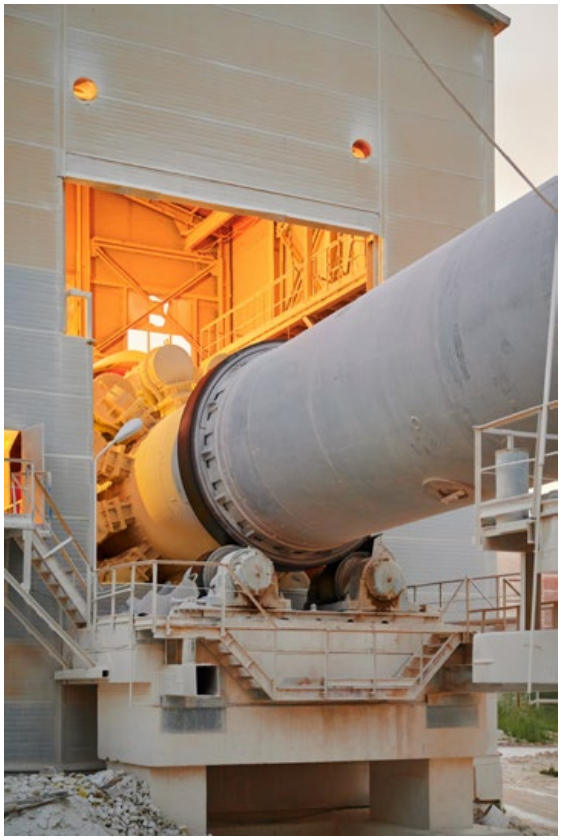


by **COLLIN MATTHIES**

Concrete is the most consumed man-made material in the world, with cementitious materials making up more than half of everything produced globally. A primary concern of concrete is related to the greenhouse gas (GHG) emissions released in its production, contributing to climate change. There is clear scientific research citing potential catastrophic climate consequences with a 1.5 °C increase in global temperature from pre-industrial averages. To avoid this, experts cite a need to reach net zero emissions by 2050. This paper will summarize current research on concrete carbon emissions, provide pathways and challenges toward decarbonizing the concrete industry, and explore the transportation sector's role in implementing carbon reduction practices related to concrete.

In cement production, calcium carbonate, otherwise known as limestone, is burned in a kiln reaching 1,500 °C, where a chemical reaction known as calcination takes place, breaking the bond between the solid calcium oxide and carbon dioxide gas. The product formed in the kiln from the reactions of limestone, clay, and other raw materials are solid chunks called clinker, which is the primary component of cement. Sixty percent of carbon dioxide emissions in clinker production come from the calcination reaction with the remaining 40 percent coming from the combustion of fossil fuels that heat up the kiln. Methods of lowering carbon emissions from concrete can be outlined in two primary methodologies: optimizing the existing process of ordinary portland cement (OPC) production and using limestone alternate binders in place of OPC.

Studies show that 76 percent of the GHG emissions from cement and concrete production can be reduced through optimization of the existing production processes. To mitigate the carbon impact of combustible fossil fuels heating the kiln, two options exist. Waste materials such as biomass, used tires, or sewage sludge can be burned to supplement or replace fossil fuels. The heating process can also be electrified, with energy supplied by renewable sources. Calcination related emissions can be reduced by lowering the clinker to cement ratio. A percentage of clinker can be replaced with supplementary cementitious materials, such as fly ash, slag, and silica fume, which are waste materials from industrial processes. Another method of decreasing clinker content is replacing a portion of clinker with limestone, known as Type IL portland-limestone cement. Additionally, the strength of concrete can be optimized, as with ultrahigh performance concrete and basalt fiber-reinforced concrete, which decreases the amount of concrete required to achieve the same strength requirements. Finally, carbon dioxide capture and storage have potential is limiting the carbon dioxide release from the processing plant.



The other method of lowering carbon dioxide emissions in concrete is in the use of limestone alternatives as the primary binder in concrete, bypassing the calcination reaction. There are multiple non-carbon concrete products such as magnesium oxide concrete, calcium sulfoaluminate based concrete, and alkali-activated binders. The primary challenges associated with greater adoption of limestone alternatives are a lack of long-term studies of their characteristics as well as a current economic disadvantage in comparison with OPC. Massive capital investment is needed in these alternatives to lower the cost of production and show its sustained durability and strength in varying conditions.

To expand on the real-world application of this topic, the transportation sector is one of the primary consumers of concrete with the vast concrete infrastructure necessary in maintaining accessibility and access across our built world. The U.S. government has made significant investment

LEFT: A giant rotating furnace is used in the factory for roasting limestone.

PREVIOUS PAGE: Concrete-making is a round-the-clock type of operation to keep supplies high.

ABOVE: Large piles of sand in a quarry are destined to be used to make concrete in a factory.
© Enrique del Barrio / AdobeStock.com.

FOLLOWING PAGE: Concrete is used for many purposes, but it's use in transportation is critical to create strong, safe, and reliable structures.
© Touch1976 / AdobeStock.com.

in recent years to aid in the effort of decarbonizing the transportation industry, most recently in the U.S. Inflation Reduction Act (2022), which established the Federal Highway Administration's Low Carbon Transportation Materials (LCTM) Program. The LCTM program provides $2 billion to fund low carbon materials, $800 million of which will be reserved for non-State applicants.

Among numerous other non-State entities, the FHWA's Federal Lands Highway Division—responsible for planning, developing, and administering projects on behalf of various Federal and non-Federal agencies—will be in a position to apply for funding through the LCTM grants program once applications are opened. A recent conversation with Mike Baron, technical services branch chief of the Western Federal Lands Highway Division (WFLHD) shared how WFLHD initiatives are advancing the use of LCTMs. The LCTM funding presents an opportunity for WFLHD and other non-State applicants to promote the utilization of LCTMs. While the specific grant application process for non-State applicants has yet to be announced, the program's official website outlines several potential funding opportunities, including "reimbursement or incentives for eligible recipients to use construction materials and products with significantly lower embodied greenhouse gas emissions in projects." Presently, the selection of concrete type and supplier for WFLHD projects is left to the contractor, typically chosen based on economic feasibility and project specific needs. Under this LCTM grant program, funding is expected to be available to cover the price difference between traditional concrete and low-carbon alternatives. This enables agencies to opt for the more expensive low-carbon concrete option while being financially responsible only for the price of traditional concrete. Consequently, this investment in low-carbon concrete suppliers aims to reduce the price disparity between the two options in the long term. Type IL cement, previously discussed as a viable means to reduce carbon dioxide emissions, is already accepted in WFLHD projects as an approved alternative within Federal project specifications. Both Federal and State departments of transportation must continue incentivizing contractors to embrace best practices for minimizing carbon emissions in cement production. Given the transportation industry's substantial role, establishing policies and practices that prioritize low-carbon options is essential as we approach the target of achieving net-zero emissions by 2050.

COLLIN MATTHIES was a graduate student at Texas Tech University. He studied civil engineering and graduated in December 2024.

Resources

- "Recent advances in the concrete industry to reduce its carbon dioxide emissions." https://doi.org/10.1016/j.envc.2020.100004.
- "Alternative Clinker Technologies for Reducing Carbon Emissions in Cement Industry: A Critical Review." https://doi.org/10.3390/ma15010209.
- "Alternative Clinker Technologies for Reducing Carbon Emissions in Cement Industry: A Critical Review." https://doi.org/10.3390/ma15010209.
- "A Short Review on Alkali-activated Binders and Geopolymer Binders." https://orbilu.uni.lu/bitstream/10993/35284/1/A%20short%20review.pdf.
- "The History of Concrete and Cement." https://www.thoughtco.com/history-of-concrete-and-cement-1991653.
- "Carbon Reduction Program." https://www.transportation.gov/priorities/climate-and-sustainability/carbon-reduction-program.
- "Why Portland Limestone Cement Is Becoming More Common." https://www.cemexusa.com/documents/27329108/59104358/plc-testing-technical-brief-20230720.pdf.
- "Cement: Background and Low-Carbon Production." https://crsreports.congress.gov/product/pdf/IF/IF12526.
- "U.S. Cement Industry Carbon Intensities (2019)." https://www.epa.gov/system/files/documents/2021-10/cement-carbon-intensities-fact-sheet.pdf.
- "Solving Cement's Massive Carbon Problem." https://www.scientificamerican.com/article/solving-cements-massive-carbon-problem/.
- "Trends and developments in green cement and concrete technology." https://doi.org/10.1016/j.ijsbe.2013.05.001.
- "Inflation Reduction Act - Low-Carbon Transportation Materials Grants | Federal Highway Administration." https://www.fhwa.dot.gov/inflation-reduction-act/fact_sheets/lctm_grants.cfm.
- "Low-Carbon Transportation Materials Grants Program - Federal Highway Administration." https://www.fhwa.dot.gov/lowcarbon/.
- "Near-term pathways for decarbonizing global concrete production." https://doi.org/10.1038/s41467-023-40302-0.
- "A cure for carbon: Putting CO2 to work in concrete manufacturing." https://www.plant.ca/features/a-cure-for-carbon-putting-co2-to-work-in-concrete-manufacturing/.
- "Myths of low carbon concrete." https://www.youtube.com/watch?v=VYhIv9YhDWw.
- "China uses as much cement in two years as the US did over the 20th century." https://www.sustainabilitybynumbers.com/p/china-us-cement.
- "Recent progress and technical challenges in using calcium sulfoaluminate (CSA) cement." https://doi.org/10.1016/j.cemconcomp.2022.104908.
- "Future directions for the application of zero carbon concrete in civil engineering – A review." https://doi.org/10.1016/j.cscm.2022.e01318.
- "Comparisons of alkali-activated binder concrete (ABC) with OPC concrete - A review." https://doi.org/10.1016/j.cemconcomp.2022.104851.
- "The Beauty Of Biological Concrete." https://www.sciencefriday.com/articles/living-concrete-buildings/.
- "The Performance of Carbonation-Cured Concrete." https://doi.org/10.3390/ma12223729.
- "A review of the mechanical properties and durability of basalt fiber-reinforced concrete." https://doi.org/10.1016/j.conbuildmat.2022.129360.

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

ABOVE: A research team in Minnesota set out to prove that LiDAR on automatic vehicles was helpful in detecting obstacles in harsh weather conditions. © Steve / AdobeStock.com.

Technical News

Advancing AV Technology to Tackle Adverse Weather

Light detection and ranging (LiDAR) is a critical technology that automatic vehicles (AVs) depend on to potentially reduce roadway fatalities and serious injuries. However, the laser radar system that creates three-dimensional maps of the vehicle's surroundings in real time has traditionally struggled with accuracy in adverse weather conditions—much like the below-freezing temperatures and wintry mix characteristics of Minnesota winters. As a result, the Minnesota Department of Transportation and researchers from the University of Minnesota set out to prove LiDAR can work in harsh meteorological conditions and recommend solutions to enhance AV performance.

LiDAR's performance was tested in controlled and uncontrolled environments. For example, the research team tested its performance in foggy conditions using a fog chamber. The research team installed a LiDAR system on the roof of a test vehicle for snowy conditions. Researchers evaluated the technology in real-world settings, including moderate snow fall and snowstorm conditions. During testing, the team used mathematical models to help the system recognize and eliminate snow from its collected data. The team recommended hardware design changes after ice accumulation blocked the LiDAR's sensors.

While more research is needed, the project shows that LiDAR is useful in detecting obstacles in adverse weather conditions. "Due to their ability to provide rich data under various weather conditions, LiDAR sensors are one of the most commonly used sensors, along with other sensors, to provide an accurate representation of the 'world view' for the many automated vehicle platforms across the world," says Govindarajan Vadakpat, Cooperative Driving Automation Program manager in the Federal Highway Administration's Office of Safety and Operations Research and Development. Additional research will help identify enhancements to further refine LiDAR and help AVs improve and become safer.

For more information, visit *https://www.cts.umn.edu/news/2023/april/lidar*.

Public Information and Information Exchange

Selma to Montgomery March Byway Turns 60

The year 2025 will mark the 60th anniversary of the Selma to Montgomery protest marches for voting rights, a pivotal event in the American civil rights movement. The marches covered a 54–mile (87–kilometer) stretch of U.S. 80, the Jefferson Davis Memorial Highway, from Selma, AL, to the Alabama State Capitol in Montgomery.

The Selma to Montgomery National March Byway, also known as the Selma to Montgomery Historic Trail, preserves the events in March 1965. Designated by the U.S. Department of Transportation as an All-American Road under the National Scenic Byway Program, the byway includes city streets and countryside roadways (where marchers camped at night), and historical sites, such as the Edmund Pettus Bridge, which became a well-known symbol of the marches. On March 7, marchers were beaten and battered by law enforcement officers on the bridge and the harsh encounter was televised across the

Nation that evening. The encounter, known as "Bloody Sunday," garnered widespread support for the civil rights movement.

The march resumed on Sunday, March 21, under the leadership of Dr. Martin Luther King, Jr. More than 3,000 participants crossed the Edmund Pettus Bridge. As the march continued, the number of participants varied but was reduced to 300, under court order, on the 22–mile two-lane stretch of U.S. 80 in Lowndes County. The march organizers configured its logistical aspects, including the marchers' access to food, water, sanitation, and other needs. By Wednesday, no longer limited by the court order, additional marchers returned. On the final day, Dr. King led about 12,000 marchers into the city, where his stage was the back of a flatbed truck. He told the crowd that, "The road ahead is not altogether a smooth one. There are no broad highways to lead us easily and inevitably to quick solutions. We must keep going." Five months later, on August 6, President Lyndon B. Johnson signed the Voting Rights Act of 1965, one of the landmark bills of the Civil Rights Movement.

In 1993, Congressman John Lewis, who suffered a cracked skull as a marcher on Bloody Sunday, introduced a bill in Congress to designate the route of the marches as a national historic trail. In 1996, Congress authorized the Selma to Montgomery March Byway; on November 12, 1996, the trail was established as a unit of the National Park System. The Edmund Pettus Bridge—named after a Civil War general who served in the U.S. Senate from 1897 until he died in 1907—was declared a National Historic Landmark in February 2013 and remains the most visible symbol of the bravery and determination of those who crossed that bridge in 1965 to secure voting rights for all entitled to them.

Twenty-five-year-old John Lewis helped lead protestors across the Edmund Pettus Bridge in 1965. *Courtesy National Archives, photo no. 222097049.*

To view Dr. King's speech from Selma in its entirety, visit *https://kinginstitute.stanford.edu/publications/autobiography-martin-luther-king-jr/chapter-26-selma#:~:text=For%20all%20of%20us%20today,We%20must%20keep%20going*.

MassDOT Announces $6.5 Million Shared Streets & Spaces Program Awards

In August 2024, the Massachusetts Department of Transportation (MassDOT) announced $6.5 million in funding for active transportation projects across the State through the Shared Streets and Spaces Program, including 28 municipalities and two regional transit authorities. The program encourages quick implementation of projects to improve plazas, sidewalks, curbs, streets, bus stops, parking areas, and other public spaces.

With a focus on improving public health, ensuring safe mobility, and strengthening commerce, funds were dedicated to a variety of walking- and biking-related projects. For instance, Boston received nearly $230,000 for a new crossing island at the Saratoga Street crosswalk, curb extensions near the Orient Heights busway, all-way stop control at Barnes Avenue/Bayswater Street, and more. Malden received nearly $250,000 to construct a pedestrian plaza in the Bell Rock neighborhood and install new Americans with Disabilities Act (ADA)-compliant curb ramps and crosswalks. Springfield received nearly $241,000 to install a crosswalk with a speed table and add a high-intensity activated crosswalk signal. Wakefield received nearly $247,000, in part, to create a new pocket park, and Dedham received nearly $249,000 to construct ADA-accessible sidewalks and paths, protective curbing, bicycle racks, a water bottle filling station, and more.

For more information, visit *https://www.mass.gov/news/massdot-announces-65-million-shared-streets-spaces-program-awards*.

NDDOT Launches Program in Schools to Promote Transportation Careers

In August 2024, the North Dakota Department of Transportation (NDDOT) announced that it had launched a new education program in science, technology, engineering, and mathematics (STEM) for high school students in grades 9 through 12. The program, known as STEM Outreach Solutions and created by the Association of State Highway and Transportation Officials, will help NDDOT promote and garner interest in transportation careers among students in North Dakota schools using hands-on class instruction focusing on civil engineering and other transportation-focused modules like bridge design, environmental engineering, traffic engineering, and highway safety.

The program's curriculum, introduced to teachers at the North Dakota Career and Technical Educational Professional Development Conference, aligns with national high school educational performance standards and is available to schools at no cost. While educators will teach most of the curriculum to their students, NDDOT and consultant engineers will collaborate with educators by visiting classrooms, teaching additional activities, and discussing the role of math and science in transportation careers.

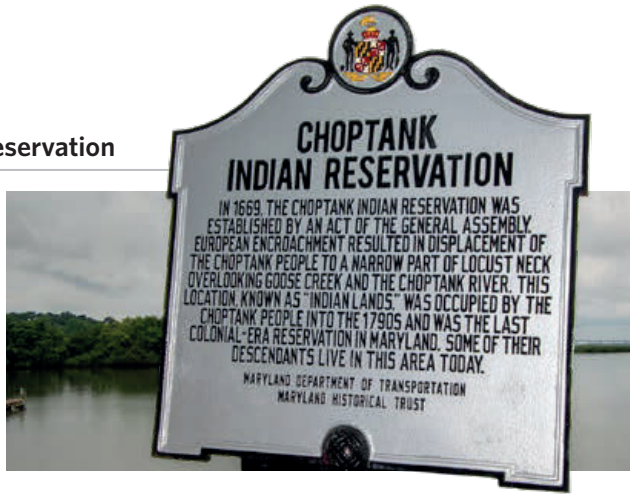
For more information, visit *https://www.dot.nd.gov/news/nddot-launches-stem-program-promote-transportation-careers*. For more on students in STEM, see the Student Writing Competition articles in the Winter 2024 issue (*https://highways.dot.gov/public-roads/winter-2024*), and more Student Writing Competition articles in this issue of Public Roads.

Historical Marker in Maryland Honors Choptank Indian Reservation

The Nause-Waiwash Band of Indians, Inc. hosted an unveiling event in July 2024, for a new roadside historical marker in Cambridge, MD, honoring the Choptank Indian Reservation. Overlooking the Choptank River, the reservation was established in 1669 by the Maryland General Assembly and occupied by the Choptank People until the 1790s.

For the Tribe, the site serves as a connection to the original inhabitants. The Choptank Indians had a vibrant culture characterized by cultural practices and traditions centered around the land and water. Their intricate basketry, made of natural materials such as river cane, sweetgrass, and cattail, has passed from generation to generation. The baskets are both functional and decorative, used for storytelling, storage, ceremonial, and transportation purposes.

The new roadside marker is part of a broader effort by the Maryland Department of Transportation and the Maryland Historical Trust to increase the number of markers that bring more attention to the State's rich history and heritage.



For more information on the Maryland Roadside Historical Marker program, visit: *https://www.mdot.maryland.gov/tso/pages/Index.aspx?PageId=201&utm_medium=email&utm_source=govdelivery*.

For more on historical markers, see the article "From Then to Now: History Along the Roadway" in the Summer 2023 issue of Public Roads: *https://highways.dot.gov/public-roads/summer-2023/02*.

NYC DOT's Public E-Bike Charging Pilot Shows Promise

In August 2024, the New York City Department of Transportation (NYC DOT) announced the initial success of the agency's public electric bike (e-bike) charging pilot. Launched in spring 2024, the pilot—within the first five months of its six-month span—showed significant promise. Best practices arising from the pilot will guide future investments in micromobility charging infrastructure around NYC.

Involving 120 delivery workers from Brooklyn, the Bronx, Manhattan, Staten Island, and Queens, the pilot addresses the city's dramatic rise in lithium-ion battery fires and aims to test the safe charging of lithium-ion batteries by delivery workers in regulated public spaces. Improper charging, storing, or disposing of the rechargeable batteries—found in items such as e-bikes, cars, and phones—can lead to overheating, which can start a fire and cause serious injuries, fatalities, and property damage.

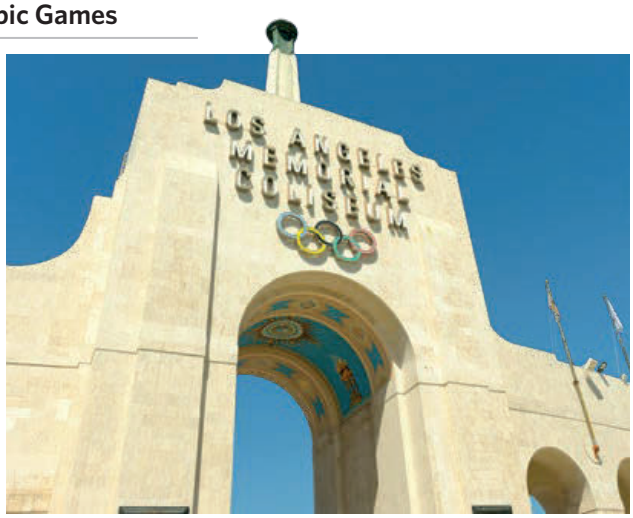
After the pilot began, more than 50 percent of the pilot's participants, who attended focus group sessions hosted by NYC DOT, reported that they had stopped charging their batteries at home in favor of using one of the five battery charging stations set up for the pilot. More than 8,000 battery swaps and nearly 1,000 onsite e-bike charges have been recorded at the charging locations since March, and overall, participants reported that they were able to complete more deliveries because of the availability to charge and swap batteries at public locations.

For more information, visit *https://www.nyc.gov/html/dot/html/pr2024/nyc-dot-successful-charging-pilot.shtml*.

In the Works: Transit-First 2028 LA Olympic and Paralympic Games

In August 2024, the mayor of Los Angeles, CA, announced plans to host a transit-first Olympic and Paralympic Games when the city hosts the event in 2028. Organizers have already begun ironing out plans to accomplish this goal, which will involve collaborating with city transportation agencies regarding their ongoing plans to expand its public transportation bus and rail system, as well as borrowing an additional 3,000 buses from transit systems around the Nation.

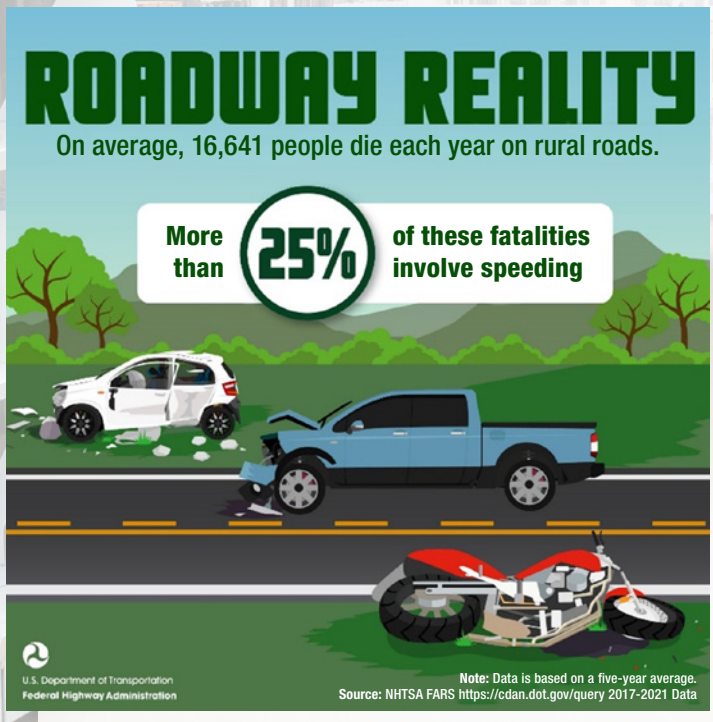
Easing the city's notable traffic gridlocks is also part of the plan, which includes holding some sporting competitions across the LA metropolitan area and beyond (the plan will also provide additional venues to hold sporting events). For example, handball, sailing, artistic swimming, water polo, canoe sprinting, rowing, marathon swimming, and the triathlon will be held in Long Beach; swimming will be held in Inglewood; equestrian will take place in Temecula; badminton will be held at the University of Southern California; tennis, rugby, track cycling, and field hockey will be in Carson; and softball and canoe slalom will take place in Oklahoma City, OK—more than 1,500 miles (2,414 kilometers) away. Work hours of locals will be staggered, and they will be encouraged to work from home throughout the games' 17-day duration. Nevertheless, organizers are approaching their plans for the games with an overall focus on making lasting environmental and transportation improvements in Los Angeles.

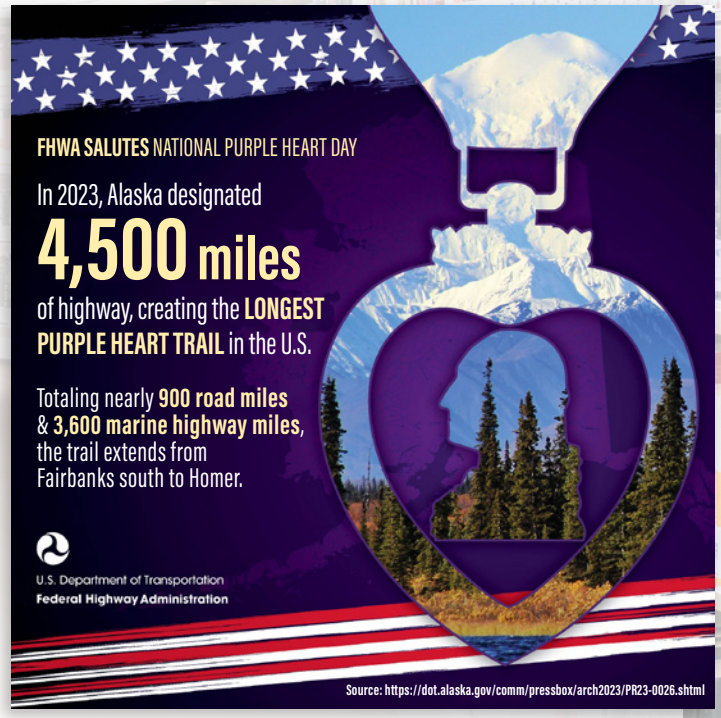


ABOVE: A new historical marker in Cambridge, MD, honors the Indigenous people who lived along the Choptank River.
© MDOT State Highway Administration.

RIGHT: The LA Memorial Coliseum will host part of the Olympic Games in 2028. The Coliseum also hosted the games in 1932 and 1984.
© dbvirago / AdobeStock.com.

Interesting Facts





For more interesting facts, visit the Federal Highway Administration on social media: https://www.facebook.com/FederalHighwayAdmin, https://twitter.com/USDOTFHWA, https://www.linkedin.com/company/federal-highway-administration/posts/?feedView=all, and https://www.instagram.com/federalhighwayadmin/.

Paving the Way Forward

by **JONATHAN STRAUSS**

The National Highway Institute's (NHI) strategic priorities align with transportation innovation and help advance robust training programs to support that alignment. NHI's strategies include emphasizing its brand and story, forging strong partnerships, engaging stakeholders, prioritizing wellness, and embracing technology and innovation. These priorities guide its learner-centric philosophy and mission to create a knowledgeable and forward-thinking workforce that supports safer, more efficient, and sustainable transportation systems.

Narrative of Excellence

NHI has grown from its modest beginnings that included a handful of basic trainings and instructors to become an institute with an extensive course catalog organized into 18 program areas and delivered in three unique training formats, all of which can be found on NHI's website at *https://www.nhi.fhwa.dot.gov/training/*. These efforts ensure NHI's offerings remain relevant to the transportation community.

Building Bridges to Success

By collaborating with Federal, State, and local agencies; private industry leaders; and other educational institutions, NHI leverages expertise and resources to help its learners. Partnerships empower NHI to create learning modules and learner-centric delivery methods. NHI and its partners address the complex transportation challenges facing the world, ensuring learners have the knowledge and skills they need for success.

NHI exemplified successful collaboration through its recent presentation at the 2024 National Local Technical Assistance Program (LTAP) and Tribal Technical Assistance Program (TTAP) Annual Conference. Through an agreement with the National Local and Tribal Technical Assistance Program Association (NLTAPA), NHI shared a list of courses tailored to the needs and interests of the attendees, encouraging the use of relevant and impactful NHI offerings.

Changing Together

NHI's learner-centric model is shaped by valuable feedback from course instructors and hosts, course participants, and partners in Federal, State, and local transportation agencies. NHI's inclusive approach ensures that courses and initiatives meet our audience's evolving needs and expectations.

NHI hosts regular forums and workshops to facilitate dialogue and gather feedback. For example, at the NLTAPA 2024 conference, Stacey Caston, NHI's director, and Lauren Harrington, a Federal Highway Administration instructional systems designer and contractor, led a masterclass on strategies for maintaining learner engagement. The session included sharing insights, discussing challenges, and exploring solutions to address broader communication concerns with learners.

Nurturing Wellness

NHI prioritizes the wellness of its community, recognizing that a healthy workforce is essential for delivering high-quality education and fostering active learning. Circle of Learning, the learner-centric model outlined in the following document, *https://www.nhi.fhwa.dot.gov/resources/docs/circle_of_learning.pdf*, empowers everyone to excel by providing the resources and guidance for success.

Transportation Future

NHI is committed to fostering innovative solutions that enhance the Nation's transportation system and empower individuals to learn and improve that system. As part of its belief in the power of technology to aid people in their lives, NHI has upgraded its services to a new learning management system (LMS), located on its website at *https://fhwanhi.geniussis.com/RegistrationByCourse.aspx#*. The new LMS offers a comprehensive range of courses and functionalities designed to equip learners with the skills they need to excel in their transportation careers.

Leading the Way

NHI's strategic priorities serve as a roadmap for achieving superior outcomes for learners, instructors, and the future of transportation worldwide. By emphasizing its brand and story, forging strong partnerships, engaging stakeholders, prioritizing wellness, and embracing technology and innovation, NHI is paving the way forward for current and future generations of highway transportation professionals. For more information about NHI course offerings, visit NHI's website at *https://www.nhi.fhwa.dot.gov/home.aspx*.

JONATHAN STRAUSS is a senior communications specialist and contractor for FHWA.

ABOVE LEFT: NHI Director Stacey Caston leads a workshop at the NLTAPA's 2024 LTAP and TTAP Annual Conference. *Source: FHWA.*

ABOVE RIGHT: Local roads assistance programs help small towns develop safer, more sustainable infrastructure. *© Kristina Blokhin / AdobeStock.com.*

INSET: *Source: NHI.*

SCRC

SMART COMMUNITY RESOURCE CENTER

Source: USDOT.

The Smart Community Resource Center

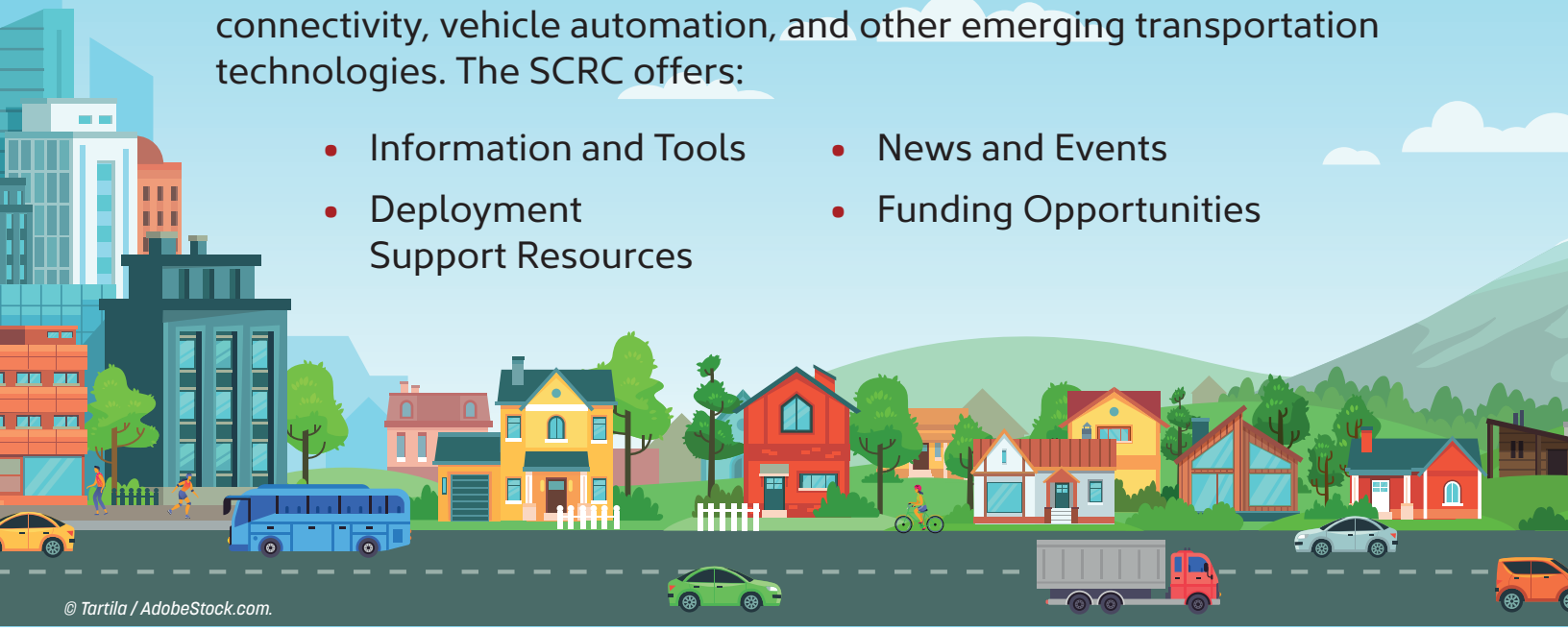
What You Need When You Need It

USDOT IS MAKING RESOURCES READILY AVAILABLE TO ITS DEPLOYERS.

Created by the U.S. Department of Transportation's Intelligent Transportation Systems (ITS) Joint Program Office (JPO), the Smart Community Resource Center (SCRC) helps connect States, Tribal governments, and local communities with the knowledge and expertise they need to advance their ITS and smart community transportation projects and programs.

The SCRC includes USDOT resources related to interoperable connectivity, vehicle automation, and other emerging transportation technologies. The SCRC offers:

- Information and Tools
- Deployment Support Resources
- News and Events
- Funding Opportunities



To access the SCRC, visit https://www.its.dot.gov/scrc.

You're Invited to Visit

FHWA's Turner-Fairbank Highway Research Center

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

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

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

You are welcome any time. Our doors are always open!

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

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Attn: HRTM
1200 New Jersey Avenue, SE
Washington, DC 20590

Official Business
Penalty for Private Use $300

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