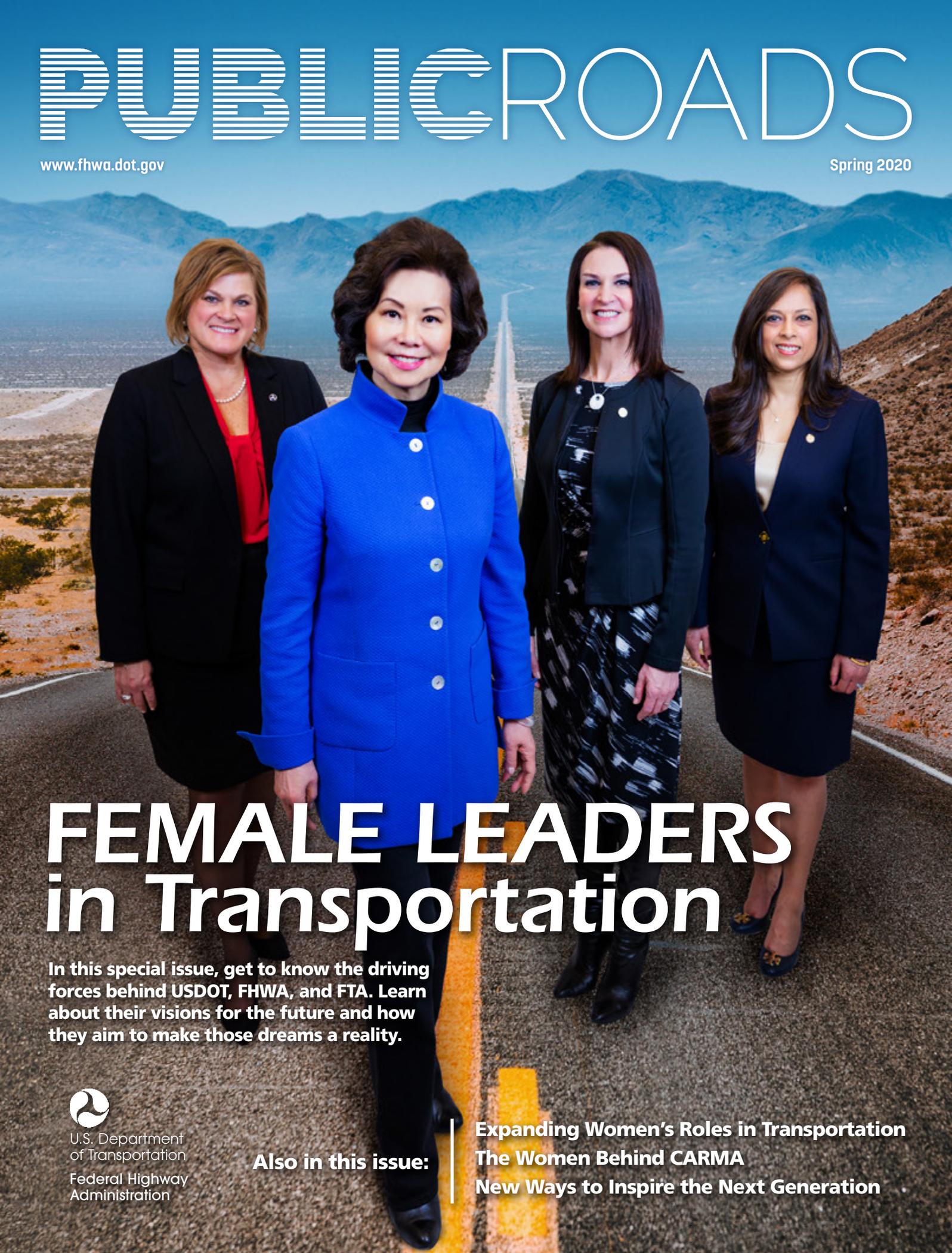


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Spring 2020



FEMALE LEADERS in Transportation

In this special issue, get to know the driving forces behind USDOT, FHWA, and FTA. Learn about their visions for the future and how they aim to make those dreams a reality.



U.S. Department
of Transportation
Federal Highway
Administration

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Expanding Women's Roles in Transportation
The Women Behind CARMA
New Ways to Inspire the Next Generation



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COVERS and ABOVE—Success is built on shared visions; dedication to excellence; and unwavering commitment to safety, resilience, and mobility. The women of USDOT, FHWA, and FTA are moving transportation into the future through innovative thinking and paving the path forward for the Nation. From left: K. Jane Williams, FTA; Elaine L. Chao, USDOT; Nicole R. Nason, FHWA; and Mala K. Parker, FHWA.

Foreground source: USDOT.

Background © bluejayphoto / iStockphoto.



U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
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Transportation = Connecting People



Transportation is deeply personal for most people. In my case, I particularly cherish a photo of my mother and sister standing next to our family's first new car: an Oldsmobile station wagon. We are immigrants. Before being able to buy this car, we had to rely upon the kindness of neighbors, other church members, and friends or the subway for transport. This car represented FREEDOM and INDEPENDENCE!!!

It had room for our family of five (parents and three daughters at the time), with space to spare! My father cheerfully drove our station wagon around the East Coast so we could see the sights in our new homeland. We took trips as a family to Acadia National Park in Maine; the Pocono Mountains in Pennsylvania; Bear Mountain near West Point; Cape Cod; Myrtle Beach, South Carolina; and Washington, DC, just to name a few. My parents were fascinated by the highways that they, as immigrants, viewed as testaments to America's modernity, ingenuity, and prosperity. Many people take the "scenic route" on road trips. Our family preferred the straight, uniform, consistent highways that symbolize efficiency and modern travel.

In 2020, more than 330 million Americans count on our Nation's transportation sector to help them safely get to where they need to go, to enable commerce, and to make possible the economic engine that leads the world. Transportation, and transportation safety, have never been more important.

Today, transportation is also synonymous with innovation—the mission of the Federal Highway Administration's Turner-Fairbank Highway Research Center. In partnership with universities, startups, and industry stakeholders, Turner-Fairbank has advanced transportation innovation, including new developments in materials, designs, operations, and safety. So, it was a pleasure to host the *FHWA Research Showcase* last fall at the U.S. Department of Transportation Headquarters. The FHWA Research Showcase event included demonstrations of the CARMASM platform, ultra-high performance concrete,



Mother, Ruth Mulan Chu Chao, and sister of Transportation Secretary Elaine L. Chao pictured in front of the family station wagon at Easter around 1973.

Courtesy of Chao Family.

hand-held instruments that can quickly determine the composition of highway materials, and a Hydraulics Laboratory robot that helps test for soil erosion. It was a wonderful illustration of how innovation is occurring in every aspect of transportation.

At USDOT, we are always working on ways to make transportation safer, more accessible, and better for everyone—today and in the future! At the Consumer Electronics Show in Las Vegas on January 8, 2020, I announced the new USDOT–White House joint initiative on automated vehicles (AV), *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0*. This initiative unifies AV efforts across 38 Federal Government entities to keep pace with the rapid changes occurring in this technology. AVs have the potential to save lives and prevent injuries, as well as restore mobility for millions of people who face transportation challenges, such as the elderly and people with disabilities.

AV technologies are not yet advanced enough to enable the wide-scale deployment of fully autonomous vehicles. But someday they will be. Meanwhile, we are seeing more automated features in new cars that are already improving safety on America's roads, such as blind-spot warning, adaptive cruise control, and automatic emergency braking, just to mention a few.

Safety innovations in vehicles, infrastructure, better driver behavior, and emergency medical services have reduced annual traffic fatalities by 34 percent since 1972. That achievement occurred while vehicle miles traveled increased more than 150 percent! The fatality rate in 1972 was more than four times higher than it is today.

2018 marked the second consecutive year of declining crash fatalities. Initial data for the first three-quarters of 2019 indicate another yearly decline. That means progress is being made. Yet, in 2018, 36,560 men, women, and children were killed in traffic crashes on America's roads. Most of those tragedies were preventable. So, there is much work to be done to further improve safety for all road users.

Let me mention two categories of road users who registered *increased* fatalities in 2018: pedestrians (6,283 fatalities, 3.4% increase and the highest total since 1990) and bicyclists (857 fatalities, 6.3% increase). In 2020, USDOT will host a *Pedestrian Safety Summit* to address the alarming rise in pedestrian fatalities. The Summit will provide a forum for attendees to identify best practices and solutions to better protect pedestrians. The event will include exhibits and demonstrations of ongoing research, emerging technologies, National Highway Traffic Safety Administration media safety campaigns, and examples of successful FHWA infrastructure countermeasures. Attendees will have the opportunity to collaborate in identifying the leading factors behind the rise in pedestrian fatalities, as well as offer solutions to help finalize a USDOT National Action Plan on pedestrian safety.

USDOT's commitment to safety includes a campaign against human trafficking. On January 28, 2020, the Department hosted the *Put the Brakes on Human Trafficking Summit*. America's roadways, railways, airways, and waterways are being used to facilitate this modern form of slavery. The transportation sector is in a unique position to help save victims of human trafficking from unimaginable suffering, abuse, and despair. And we are uniquely positioned to assist law enforcement in apprehending the perpetrators as well.

Hundreds of transportation leaders have taken a public stand against human trafficking. Over 440 have signed USDOT's *Transportation Leaders Against Human Trafficking* pledge. Corporate, labor, governmental, and non-governmental organizations in every mode of transportation are stepping up. They have committed to training over 1.2 million workers to help fight human trafficking. Multiple initiatives are underway to increase awareness of human trafficking and equip transportation industry employees and the public with strategies to fight it.

We are enlisting as many allies as we can to bring together the best efforts, the best strategies, and the necessary resources to battle against human trafficking. If your organization has not already signed USDOT's *Transportation Leaders Against Human Trafficking* pledge, please join the effort by contacting us at: trafficking@dot.gov.

Transportation is an exciting field to be in because there are many opportunities to make a positive difference for individuals, for communities, and for our Nation. The future of transportation is brighter than ever with the promise for advancing safety and mobility, and for improving the quality of life for all Americans.

Elaine L. Chao
U.S. Secretary of Transportation



Safe Work Zones for All

Protect workers. Protect road users.

Work zones play a key role in maintaining and upgrading the Nation's roadways. Unfortunately, daily changes in traffic patterns, narrowed rights-of-way, and other construction activities often create a combination of factors resulting in crashes, injuries, and fatalities. Speed is a contributing factor in about 28 percent of fatal work zone crashes.

National Work Zone Awareness Week brings attention to the safety, mobility, and construction issues associated with work zones. The key message is for drivers to use extra caution in work zones to keep themselves and others safe. Let's work together to make **Safe Work Zones for All**.

For resources, guidance, and training, visit the FHWA Work Zone Management website at www.fhwa.dot.gov/workzones and the National Work Zone Safety Information Clearinghouse at www.workzonesafety.org.

A man and a woman in construction gear standing in a work zone. The man is on the left, wearing a white hard hat and a yellow safety vest over a white shirt, with his arms crossed. The woman is on the right, wearing a white hard hat and a blue shirt with a yellow safety vest, flexing her right bicep. They are standing in front of a construction site with orange and white traffic barrels and a yellow background.

We Can Do It!

2020 National Work Zone Awareness Week
April 20-24

Women in Research: Dr. Kelly Regal

by LISA A. SHULER

Women are at the forefront of innovation at the Federal Highway Administration's Turner-Fairbank Highway Research Center (TFHRC). From engineering to analysis, women fill key roles across the TFHRC, including senior leadership. In January 2020, Dr. Kelly Regal joined TFHRC as the new Associate Administrator for Research, Development, and Technology, becoming the first woman to lead the center in its 70-year history.

Dr. Regal's career path exemplifies the curiosity and perseverance that TFHRC's women rely on to develop the latest in highway innovation. Initially, Dr. Regal went to college to study accounting. However, taking a few computer science electives opened her eyes to new possibilities; she discovered that she loved the new and exciting field of computer science and decided to change her major.

Dr. Regal had many mentors growing up, but the one who had the most significant impact on her career trajectory was her mother, who encouraged Dr. Regal to pursue a Federal career. Thanks to this encouragement, Dr. Regal joined the Federal workforce as a computer scientist at the Federal Aviation Administration (FAA) Technical Center in Atlantic City, NJ, where she held several positions of increasing responsibility. Her most rewarding and challenging assignment was with the Aviation Security Research and Development Laboratory, where she oversaw the development of a software tool to assess the effects of explosions against civil aviation facilities and their occupants. In the aftermath of 9/11, the Department of Defense used this same tool to strengthen their facilities overseas.

After her time with the FAA, Dr. Regal continued her Federal career while pursuing her passion for research and technology, most recently as the Associate Administrator for Research and Information Technology at the Federal Motor Carrier Safety Administration. Dr. Regal describes her choice to join FHWA as a dream come true: "The research that's done at the TFHRC and the innovations that are developed here impact safety in a very positive way. We need to look at what more we can do so that we don't have over 37,000 deaths on the highway. That's why I'm here. I'm in the twilight of my career. There's probably no better position to be in, in the twilight of your career, than a fabulous place like this, where I can directly contribute to transportation advancements and also serve as a role model to the next generation of women in transportation."

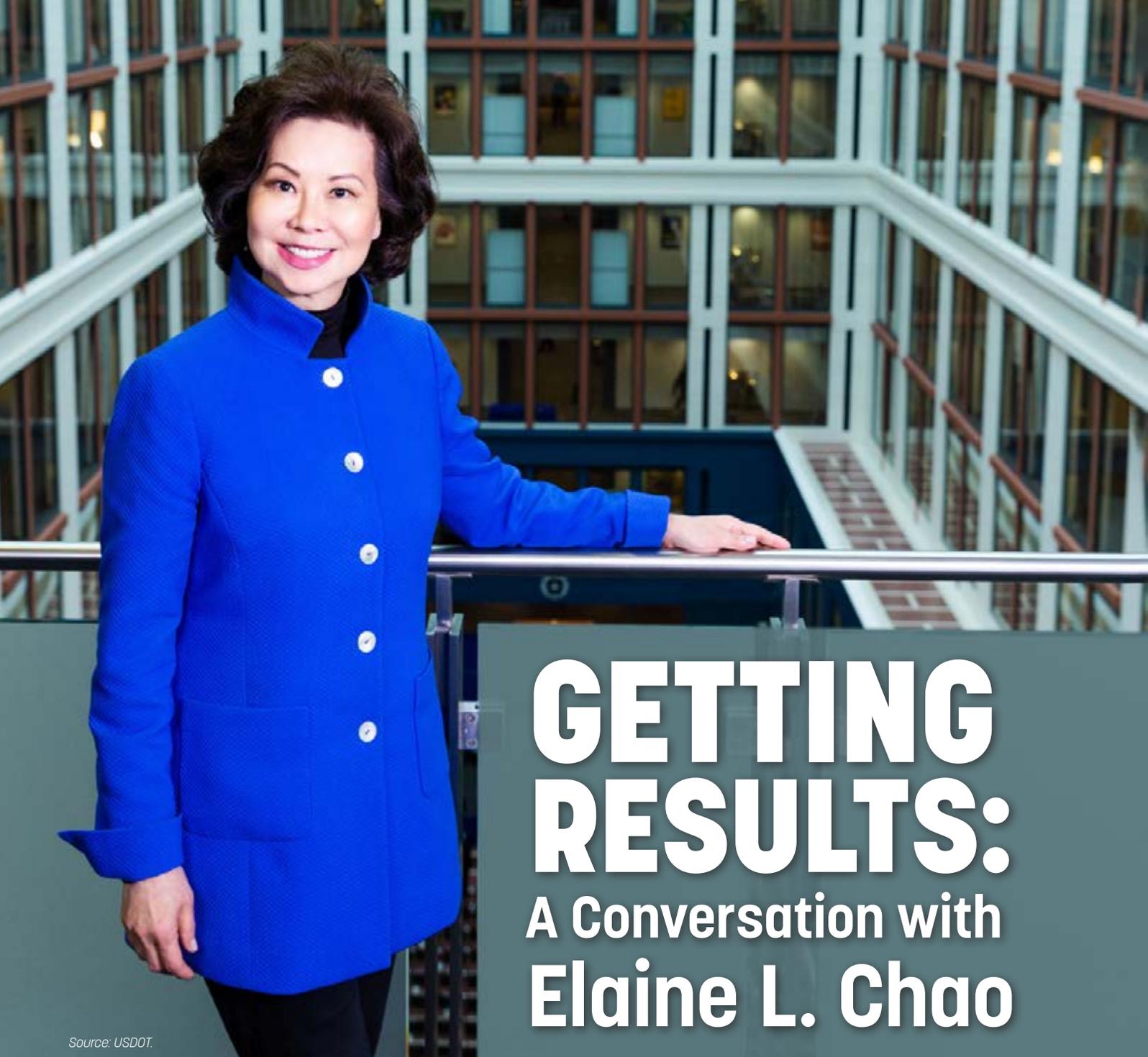
When reflecting on her career journey, Dr. Regal offers the following advice for women considering careers in transportation: "There probably isn't any other career that is as multidisciplinary as transportation. That's why my entire career has been in transportation and I enjoy it so much. Transportation is engineers, researchers, computer scientists, financial experts, economists, and transportation specialists. Any discipline you can think of, there's some need for it in transportation. My career advice to anybody is just find something that you like and be good at it. If you want a career in transportation, there's a fit for you."

LISA A. SHULER is the team director for marketing and communications at the TFHRC. For more on Dr. Regal, see *Along the Road* on page 47 of this issue.



Dr. Regal (front, second from left) with many of the women at the cutting edge of research and innovation at the TFHRC.

Source: FHWA.



GETTING RESULTS: A Conversation with Elaine L. Chao

Source: USDOT.

Elaine L. Chao is the U.S. Secretary of Transportation and first female Asian American Cabinet Secretary. Federal Highway Administration's Administrator Nicole R. Nason recently interviewed Chao about the U.S. Department of Transportation's most pressing initiatives and how Chao is empowering women to serve at all levels within the Department. What follows are excerpts from their discussion.

NASON: What are your top priorities as U.S. Secretary of Transportation?

CHAO: The first priority is always safety. The second priority is rebuilding and refurbishing our country's critical infrastructure. The third priority is to prepare for the transportation systems of the future by engaging with new technologies to address legitimate public concerns about safety, security, and privacy, without hampering innovation.

NASON: You have served as the Deputy Maritime Administrator, Chairman of the Federal Maritime Commission, Deputy Secretary of Transportation, and now U.S. Secretary of Transportation. What drew you to service in the transportation industry? What do you enjoy most about it?

CHAO: Among my earliest memories is immigrating to America on a cargo ship. My father had immigrated to New York three years earlier to seek a better life for the family. I was eight years old when my mother and two sisters and I boarded that ship and began a 37-day ocean journey to be reunited with my father. We went through the Panama Canal

and past the Statue of Liberty. We settled in Queens, NY, and relied upon public transportation to get from place to place. When we were able to afford our first car, my dad took the family on weekend road trips on America's highways to explore our new

homeland! From an early age, I understood how important transportation systems were to enabling new opportunities, improving the quality of life for our citizens and residents, and strengthening the vibrancy of our economy.

NASON: In industries like transportation, women tend to hold fewer positions than their male counterparts. This is even more evident in leadership roles. What can we do to encourage women to enter our field of transportation? As a female leader and a two-time Cabinet Secretary, how have you helped to promote women in leadership roles?

CHAO: As a leader, if you are ignoring half the talent pool, then your organization is missing out on a lot of great people who could help advance the mission. There are many accomplished women leaders at USDOT today in both the career and non-career ranks. We have you, Administrator Nason, at the helm of FHWA, and you were previously head of the National Highway Traffic Safety Administration. Mala Parker is the Deputy FHWA Administrator. Jane Williams, Acting Administrator of the Federal Transit Administration (FTA), brought with her decades of experience at the U.S. Departments of Energy, Interior, and Labor as well as State government. A few doors down from my office is Laura Genero, Associate Deputy Secretary for Communications, as well as Senior Advisor, Tam Somerville, who has sitting on her desk a full-face motorcycle helmet that she wears to safely commute through DC traffic on her motorcycle. There are also impressive women leaders in the career ranks, including Judy Kaleta (Deputy General Counsel), Lana Hurdle (Deputy Assistant Secretary for Budget and Programs), and Henrika Buchanan (Associate Administrator of FTA), to name a few. By the way, Henrika was a recipient of the Presidential Rank Award in 2019. So, we have many

women bringing impressive qualifications, experience, and diverse perspectives to carry out the Department's mission.

Throughout my career, whenever I've had the authority, I have launched programs that empower women. As Director of the Peace Corps, I launched the first entrepreneurship training programs in the emerging democracies of Eastern Europe after the fall of the Iron Curtain, with an emphasis on empowering women. When I was Secretary of Labor, half of the leadership team were women and they ran some of the biggest bureaus in the Department, including pensions, wage and hour, employment training, and employment standards.

As Secretary of Transportation, I regularly urge women and girls to pursue education in the science, technology, engineering, and mathematics (STEM) disciplines that can lead to rewarding careers in transportation. The Department's Women in Aviation Advisory Board has been created to promote the education, mentorship, and recruitment of even more women into the aviation industry. The Department's Office of Small and Disadvantaged Business Utilization has helped women-owned small businesses successfully compete for contracts.

Transportation Secretary Elaine L. Chao pictured next to Administrator Nicole R. Nason and Brian Cronin, Director of Safety and Operations Research and Development, along with the CARMA team during the FHWA Research Showcase on September 18, 2019.

Source: FHWA.





U.S. Secretary of Transportation Elaine L. Chao delivers remarks at the University of Michigan ADS Symposium at Mcity on September 12, 2017.

Source: USDOT.

NASON: The surface transportation system continues to undergo transformation, in terms of both the technology on our roads and the way the traveling public uses the roadways. How has the Department prioritized innovation to ensure we are prepared for the future needs of our transportation system while providing for the traveling public’s safety?

CHAO: There is so much innovation going on in the transportation field today. Our mantra has always been: The Department needs to engage with emerging new technologies to address legitimate public concerns about safety, security, and innovation without hampering innovation.

The Department is technology neutral—not top-down, command and control. That means the Government is not in the business of picking technology winners and losers. Our goal is to enable the safe testing and deployment of a wide variety of new technologies, so communities and individuals can choose what fits their needs best. This employs a flexible, performance-based approach that protects safety while giving entrepreneurs the room they need to innovate and grow.

One example of how we are advancing innovation and improving safety and infrastructure is through our new pilot

program designed to help avoid traffic accidents and save the lives of first responders by utilizing the 5.9 GHz Safety Band. Recently, the Department has announced its intention to invest up to \$38 million in the First Responder Safety Technology Pilot Program, which will help equip emergency response vehicles and key infrastructure with vehicle-to-everything (V2X) communication technology.

Many of the new technologies are cross-modal, so in March 2019 the Department established the *Non-Traditional and Emerging Transportation Technology (NETT) Council*, which is a one-stop shop to make it easier for innovators and stakeholders to work with the Department.

The Department is also engaged in ground-breaking rulemakings that will create a path forward for some of the most advanced emerging transportation technologies.

NASON: Why is the 5.9 GHz Safety Band so important to the Department and the safety of the traveling public?

CHAO: The Safety Band—5.9 GHz—holds great promise to help reduce the number of traffic fatalities each year through the development and deployment of lifesaving technologies. Among the revolutionary crash-preventing technologies nearing readiness for mass deployment is the enabling of vehicles to communicate—with other vehicles, other road users (including bicyclists and pedestrians carrying cell phones), and traffic lights and other road infrastructure. This V2X communication, as it is known, occurs via a short-to-medium range wireless signal. The signal carries information that allows vehicles to “see” around blind curves and traffic in ways that conventional line-of-sight technologies (including LiDAR and radar) cannot. V2X receives and transmits data including GPS

location, speed, direction, braking, and turning status.

The V2X signal is unaffected by fog, rain, snow, and blinding sunbeams. Potential traffic safety applications include do-not-pass warnings, intersection collision avoidance and movement assistance, approaching emergency vehicle warning, emergency vehicle signal priority, commercial vehicle clearance, safety inspections, and traffic and travel condition data to improve traveler information and maintenance services.

Equipped with such communication technology, cars would be able to exchange information in real-time and provide drivers with 360-degree situational awareness that will contribute to greater safety.

NASON: On a related topic, how is the Department preparing for the future of Automated Vehicle (AV) technology?

CHAO: On January 8, 2020, I announced the release of *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0*. This document unifies AV efforts across 38 Federal departments, independent agencies, commissions, and Executive Offices of the President. It signifies that the Federal Government is all in for safer, better, and more inclusive transportation, aided by automated driving systems. It recognizes the value of private sector leadership in AV research, development, and integration.

Bringing to fruition the vast potential of AVs will require collaboration and information-sharing among industry partners, State and local governments, academia, non-profits, standards

development organizations, and the Federal Government.

Automated vehicles have the potential to save thousands of lives annually and restore mobility to millions of people who face transportation challenges, such as older Americans and people with disabilities.

And I'd like to mention that FHWA is pursuing an update of the Manual on Uniform Traffic Control Devices, the first major update in a decade. The updated version will reflect advances in technologies that are not currently represented in the Manual today.

NASON: The final year of the Fixing America's Surface Transportation Act (FAST Act) is upon us. Why is it important to have a fully-funded, long-term highway reauthorization?

CHAO: Stakeholders have advised repeatedly, and persuasively, that a fully-funded, long-term reauthorization allows them to better plan for the future. When stakeholders have reliable and stable funding sources, their ability to coordinate and streamline their planning and execute transportation projects increases greatly, which saves

on time and overall cost. The Department is striving to provide State departments of transportation the flexibility and certainty they need to make the best decisions for their States or localities. A long-term, fully-funded reauthorization will help them meet their surface transportation needs.

NASON: In looking at safety needs across the country, it becomes quickly apparent that a disproportionate number of roadway fatalities occur in rural areas. How is the Department addressing safety in rural communities?

CHAO: Rural infrastructure is not just for the benefit of rural residents. 44 percent of passenger vehicle traffic in rural areas is urban residents traveling. Only 19 percent of Americans live in rural

areas, yet 46 percent of the Nation's highway fatalities occur there. So, from a safety point of view, it should concern everyone that the fatality rate on rural roads is twice that on urban roads.



In addition, rural transportation networks—which bring manufactured products, agriculture, and other commodities to markets—are vital to our Nation’s economy and all Americans’ quality of life. Nearly half of all truck vehicle miles traveled occur on rural roads. And two-thirds of rail freight originates in rural areas.

For far too long, rural America has been neglected and overlooked. I do NOT believe rural America is looking for a handout or preferential treatment. Rural American is looking for fairness and equity in the distribution process of Federal dollars.

On October 8, 2019, at the annual meeting of the American

Association of State Highway and Transportation Officials, I announced the *Rural Opportunities to Use Transportation for Economic Success* (ROUTES) Initiative to better support the Nation’s critical rural transportation infrastructure. This effort will help rural communities access Federal transportation grant programs. It will provide user-friendly information to these communities to assist in applying for discretionary grants. It will improve sharing of rural data and analysis to achieve national transportation infrastructure goals. In addition to highway infrastructure, the ROUTES Initiative is also addressing airports and transit in rural areas.

NASON: One of the things you are known for is getting results. Can you share with us some examples?

CHAO: Ideas are needed, but if nothing gets implemented, the ideas are for naught. For example, as a former U.S. Secretary of Labor and President & CEO of United Way, I’ve had a lot of experience dealing with emergencies. We prepare for them at USDOT. The I-85 bridge in Atlanta caught fire and collapsed on March 30, 2017. DOT staff arrived in Atlanta that same night. Within 18 hours, \$10 million in quick release emergency funds was delivered. Within 36 hours, emergency repairs began. The whole project was accomplished ahead of schedule and under budget in just 47 days. The seven communities that depended on this bridge were able to resume their commuting routine. This was a credit to the partnership between USDOT and the Georgia Department of Transportation.

On the policy front, it is not a coincidence that USDOT is rated number one in the cabinet in reducing unnecessary and overly burdensome regulations that needlessly delay infrastructure projects and do not contribute to safety. This has been a focus at

the Department since February 2017.

Regulatory reform is important because regulations impose direct costs on the economy, and too many overly burdensome and unnecessary regulations can stifle growth and hamper job creation. For example, employers say repeatedly that the regulatory burden was a key factor in why the economy did not recover as quickly as it should have following the 2008 recession.

From 2009 to 2016, USDOT alone imposed about \$2–3 billion in new regulatory costs each year. That’s why in February 2017, the President signed an Executive Order requiring two regulations to be withdrawn for every new one submitted. Since then, regulatory costs at USDOT decreased by a net of approximately \$3.9 billion. The Department accomplished this by reducing unnecessary and overly burdensome regulations while ensuring that the regulatory costs that are imposed are truly necessary for safety. This is a major reason why the economy is doing so well today.

In addition, we are continually striving to achieve the goal of the President’s “One Federal Decision,” which aims to speed up infrastructure delivery and streamline the permitting of large, complicated projects that require approval from multiple agencies. Unnecessary delays due to permitting are depriving our country of the new highways, bridges, roads, and airports we need to remain competitive in the global economy and improve the quality of life for everyone.

NASON: What’s your recipe for accomplishing so much?

CHAO: Hire the right people for the right jobs. In many ways, crafting policy is easier. The toughest challenges are working through and with others, and building consensus on the path forward.

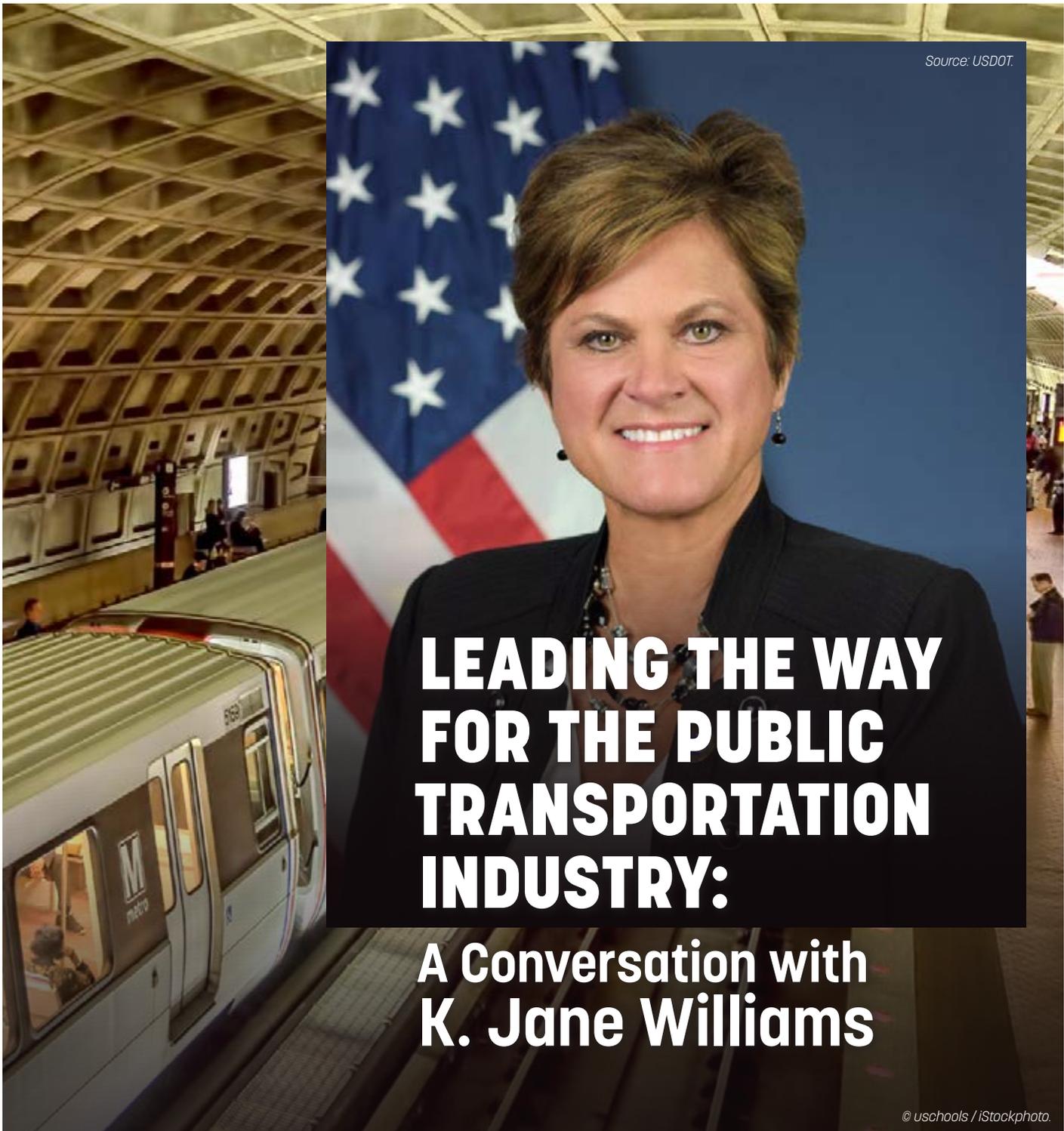
It is important to listen to diverse points of view. It is the right of every citizen and group to petition their government. It makes for better policy to listen and learn.

I try not to procrastinate. “The days are very long, but the years are short so make every day count!”—a refrain familiar to anyone who has worked with me. Administrations get a maximum of 8 years. It takes time to effect change. The rulemaking process, in particular, takes an especially long time. So, savor each day. It is a privilege to serve our country.



U.S. Transportation Secretary Elaine L. Chao was joined by leaders from Congress, State governments, and the transportation industry on January 28 to pledge their effort to fight human trafficking.

Source: USDOT.



Source: USDOT.

LEADING THE WAY FOR THE PUBLIC TRANSPORTATION INDUSTRY:

A Conversation with K. Jane Williams

@ uschools / iStockphoto.

K. Jane Williams is currently the Acting Administrator of the Federal Transit Administration (FTA). FHWA Administrator Nicole R. Nason recently interviewed Williams about her career experiences and priorities for FTA. What follows are excerpts from their discussion.

NASON: What is your current role at the U.S. Department of Transportation?

WILLIAMS: As the Acting Administrator of FTA, I lead an agency of more than 500 people located in Washington, DC, and 10 regional offices across the country. I am responsible for managing an annual budget of over \$13 billion that assists over 3,000 transit providers in all U.S. States and territories. FTA is one of USDOT's nine operating administrations and provides financial and technical assistance to local public transit systems, including buses, subways, light rail, commuter rail, trolleys, and ferries.

NASON: What previous experience did you have prior to joining FTA?

WILLIAMS: I began my career in DC, working for President Reagan and then President Bush. After taking some time off to focus on my family and raising my children, I re-entered the workforce in 2010. After working on Capitol Hill for five years, I was recruited to serve as the Director of the State of Maryland's Washington Area

Transit Office at the Maryland Department of Transportation under Governor Larry Hogan. It was serving in that position that led to my appointment working with Transportation Secretary Elaine L. Chao as the Deputy Administrator, then Acting Administrator of FTA.

NASON: What's it like to be a woman working in the transportation industry—a traditionally male-dominated field?

WILLIAMS: I am incredibly fortunate to have a great mentor and leader in Secretary Chao. She sets the standard. As a two-time Cabinet member and the first female Asian American Cabinet Secretary, she often is faced with making difficult decisions amid competing priorities. Her collaborative management style, one which I try to emulate as I lead FTA, allows for an open and

diverse discussion. Following her lead, many of our FTA leadership team are also women. In fact, I am proud that women comprise 50 percent of our FTA leadership team. Our education and experiences inform what we bring to the table, and I am glad that I have such a capable and diverse leadership team.

NASON: Name one accomplishment you are proud of achieving as the FTA Acting Administrator.

WILLIAMS: I'm proud of the progress we've made in advancing Secretary Chao's top priority of safety at FTA. Under the Moving Ahead for Progress in the 21st Century Act (MAP-21), FTA was given a safety mandate for the first time by Congress, and when I arrived at FTA in August of 2017, we were undertaking a major initiative to help States with rail transit systems achieve State Safety Oversight Program certification prior to the April 15, 2019, deadline. At the time, not one State was

certified. During my tenure, FTA certified all 31 States with rail transit for safety oversight responsibilities—including the certification of the Washington Metrorail Safety Commission (WMSC), allowing FTA to transfer direct safety oversight of the Washington Metropolitan Area Transit Authority's Metrorail system to the WMSC. I'm proud of our team and our partnership with the States to establish stronger safety oversight of rail transit systems across the country.

NASON: Looking ahead, what are key priorities for FTA and public transportation in 2020?

WILLIAMS: Advancing Secretary Chao's top priorities of safety, infrastructure investment, and innovation remains my top priority as FTA leads the way for the public transportation industry in 2020 and beyond. Safety is our top priority, and FTA is working closely with transit agencies and States to establish their Public Transportation Agency Safety Plans (<https://www.transit.dot.gov/PTASP>), which each agency should have completed by July 20, 2020. We've hosted 10 workshops around the country and offered 30 webinars and other online resources to help the industry make public transportation safer. To date, we've trained over 5,700 individuals representing transit systems from across the country.

Continued infrastructure investment is a key priority for Secretary Chao and the Trump Administration. FTA invests more than \$13 billion annually in our Nation's public transportation systems through formula and competitive grant programs. The President's FY 2021 budget proposal requests an \$896 million (9 percent) increase for transit formula and competitive programs and \$1.89 billion for the Capital Investment Grants (CIG) Program—the highest amount ever proposed under this Administration. To date, FTA has supported funding for 25 new CIG projects throughout the Nation during this Administration, totaling approximately \$7.6 billion in funding commitments, and we plan to support additional projects as they become ready for funding.

Innovation is revolutionizing the transportation industry, and this is my priority for FTA in 2020. We prioritized innovation for all our FY 2020 competitive programs, encouraging applicants for FTA funding to incorporate innovation in a broad range of areas, including transit service delivery, financing, procurement, fare payment integration, new technologies, and web-based applications. We need to be more forward-thinking than ever before to meet the needs and expectations of transit riders—today and into the future.



FTA Acting Administrator Jane Williams pictured in Detroit, MI, during an event announcing grant funding from the Buses and Bus Facilities Program.

Source: FTA.





HONORED TO SERVE:

A Conversation with Nicole R. Nason

Source: USDOT.

Nicole R. Nason is the Administrator of the Federal Highway Administration. Deputy FHWA Administrator Mala K. Parker recently spoke with Nason about her career path, her goal of reducing fatalities on the Nation's roadways, and her advice to women looking to begin careers in transportation. What follows are excerpts from their discussion.

PARKER: What was the career trajectory that led you to become the FHWA Administrator?

NASON: I've been blessed in my life to be supported by many leaders who have allowed me to work on issues I am passionate about and find inspiring. I have always been fascinated by Government service, and I selected a school in Washington, DC, specifically because I was interested in working in Government. I went to law school, spent several years working on Capitol Hill, and then had the extraordinary opportunity to serve as President George W. Bush's Assistant Secretary for Government Affairs and the National Highway Traffic Safety Administrator. I love the U.S. Department of Transportation, and I am thrilled to be back serving as the 20th FHWA Administrator. It is truly an honor to be trusted by President Trump and Secretary Chao to be at the helm of this organization.

PARKER: How do you maintain a healthy work-life balance?

NASON: Fortunately, I have a very supportive spouse and my three children are always rooting for me. They have all dutifully sat through every one of my hours-long confirmation

hearings! I believe it is important to explore different fields and issues, both in our professional and personal lives. For example, I took 5 years off from work to focus on my children and to train in Japanese martial arts. I finally earned a black belt, Shodan level in Japanese, and went on to volunteer as a martial arts instructor to high school girls in Queens and Harlem, NY. That was an experience I will never duplicate! Taking that time to do something completely new and challenging only made me a stronger leader when I returned to Government. My children appreciated the time I devoted to them, and I developed new skills—through very old teachings—that helped me refocus at work. I even made my three kids come to class with me for a few years, and my oldest daughter recently earned her black belt after nearly a decade of training. It's an activity and accomplishment we love to share.

**PARKER: What challenges have you faced in your career?
What are some lessons you've learned from these challenges?**

NASON: The challenging times are when we all truly develop our skills as leaders and mentors. It's easy to manage a team when everything is moving along smoothly and the coffers are full. It is during the challenging moments that we develop patience and get to practice kindness toward our colleagues. That's when we learn what kind of leader—and person—we really are. I love the challenging days; even in the darkest of times I knew I had great people in the foxhole with me.

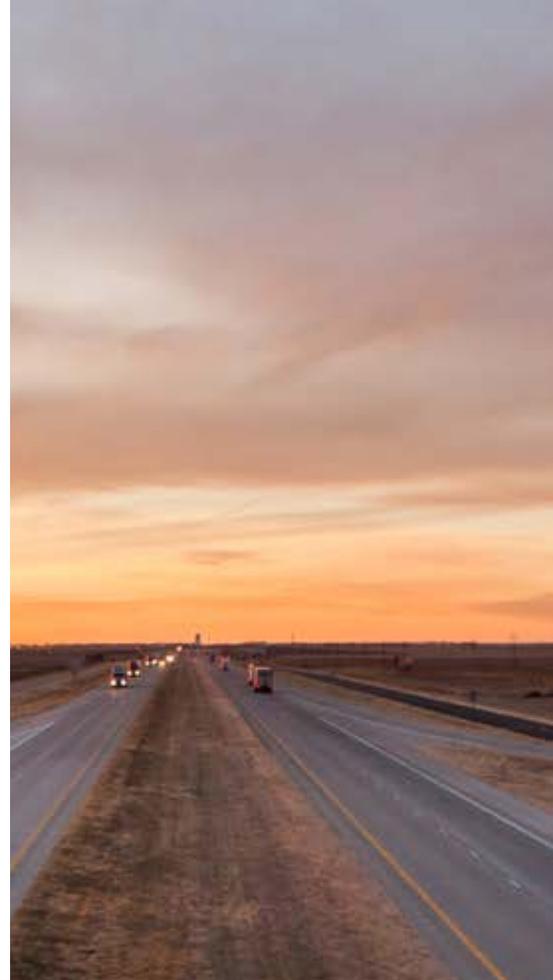
I also know we need support from family to get through the tough times. During the Government response to Hurricane Katrina, when I was serving as Assistant Secretary for Government Affairs at USDOT, I relied on the support of my mother-in-law to care for my 4-year-old and 11-month-old daughters. I basically lived at the office. I cannot stress enough how critical it is to have the strong support of family.

**PARKER: How have mentors helped you navigate your career?
What lessons have you learned from your mentors?**

NASON: I've been fortunate throughout my life to have many people help shape my career. My father, a highway patrol officer who worked his way up to chief of police, taught me the value of road safety from an early age—it was his personal obsession. Former Congressman Henry Hyde gave me my first job on Capitol Hill. And I remain grateful to former Transportation Secretaries Norm Mineta and Mary Peters, who both supported and guided me at a time when I was young and didn't have a lot of experience. Now, being back at the Department more than 10 years later, I am privileged to work for an experienced executive like Secretary Chao who has taught me how important it is to surround yourself with good people. She always says that personnel is policy. Public service is one of the great privileges of my life, and I'm grateful to all the leaders who have given me the opportunity to serve.

**PARKER: What are your goals for FHWA?
What direction do you see us heading in?**

NASON: The first priority, of course, is to do everything we can to ensure America's roads, bridges, and tunnels are safe for the public. We also want to find new ways of reducing the Federal burden on States and cities who wish to improve their infrastructure, but roadway safety is always the top priority. I am especially focused on addressing pedestrian and bicycle safety issues. When I testified before Congress for my confirmation, I made it very clear that pedestrian safety is an area of special interest for me. Pedestrians are among the most vulnerable road users, and pedestrian fatalities today are at the highest level since 1990. In an effort to address this issue, Secretary Chao and I will be convening



Administrator Nicole R. Nason sits in the driver's seat of one of the newest additions to FHWA's CARMA fleet.

Source: FHWA.

a Pedestrian Safety Summit this year in Washington, DC, where we will bring together stakeholders and USDOT leaders to finalize a National Action Plan on Pedestrian Safety. This is a problem we must take immediate action in addressing. I look forward to working with our many partners to find and implement joint solutions to protect our most vulnerable road users.

PARKER: What do you think FHWA and the Department are doing right when it comes to safety, and what can we improve upon?

NASON: Under Secretary Chao's leadership, the Department's number one priority is always safety. We are all working closely with our State and industry partners to reduce America's roadway fatality problem, and harmonizing so many different interests on a single goal like that is absolutely a success. In only 2 years, the number of fatalities on America's highways has fallen—and we want that to continue. We have a long way to go, but we are heading in the right direction. With our *Better Utilizing Investments to Leverage Development (BUILD) Grant* program, we are making it easier for States to get the funds they need to make investments in key transportation projects. With our *Rural Opportunities to Use Transportation for Economic Success (ROUTES) Initiative*, we are targeting the needs of rural communities and their transportation networks, which face significant challenges. Though only one-fifth



of Americans live in rural areas, almost half of all road fatalities occur in rural areas. Rural America has been overlooked long enough, and we believe our work will make a big difference there.

PARKER: What advice would you offer a young woman interested in pursuing a career in transportation? What benefits do you think women can bring to transportation?

NASON: The world of transportation is so diverse that there is always room for someone with talent. For the traditional methods of road design and construction, female civil engineers are in short supply. We will also need women to help us with coding, computer engineering, and designing the software needed to make America's

road system ready for autonomous vehicles. From financial analysts and attorneys to environmental planners and communications or marketing experts, there is a world of opportunity for women within the transportation industry. Women bring the same qualities to transportation that men do, but from a different perspective. Whether it be improvements to project delivery, areas where red tape can be cut or reduced, innovations in technology, or funding, many perspectives enrich the decision-making process.

With Secretary Chao, USDOT now has its third woman leader. There is a woman leading the Federal Transit Administration, we have TWO women leading FHWA, and 13 women are leading State departments of transportation. That is the most *ever*. Until now, the most women directors of State departments of transportation at one time was six. Progress is happening. There are hundreds of women working within FHWA who help to keep America moving and safe, and I look forward to working hard to increase that number within FHWA and all of USDOT.



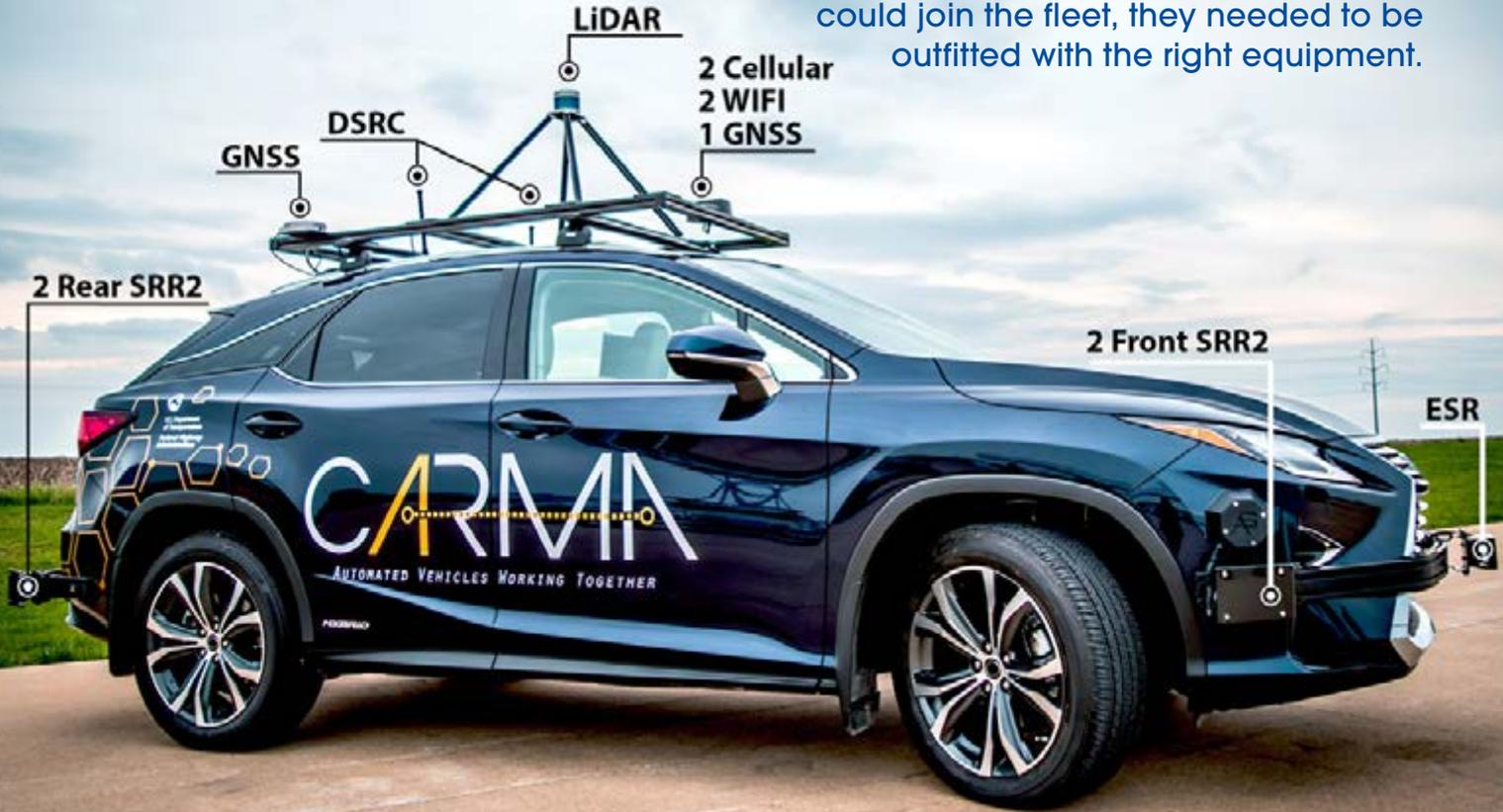
ABOVE: Administrator Nason with Deputy Administrator Parker.
Source: FHWA.

LEFT: Administrator Nason speaks at the FHWA Research Showcase in September 2019.

Source: FHWA.

CARMASM: TESTING AUTOMATED VEHICLES

Before FHWA's newest CARMA vehicles could join the fleet, they needed to be outfitted with the right equipment.



CARMA vehicles are loaded with equipment, including two rear and two front side detection sensors (labelled SRR2), antennas for global navigation satellite systems (GNSS), dedicated short-range communications (DSRC), light detection and ranging (LiDAR), and electronically scanning radar (ESR).

Source: FHWA.

by **DEBORAH CURTIS, MAE FROMM, and LAURA DAILEY**

In 2019, the Federal Highway Administration added four CARMA-equipped passenger vehicles to its fleet of test vehicles. Before the vehicles were delivered to the Saxton Transportation Operations Laboratory at the Turner-Fairbank Highway Research Center, FHWA conducted verification and acceptance testing in Morton, IL. There, FHWA engineers and researchers customized the four vehicles with aftermarket, highly automated vehicle kits using open source software to achieve Society of Automotive Engineers (SAE) Automation Level 2. (For more information about the CARMA Platform, see “CARMASM: Driving Innovation” in the Winter 2020 issue of PUBLIC ROADS.)

For the first time, the U.S. Department of Transportation tested SAE Automation Level 2 vehicles, and this advanced the process of achieving cooperative driving automation (CDA) used in support of transportation systems management and operations research. The Volpe National

Transportation Systems Center provided validation for FHWA's automated driving systems (ADS) verification and acceptance test plan. Because of specific feature implementation required for each model, testing ADS at this level posed many challenges, such as verifying the vehicle calibrations involved with the different sensors that impact ADS performance and ensuring the fail-safe mechanisms are properly tuned with the different types of by-wire controllers.

Selecting the Vehicles

Prior to purchasing two sport utility vehicles (SUVs), one minivan, and one midsize sedan to add to the fleet of CARMA-equipped vehicles, FHWA considered a variety of passenger vehicles. FHWA performed two rounds of a trade study aimed at choosing the most appropriate vehicle type and model to implement SAE Level 2 capabilities and to extend to higher SAE levels. The research team

evaluated 16 vehicle models on 15 different attributes.

Researchers weighted four comparison criteria the most heavily. The first was the cost of instrumentation, including any reverse engineering and design work. Second was the FHWA team's knowledge and ability to access the vehicle's controller area network (CAN) messages, which provide critical information about the vehicle's state at any given moment. Researchers also heavily considered each vehicle's existing potential for by-wire integration and customization (the ability to control the vehicle through electronic signals vs. mechanical motions). The final weighted criterion was passenger comfort, including capacity.

“We recognize the importance of interoperability and consistency as major aspects for the future of CARMA research and usability,” says Taylor Lochrane, the CARMA technical program manager. “FHWA selected the four passenger



Administrator Nicole R. Nason, center, joins the women of FHWA's CARMA team at the Turner-Fairbank Highway Research Center in September 2019.

Source: FHWA.

The Women Leading the CARMA Collaborative

FHWA initiated the CARMA Collaborative to engage with stakeholders and collectively support the future of automated vehicles and connected infrastructure in the transportation industry to improve safety, efficiency, and mobility. The CARMA Collaborative is a largely female-driven initiative. In the past 2 years, the team:

- Established FHWA's CARMA branding and promoted the CARMA engineers' efforts, which enabled the development and public release of the CARMA Platform.
- Created a robust array of CARMA content and collateral to inspire stakeholder awareness and engagement.
- Collaborated with academic, industry, public agency, and Federal stakeholders to advance transportation with CDA.
- Cultivated relationships at conferences supported with innovative exhibits, including the Transportation Research Board Annual Meeting 2019 and 2020, South by Southwest 2019, and the Automated Vehicle Symposium 2019.

Overall, the women leading the CARMA Collaborative enable conversations and foster relationships across stakeholders to advance transportation safety, efficiency, and mobility.

vehicles to accommodate the CARMA Platform and conduct research on different types of controllers and across diverse vehicle types, makes, and models.”

FHWA selected industry leaders based on their expertise building and supplying platforms and components used within ADS.

Adding the Automated Equipment

For enhanced CARMA research and development, FHWA installed several aftermarket hardware devices to provide additional radar data collection, improved detection and navigation, and vehicle-to-everything communication.

On the exterior of the vehicle, high-resolution three-dimensional light detection and ranging (LiDAR) provides a 360-degree surround view along with real-time data for navigation and object detection. A multimode, electronically scanning radar combines a wide field of view at midrange with long-range coverage for object detection. Four rear and side detection radar sensors provide awareness of approaching vehicles as well as support for blind spot detection applications. For enhanced positioning solutions, two global navigation satellite system (GNSS) antennas track the maximum number of satellites in any environment. Additionally, vehicle-to-everything communication is managed with an onboard unit with two

dedicated short-range communications antennas. Lastly, global navigation, cellular, and Wi-Fi antennas were installed on the exterior of the vehicle.

Inside the vehicle, FHWA installed multiple cameras: one camera for collision detection and lane marking identification, and two cameras for object and traffic light detection. Light bars are located in the front and back vehicle windows. In the middle console, each vehicle is equipped with a push-button shifter, a tablet, and a red emergency stop button to disable automated controls.

FHWA outfitted each vehicle with a different by-wire control kit that provides electronic control of the vehicle's brake, throttle, steering, and shifting to enable testing for automated vehicle applications. The team incorporated LED lighting on the vehicles' floors for immediate visual indicators: green shows manual driving mode, blue signifies by-wire mode, and red denotes a fault or failure of the by-wire system.

The team installed speed and steering control (SSC) software packages in the Linux-based computer to provide a common interface to tune the speed and steering actions of the by-wire controllers. Using a robot operating system (ROS), the SSC software enables research applications to send messages to this package with desired vehicle path curvature, maximum curvature, desired speed, acceleration limits, deceleration

limits, and desired gear. On top of the SSC interface, Autoware,TM an open-source software, provides the necessary automated driving functionality for localization, motion planning, and object detection and avoidance. With by-wire, SSC, and Autoware installed, the vehicle is able to perform waypoint following. Using a prerecorded set of waypoints (geographic coordinates that define a route of travel), desired speed, and a high-definition map of the test facility, the vehicle was able to pinpoint its location on the map and drive itself using lateral and longitudinal controls.

These integrated aftermarket subsystems serve to develop the next phases of the CARMA Platform enabling cooperative driving at SAE Automation Levels 2 and 3 for the benefit of transportation systems management and operations research.

“The goal of CARMA is to accelerate understanding of the benefits of CDA through testing,” says FHWA Administrator Nicole R. Nason. “We want automated vehicles to work together, and increasing the SAE levels of automation available on research vehicles is an important next step to advancing transportation safety, efficiency, and mobility.”

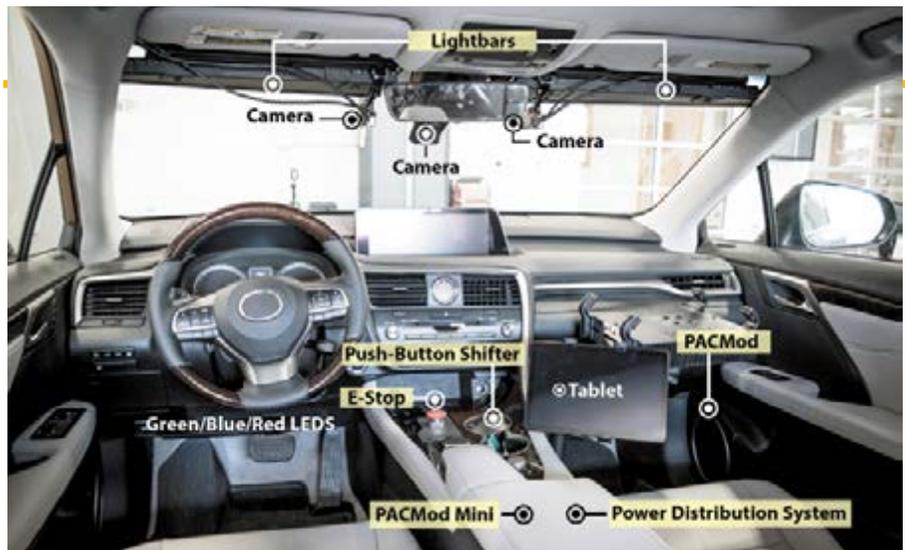
Developing the Acceptance Test Plan

FHWA developed a detailed test plan to verify that each vehicle’s hardware, software, safety requirements, and design specifications were met prior to acceptance and delivery. The document included the scope, approach, test facility or environment, schedule, roles and responsibilities, and detailed test cases.

Researchers started with a template of test case scenarios and objectives. The collection, review, and discussion of the vehicle requirements, design specification documents, and original equipment manufacturers’ manuals for the installed components were essential to gain a deeper understanding of the features and functionality of each component. FHWA collaborated with Volpe and subcontractors to refine the scope and develop detailed test case scenarios and procedures.

Hardware testing involved the inventory and inspection of each hardware unit supplied by the contractor, including the strength of hardware mounting and its proper location. The team measured the location of each aftermarket sensor to ensure an optimal position when compared to the manufacturer’s standards. Testing also included verifying that the vehicle had sufficient power distribution for all equipment, inside and out.

Safety testing confirmed that customizations did not impact the vehicles’ stock safety features and that the by-wire fail-safe



Equipment in the vehicles’ interiors includes lightbars and floor LEDs, cameras, a push-button shifter and emergency stop button, a tablet, the power distribution system, and the platform actuation and control module (PACMod and PACMod Mini).

Source: FHWA.



The Linux-based computer housed in the vehicle’s trunk runs the speed and steering software.

Source: FHWA.



This photo depicts how waypoint following appears on a screen in a CARMA3-equipped vehicle to show localization, which is how CARMA recognizes what is around the vehicle.

Source: FHWA.



Introducing CARMA Support Services

CARMA Support Services kicked off in late 2019 to provide support services for the implementation of the CARMA product suite. CARMA Support Services established a CARMA Help Desk and email to respond to common issues from CARMA users, researchers, and deployers while also monitoring user feedback for future improvements.

mechanisms were working properly. With system safety and risk minimization as the primary objectives, the team reviewed two National Highway Traffic Safety Administration publications during the development of the test plan and procedures: *A Framework for Automated Driving System*

Safak Ercisli, left, the project manager for CARMA Support Services, and Deborah Curtis, right, the Government task manager for CARMA Support Services, show off one of FHWA's CARMA vehicles.

Source: FHWA.

Testable Cases and Scenarios (DOT HS 812 623) and *Automated Driving Systems 2.0 – A Vision for Safety* (DOT HS 812 442). To ensure safe operations, researchers incorporated the operational design domain and object and event detection and response into the description of each test case.

Finally, to enable testing the new passenger vehicles at higher automation levels and assisting with future operational and safety design requirements, the team added elements of SAE Levels 3 and 4.

FHWA created functional test cases to evaluate the basic functions and operations of the installed aftermarket hardware and software. These test cases also verified the range, tracking, and calibrations of all the sensors and cameras and assessed

the by-wire and SSC capabilities from low to high speed. Functional test cases also examined Autoware localization, waypoint following, camera-LiDAR calibration, and object detection.

Test plan development required multiple reviews and iterations, and the plan created is continually updated to capture evolving requirements during the Agile development lifecycle of a research and development program. Additionally, the test cases and procedures are constantly refined based on the outcomes and lessons learned from each verification test. The test plans are available at <https://usdot-carma.atlassian.net/wiki/spaces/CAR/overview>.

Executing the Acceptance Testing

Prior to the test event, a readiness review examined the contractor's preliminary test results, the logistics of the local test facilities, the test priorities, and the coordination of the personnel and equipment. In April 2019, testing began with the two CARMA-equipped SUVs. A second iteration of testing began in June 2019 with the minivan and midsize sedan. Each of these test events spanned a week. During the first day, classroom and hands-on training of the by-wire controller, SSC, and Autoware prepared the team for subsequent tests. Before beginning the more complicated testing of the by-wire and ADS features, the team completed important hardware and safety inspections. At the end of each



day, the team discussed and documented the issues to be addressed the following day based on priority and severity, including whether the test cases would be executed sequentially or in parallel. Toward the end of each week, the team prioritized addressing test cases and high severity issues for vehicle acceptance and delivery.

Lessons Learned from Testing

The incremental testing approach minimized risk from scheduling and testing resource constraints. The range of requirements tested necessitated a plan for varied staff support. The team needed a diverse background of mechanical, electrical, software, and robotics engineers combined with the proper equipment to ensure that questions and concerns could be quickly resolved.

Safety is always the number one priority, and the engineers received driver accident avoidance training in addition to automated vehicle operation training prior to operating the newly equipped vehicles. Safety drivers operated the vehicles to test the ADS features alongside test engineers who understood the automated operations and capabilities.

The team extensively tested the fail-safe mechanisms. Because of the different types of controllers and the implementation of the by-wire system, the performance and operation varied by vehicle. Each system had four types of fail-safe or override: throttle, brake, steering, and an emergency

stop button. The team found that calibrations across by-wire systems differed due to operational variances within fail-safe mechanisms and override procedures to take manual control of the vehicle at higher speeds.

“In the end,” says Lochrane, “the team verified that each system was properly tuned to provide sufficient results: the safety driver could easily and naturally use any of these mechanisms to immediately take full control of the vehicle in order to ensure its safe travel at all times.”

In addition, confirming the proper calibration of the LiDAR and the proper configuration of Autoware was very important. Remembering to collect ROS bags prior to each test case was significant for simulating and troubleshooting issues that occurred.

Moving Forward

Including the newest four vehicles, the initial CARMA-equipped passenger fleet has set the foundation to advance the FHWA team supporting the CARMA Program to higher SAE automation levels with extensive safety considerations. The next test fleet will include four heavy trucks. Class 8 vehicle dynamics will challenge the team to find a proper test facility as well as to create new test cases for both tractor and trailer that address complications during sensor calibration while testing under SAE Automation Levels 1 and 2.

“CARMA aligns with the Department of Transportation’s approach to

multimodal automation,” says FHWA Deputy Administrator Mala K. Parker, “and this program enables transportation innovation and safety with automated technology.”

DEBORAH CURTIS is a research transportation specialist at FHWA. She has more than 28 years of experience leading projects related to traffic signal systems, intelligent transportation systems, and, most recently, cooperative automation. She has a B.S. in civil engineering from West Virginia University.

MAE FROMM is the senior software engineer for the Saxton Transportation Operations Laboratory. She has a B.S. in decision sciences and management information systems with a minor in information technology from George Mason University. She has 17 years of software development experience and currently supports CARMA software development and testing activities.

LAURA DAILEY is the communications manager for the Saxton Transportation Operations Laboratory, overseeing marketing and engagement activities. She earned an M.S. from Drexel University and a B.S. with a marketing concentration from Elon University.

For more information, contact Deborah Curtis at Deborah.Curtis@dot.gov or visit <https://highways.dot.gov/research/operations/Cooperative-Driving-Automation>.



A group of transportation engineers and researchers supporting the CDA program and CARMA development in Peoria, IL, including testing and accepting the new CARMA3-equipped passenger vehicles.

Source: FHWA.

Experiencing **MAGIC** in Kansas



During a field trip to a local contractor's lot, the MAGIC Camp participants had the opportunity to operate large construction equipment.

© 2019 KDOT.

by **SAMANTHA DARLING**

A week-long orientation to the range of career opportunities for girls in transportation is making waves in the Sunflower State.

Each summer in Kansas, a group of high-school age girls gathers for a summer camp unlike any other. At this camp, pink hard hats, tool kits, T-shirts, and safety goggles are provided. The Kansas Department of Transportation's (KDOT) Mentoring A Girl In Construction (MAGIC) Camp offers girls the opportunity to learn about the many avenues of employment that are available to women in the transportation industry. This opportunity to gain exposure to a historically nontraditional industry for

women helps the girls build self-confidence as they explore career paths.

"In Kansas, as in much of the Midwest and the rest of the United States, transportation has been a male-dominated field," says Doria Watson, civil rights administrator in KDOT's Office of Civil Rights. "We want to expose the girls to career possibilities in transportation and challenge them to think about nontraditional fields and career paths."

During the 5-day camp, participants meet and interact with female business owners and construction workers, as well as participate in many hands-on activities and supervised field trips. The experience also introduces girls to female role models who have achieved success in many areas of transportation.

"MAGIC Camp is the best camp I've ever attended. Not only is it a camp full of females, but it's a camp that opens your eyes to career fields known as 'manly' jobs," says Jae'Mya L., age 15. "It showed me that these same jobs can be a woman's career and that females are capable of doing the same hard work that men do. For me, it made me feel so empowered!"

How It Started

Based on a national program started in Atlanta, GA, KDOT's MAGIC Camp has adopted a unique delivery model. KDOT focuses on transportation, in addition to the national program's general construction focus.

KDOT held its first camp in Topeka in 2015, with other camps in that city held in 2017 and 2019. Originally scheduled to be held every other year, the Topeka camp will now be held annually beginning in 2020. KDOT also added an annual camp in Wichita, which began in 2017, and will expand to Kansas City, KS, in 2020. So far, the camps have reached about 150 girls, and the agency hopes to expand further



MAGIC Camp participants spent an afternoon working at the Topeka Habitat for Humanity constructing a lemonade stand.

© 2019 KDOT.

and reach other communities in the future.

“While opening the doors to nontraditional careers for women is important, we also believe in the power of our MAGIC Camp in building self-esteem, understanding networking, and empowering girls to be confident in tackling things that are new to them,” says Watson. “We want the girls to understand they have a place here. We don’t want them to just survive, we want them to thrive.”

In addition to boosting self-esteem and career exposure, the camp provides a safe place for girls who are facing myriad challenges in their lives. KDOT strives to reach girls from disadvantaged homes and circumstances every year. In 2019, the Wichita camp had 80 percent of its participants come from group homes.

KDOT recruits girls through outreach efforts to schools, community centers, churches, and parents. Thanks to community partners and KDOT, participants can attend at no cost. “We target recruitment efforts toward females and minorities, and especially those who normally would not be able to afford summer camps,” says Watson.

Behind the Scenes

The itinerary for each day at MAGIC Camp focuses on a different mode of transportation. For example, on aviation day, the girls received a presentation by KDOT’s aviation department, visited an air traffic



Heidi S. practices moving dirt using a front loader.

© 2019 KDOT.



Peytan A. gets instruction from a KDOT employee on how to move the soccer ball on the cone into the garbage can, giving her the opportunity to test her accuracy.

© 2019 KDOT.

control tower and the Air Force’s 190th Air Refueling Wing, and received a tour of the Combat Air Museum led by veterans. Most days include field trips to destinations such as airports and transit facilities, where the girls can see jobs firsthand, experience simulators, and operate equipment.

“MAGIC Camp taught me that there are so many options when it comes to construction,” says

Peytan A., age 14. “My favorite part of MAGIC Camp was operating the machines and learning from everyone in the different areas. The professionals and instructors were helpful and wanted to show us that women can be in the construction field and succeed. The camp was so much fun!”

On the last day of each camp, KDOT holds a women in transportation roundtable. The girls hear from a panel of women working in the industry to learn about their experiences, their hardships, and how the field has evolved, among other topics. The girls can ask the panelists questions as well. At Topeka’s MAGIC Camp in 2019, panelists included KDOT representatives Gelene Savage, chief counsel; Sue Eiseman, construction and materials assistant bureau chief; Dominique Shannon, bridge evaluation engineer; and Catherine Patrick, director of safety. The panel also included Angie Gavin, the director of business development for a woman-owned construction business in Kansas City, MO.

“MAGIC Camp was a good way to learn that there are many jobs within construction,” says Heidi S., age 13. “Not only can you build and design structures, but also pave roads, supervise construction, find ways to keep roads safer, and work in a lab to create stronger bridge



This group of girls had a chance to get an up-close look at a few different jobs at a rail yard.

© 2019 KDOT.



Jae'Mya L. drills holes into a sign the girls constructed on the first day of camp.

© 2019 KDOT.

supports, among other things.”

The future of MAGIC Camp in Kansas looks bright. Plans include expanding to additional cities and developing methods to track the camps’ impact on participants. KDOT hopes to track the girls as they enter the workforce to learn whether they pursue careers in transportation.

“My eyes were opened in so many crazy ways, from tiling to road construction,” says Jae'Mya L. “I enjoyed the tiling so much that I am now starting a few projects at home. My mother used to be a steamroller operator and she said she loved it. I never completely understood how she could want to do a job like that.

But now that I have experienced MAGIC Camp, I completely understand why!”

Mentoring Beyond Camp

At KDOT, mentoring is essential. KDOT Secretary Julie Lorenz credits her success in her own career

to mentoring. Lorenz is only the second woman to hold the secretary of transportation position in the State. In an interview with Women of Asphalt in 2019, Lorenz said: “I think [holding this position] speaks to mentorship—the importance of mentorship. I think for women in particular, if they can see the opportunities that may not be as obvious, that will give them an opportunity to grow their careers in ways they hadn’t imagined.”

KDOT is also involved in other programs that reach women, minorities, and youth:

Jobs for America's Graduates is a school-based program for boys and girls in which KDOT representatives participate as presenters. KDOT also uses the program as a potential applicant pool for interns. For more information on the program, visit <https://jagkansas.org>.

Conference of Minority Transportation Officials (COMTO) is a national organization in which KDOT is actively involved. For more information on the activities of the COMTO Kansas City chapter, visit <https://comtokc.org>.

The *Garrett A. Morgan Shadow Day Program* is a national program designed to

educate students about career opportunities in transportation. Each February, KDOT participates by organizing a tour of various transportation-related agencies for a group of Kansas high school students. For more information, visit <https://comtokc.org/2016/01/11/who-was-garrett-a-morgan>.

KDOT's internship program is available to high school seniors. The program has been active for the last 3 years. Currently, KDOT hires five interns who work 10 to

“This opportunity was a real eye opener. It [gave me] the chance to have a better understanding of what women can be capable of.”

— Alicia T., age 15

15 hours a week during their senior year. The student interns are placed in various divisions throughout the agency based on their interests. Students often have the potential to be retained in a temporary position after graduation.

The National Summer Transportation Institute (NSTI) is a collaboration among



During a camp activity, Isabel R. and Heidi S. mix concrete they will use to make a planter.

© 2019 KDOT.

the Federal Highway Administration, State transportation agencies, and educational institutions. In Kansas, KDOT partners with FHWA to host a STEM-focused transportation camp at Washburn University. Held every June or July, the residential camp hosts middle school students on the college campus for the entire week.

KDOT's Construction Career Expo provides career information and educational

resources for students considering entering the skilled trades and the engineering and technology fields. In 2018, the biannual event hosted its largest expo to date with approximately 2,300 students from area middle schools, high schools, and technical schools. The next expo will be held September 22, 2020.

“People don't know what they don't know,” says Watson. “That is why we concentrate so many of our efforts on educating and demonstrating the possibilities for successful careers in transportation in a way that we think is exciting to girls—and to all kids and young adults.”

SAMANTHA DARLING is the coordinator for MAGIC Camp. She works for KDOT's Office of Civil Rights, focusing on project compliance and community outreach. She graduated from the University of Kansas with degrees in journalism and English.

For more information, contact Doria Watson at 785-296-7940 or Doria.Watson@ks.gov.

The girls listen to a KDOT employee discuss asphalt testing in the KDOT Materials Lab.

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INSPIRING THE NEXT GENERATION OF WOMEN TO JOIN THE TRANSPORTATION INDUSTRY

The Federal Highway Administration and its partners recognize the importance of introducing women and girls to the career possibilities and opportunities of the transportation sector. The importance of that goal drives a variety of activities and outreach programs focusing on science, technology, engineering, and mathematics (STEM).

Kids in the Workplace

Every year, the U.S. Department of Transportation and the Federal Highway Administration take part in Take Our Daughters and Sons to Work Day. Various activities at USDOT Headquarters and at FHWA's Turner-Fairbank Highway Research Center (TFHRC) are a hit with kids.

On April 25, 2019, USDOT's Office of the Secretary hosted more than 600 children aged 8 to 18 and their parents for USDOT Headquarters' Take Our Daughters and Sons to Work Day. The event featured more than 40 workshops and exhibits. Highlights included "The Drone Experience," where participants could learn to fly small consumer drones, and a booth where children could write about how they would improve the Nation's transportation sector.

The TFHRC also hosts a popular Take Our Daughters and Sons to Work Day event, sharing science and technology principles—and innovations—with schoolchildren of all ages. In the TFHRC labs, kids get a chance to see how a broad range of science and engineering disciplines are applied to highway research. Previous demonstrations have included seeing the science behind how road signs and road marking materials show up so well at night in the Chemistry Laboratory and the ways FHWA is making roads safer for pedestrians and cyclists in the Human Factors Laboratory. In 2019, kids even got to see a crash test at the center's Federal Outdoor Impact Laboratory, where FHWA scientists are experimenting with roadside barriers and guardrails.

TFHRC is using virtual reality to conduct human factors research in a safe, simulated environment. At Take Our Daughters and Sons to Work Day, children got to see applications for this technology and experience the world in virtual reality.

Source: FHWA.





ABOVE: In the TFHRC Hydraulics Lab, children used a sand table to build a river channel and then explore what happened to the water as the flow was altered or blocked by culverts and other structures.

Source: FHWA.



LEFT: Children and their parents participate in USDOT Headquarters' Take Our Daughters and Sons to Work Day.

Source: USDOT.



RIGHT: A USDOT employee shows a child how to operate a drone.

Source: USDOT.



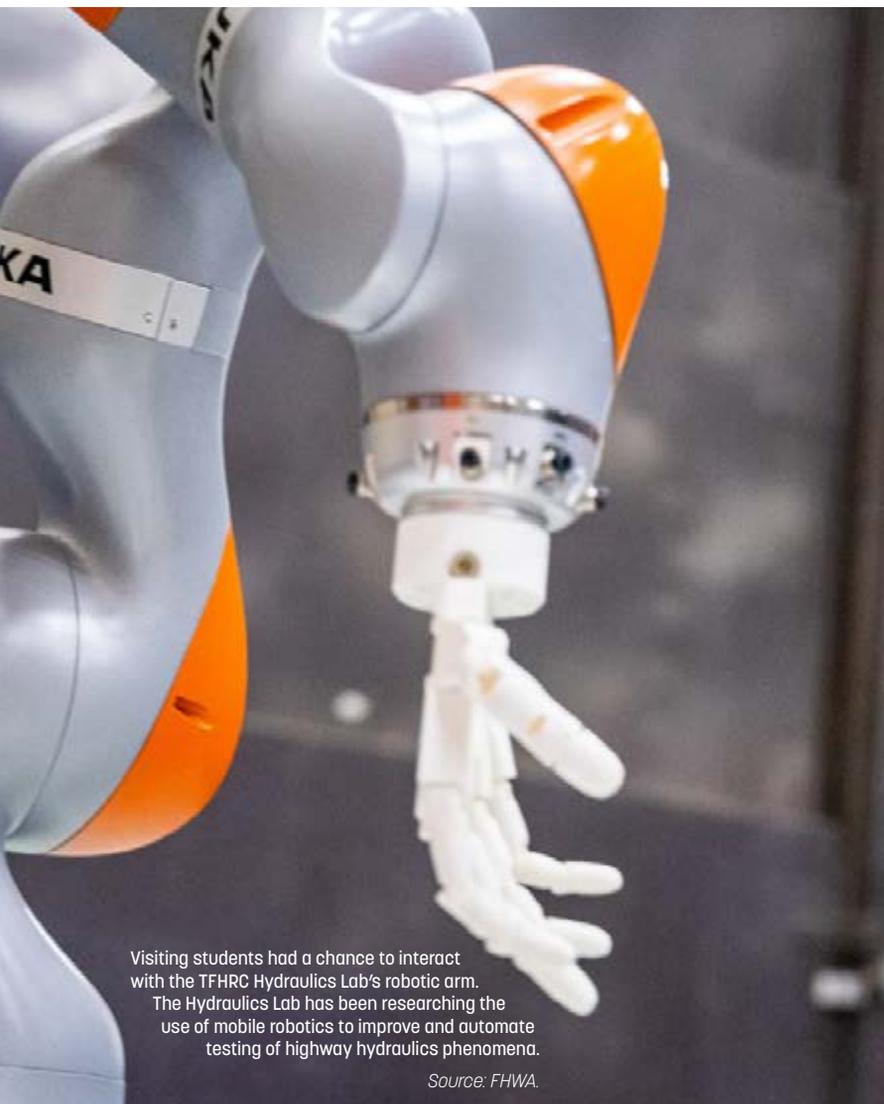
ABOVE: TFHRC engineers showed off an example concrete cylinder, explaining that concrete gets its strength because sand and aggregate are glued together with cement. Then, the kids got to see this principle in action with a delicious mix of “concrete” made from baker’s chocolate as the cement and chocolate puff cereal as aggregate. It took double the load to crush the chocolate mixture as it took to crush the cereal alone.

Source: FHWA.



RIGHT: As part of the TFHRC event, students got the chance to apply chemistry to analyze the components of various roadway materials. Here, they prepare to identify different metal ions in a solution.

Source: FHWA.



Visiting students had a chance to interact with the TFHRC Hydraulics Lab’s robotic arm. The Hydraulics Lab has been researching the use of mobile robotics to improve and automate testing of highway hydraulics phenomena.

Source: FHWA.



Cathy McGhee, director of research and innovation for the Virginia Department of Transportation, works with students using a small coding robot to simulate automated vehicle technology.

© WTS.

Transportation YOU in DC and VA

WTS International (formerly Women's Transportation Seminar) runs Transportation YOU, a hands-on, interactive mentoring program that offers girls ages 13 to 18 an introduction to a wide variety of transportation careers. Through the program, WTS chapters work to make a difference in the lives of young women by offering programs and activities that will spark their interest in all modes of transportation. The program encourages young women to take courses in math, science, and technology, the stepping stones to exciting careers that can change the face of the transportation industry.

Jasmy Methipara, of FHWA's Office of Transportation Policy Studies, has served the Washington, DC, chapter of WTS as the chair of the chapter's Transportation YOU committee since 2014, working with the young women of the Cardozo Education Campus (formerly Cardozo High School), McKinley Technology High School, and Dunbar High School. The committee of transportation professionals develops monthly youth mentoring events, including spotlight speakers, field trips, and in-class transportation activities for a select group of young women from



these schools. The events focus on STEM education, college readiness, and career opportunities in transportation. Spotlight speakers have included engineers, planners, flight attendants, and public engagement professionals. Each spring, Methipara's team hosts a speed mentoring event where students can exchange business cards with a multitude of professionals.

Since 2011, the Central Virginia Chapter of WTS has held a hands-on mentoring workshop for middle school girls. Each year, about 35 students from nearly a dozen schools come together for a day filled with hands-on STEAM (which adds the arts

into the traditional STEM disciplines of science, technology, engineering, and math) activities and opportunities to network with women in a variety of transportation careers. Several FHWA Virginia Division employees are active WTS members and are key participants in planning and coordinating the workshop. Event organizers use a variety of STEM lesson plan resources with creative twists to come up with fun and engaging activities, including solving puzzles in an escape room, programming dynamic message signs, and analyzing bridge designs.



LEFT: A workshop presenter for the Central Virginia Chapter of WTS demonstrates the features of an electric vehicle.

© WTS.

BELOW: Students and professionals participate in a Transportation YOU speed mentoring event in Washington, DC.

Source: FHWA.



Helping Girls Become Tech Savvy in Michigan

The American Association of University Women (AAUW) advances equity and education for women and girls nationwide. In Michigan, AAUW's Gaylord Area Branch hosts an annual Tech Savvy event, a 1-day conference designed to introduce girls in grades 6 through 9 to STEM studies and careers. Brandy Solak, an area engineer with FHWA's Michigan Division, coordinates volunteers for the event held each April at the University Center in Gaylord, MI. The event hosts approximately 200 girls annually, inspiring and enabling them to explore exciting opportunities through hands-on workshops.

For more information, visit <https://gaylord-mi.aauw.net/tech-savvy>.



ABOVE: Tech Savvy attendees don protective gloves and eyewear while creating a chemical reaction at a Tech Savvy booth.

© AAUW.



LEFT: Tech Savvy students learn about fingerprints and how they are used as identification.

© AAUW.

AASHTO Encourages Women in Transportation

The transportation workforce faces a pressing problem: a critical shortage of women in civil engineering and the transportation profession as a whole. To help address this issue, the American Association of State Highway and Transportation Officials offers the TRAC™ (Transportation and Civil Engineering) and RIDES (Roadways In Developing Elementary Students) programs, which aim to inspire students of all ages to consider

careers in transportation. The programs engage students in solving real-world transportation problems with innovative solutions by designing bridges, building magnetic-levitation trains, planning cities, and overcoming a host of environmental issues that impact transportation.

AASHTO's National Bridge Challenge, an extension of the TRAC program's bridge module, promotes an interest in STEM for girls and boys in grades 7

through 12. Students in this competition travel to the AASHTO spring meeting each year, where their bridges are tested and evaluated by State department of transportation engineers. Girls are encouraged to participate in the challenge; in 2019, an all-girl team from Michigan took first place in the 7th and 8th grade division.

For more information, visit <https://tracrises.transportation.org>.



Students participate in AASHTO's National Bridge Challenge, part of the TRAC program. The bridge designs are evaluated by professional engineers.

© Mississippi Department of Transportation.



ABOVE: Ashlei Davis pitches her idea for a product aimed at reducing tailpipe emissions.

© VDOT.



RIGHT: Student Ashlei Davis won first place in the business plan competition.

© VDOT.

Building Virginia's Transportation Workforce of Tomorrow

The Virginia Department of Transportation (VDOT) understands the importance of encouraging the future workforce. As part of its efforts, the VDOT Northern Virginia District's Civil Rights Division hosts an annual Transportation Career Fair for high school students, providing educational and networking opportunities. In 2019, the 15th annual fair included more than 100 engineering firms, organizations, agencies, and contractors from across Virginia. Approximately 1,300 high school students attended to learn about careers in civil engineering, architecture, technology, construction, environment, administration, and other transportation-related fields.

"The transportation industry has so many opportunities for careers following various paths," says Leslie Martin, the civil rights manager for VDOT Northern Virginia. "It's so rewarding when we find a new employee within the industry who came to know us through the career fairs in the past."

For more information, visit www.virginiadot.org/novacareerfair.



A student uses survey equipment during VDOT's Transportation Career Fair.

© VDOT.



WSSU's NSTI program partnered with the university's GEMS program to run an all-girls session for 25 students in 2019.

© GEMS.

North Carolina Hosts All-Girls Session of NSTI

The National Summer Transportation Institute (NSTI) is a transportation-focused career awareness initiative funded by FHWA's On-the-Job Training Support Services Program. NSTI aims to stimulate interest among middle and high school students in educational and career opportunities in transportation and related industries. The program encourages minority, female, and disadvantaged youth to pursue transportation-related coursework at the college and university level.

NSTI is open to all students in the United States and its territories. Since its

inception in 1991, NSTI has contributed \$80 million in funding to more than 60 accredited colleges and universities in 56 States and U.S. territories. To date, more than 25,000 students have participated—some even continue into other USDOT and FHWA internship, fellowship, and professional development programs.

In 2019, one of NSTI's hosting sites, Winston-Salem State University (WSSU) in North Carolina, took its program to another level. The university hosted an all-girls program with 25 students from Forsyth County, NC, schools. To develop

this special session, the NSTI program partnered with WSSU's Girls Empowered in Math and Science (GEMS) program, which celebrated its 10-year anniversary in 2019. GEMS aims to provide girls with the academic foundation and fortitude to be successful in any STEM environment, academic or professional. In 2018, GEMS received the Inspiring Programs in STEM Award from *INSIGHT into Diversity* magazine, which honors colleges and universities that encourage and assist students from underrepresented groups to enter STEM-related fields.



LEFT: Students visit the Battleship North Carolina museum in Wilmington, NC, during WSSU's 2019 NSTI program.

© GEMS.

BELOW: A student in WSSU's all-girls NSTI program learns how to remove the lug nuts from a tire.

© GEMS.



Female Innovators in Transportation: Yesterday and Today



Learn how women have contributed to transportation history through innovation, and meet some of FHWA's current female leaders.

Women have made important contributions to transportation history and continue to pave the way today.

@Bannafarsaj_Stock / Shutterstock.

by **DOUG HECOX**

Women have played important parts in the Nation's ever-expanding transportation system since its earliest days.

"Women have been critical to transportation history, but they must play a larger role in transportation's future," says FHWA Administrator Nicole R. Nason. "We have come a long way, but there are still miles to go."

According to the U.S. Census Bureau, women make up 51 percent of the U.S. population. Women earn more than half of college degrees and nearly 60 percent

of master's degrees. Women account for 47 percent of the U.S. workforce and 50.5 percent of the college-educated workforce. For each of the last 15 years, data from the Federal Highway Administration show there have been more women drivers than men.

"Women are the majority in literally every walk of American life, except in the world of transportation," Nason says. "Our workforce should reflect the population we serve. When there is balance in the workforce, everybody benefits."

Female Innovators in Transportation History

Women have played a greater role in transportation history than perhaps is common knowledge.

In 1825, Rebecca Lukens took over the Brandywine Ironworks after the death of her husband, Charles Lukens. Under her leadership, the business overcame near bankruptcy and went on to produce boiler plates for ships and trains and to manufacture rails. Today, nearly 200 years later and now owned by an international steel company, the former Lukens mill is the oldest continuously operating steel mill in North America.

In 1872, Emily Roebling was the wife of Washington Roebling, the chief engineer overseeing construction of the Brooklyn Bridge—then the Nation's tallest structure. When her husband fell victim to caisson disease—decompression sickness, now often called the bends—she managed the project on his behalf for the next 11 years until it opened to the public. She even crossed the bridge with President Chester Arthur to prove it was safe. More than 140 years later, its



From College

To Career



BEVERLY COVER IN CHARACTERISTIC POSE AS BATON-TWIRLING MAJORETTE WITH THE GEORGIA INSTITUTE OF TECHNOLOGY BAND.



MISS COVER TAKES OATH OF OFFICE.—Deputy Federal Highway Administrator D. Grant Mickle (right) administers oath of office to Miss Beverly Cover in his office on April 2 as Edward J. Martin, Chief, Personnel and Training Division, holds Bible.

First Woman Highway Engineer in Public Roads

Miss BEVERLY COVER, 22, a native of Cumberland, Md., should be getting used to pioneering. Miss Cover was graduated March 18 from Georgia Institute of Technology with a Bachelor of Civil Engineering degree. She was only the second woman in Tech's long history to receive such a degree. On April 2, Miss Cover became the first woman highway engineer to be employed by the Bureau of Public Roads.

Her reception at Public Roads offices in Washington was a bit more elaborate than that for most new employees. While flashlights popped, Deputy Federal Highway Administrator D. Grant Mickle administered the oath of office. He was assisted by E. J. Martin, Chief, Personnel and Training Division.

Three other top officials of the Bureau waited at one side to greet the smiling Miss Cover. They were F. C. Turner, Assistant Federal Highway Administrator and Chief Engineer; O. K. Normann, Deputy Director, Office of Research; and Carl C. Saal, Chief, Traffic Operations Division, where Miss Cover is now working.

The Bureau's "prettiest engineer" took it all in stride, even the inevitable puns about her being a "cover girl."

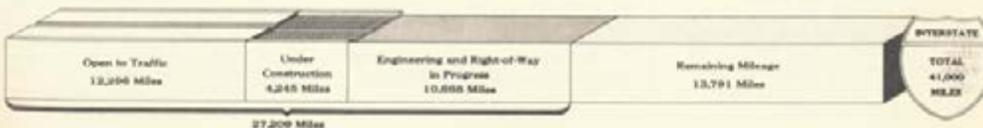
"That one has been used before," she said. "I don't mind, but actually my name is pronounced Koh-ver."

Mr. Saal said he had been getting lots of complaints about lack of office space in his division. "Now," he said, "everyone has suddenly discovered that he has room in his office for another desk."

Miss Cover sees nothing particularly strange about a pretty young girl being a traffic research engineer. She says

(Continued on page 6)

PROGRESS ON THE INTERSTATE SYSTEM AS OF DECEMBER 31, 1961 (See article in February issue of "The News")



This 1962 publication of the Bureau of Public Roads introduced Beverly Cover, the first female engineer hired by the agency.

Source: FHWA.

impressive network of wires, masonry, and iron bars makes the iconic Brooklyn Bridge an enduring testament to Roebling's strength and perseverance as the Nation's first female bridge engineer.

As automobiles became increasingly common nationwide at the start of the 20th century, women played other roles in transportation. In 1903, Mary Anderson invented the windshield wiper, which improved safety for those driving in bad weather. During the next two decades, 175 other patents were issued to women for inventions related to automobiles, traffic signals, and turn indicators.

For 40 years, American road and bridge building

remained very much a men-only industry. On April 2, 1962, FHWA's predecessor—the Bureau of Public Roads—hired Beverly Cover, the Bureau's first female highway engineer. She made headlines for being the second female engineer to graduate from Georgia Tech. At the time, "The News in Public Roads"—the agency's in-house newsletter—called the 22-year-old Cover the "Bureau's prettiest engineer" and ran a photo of her in a cheerleading outfit twirling a baton.

Cover worked for the Bureau for 2 years before leaving to start a family, shortly before the agency hired two more female engineers, Karen Porter and Judith Carlson. In an interview, Porter said her teachers encouraged her and took pride in the fact that a girl was studying civil engineering.

Not long after, in 1972, Janet Bonnema made history by becoming the first woman to work in a tunnel. After graduating from the University of Colorado-Boulder, she was hired in 1970 by the Colorado Highway Department as an engineering technician and was assigned to the Eisenhower Tunnel (then called the Straight Creek Tunnel) project on I-70, in the mountains west of Denver.

Despite having the proper training and being an avid rock climber, a downhill skier, a licensed pilot, and in better condition physically than many of the men on the project, Bonnema was assigned to a desk job because the workers in the tunnel would not work with a woman, believing that a woman's presence in the tunnel would jinx it and

cause men to die. In November 1972, Colorado changed its equal employment laws, and, after 18 months at a desk job, Bonnema was allowed to work in the tunnel. Her presence there prompted 66 workers to walk off the job in protest, although they returned the following day.

She stayed with the project until its completion on March 8, 1973, and went on to earn a master's degree in civil engineering from the University of Colorado-Denver. She later moved to Florida where she spent many years working for the South Florida Water Management District. For her work in equal rights in the workplace, Bonnema was inducted posthumously into the Colorado Women's Hall of Fame in 2012.

FHWA Women Changing Transportation Today

Valeriya Remezova

Dr. Valeriya Remezova describes herself as “driven,” which is appropriate for anyone who has earned a Ph.D. in technical sciences. Since joining FHWA in 2005, she has worked in the New York, Maine, and Vermont Division Offices and the National Highway Institute, and is currently the Deputy Division Administrator in New Jersey.

Remezova grew up in Turkmenistan and Ukraine and spent nearly a decade in various music- and sports-oriented schools. She was a junior quadrathlon champion at 13 and a concert pianist at 15, before being accepted to the prestigious Odessa State Academy of Civil Engineering and Architecture. She says, “My parents raised me as a strong and ambitious child,” hoping she would grow up to be “a happy, successful, and productive member of work and family communities.”

When not working, Remezova enjoys golf and yoga. “Golf helps me to rationalize or re-evaluate critical decisions I’ve made during the work week, as well as think about lessons learned,” she says. “Yoga helps me to let go of negative thoughts, release stress, and bring my focus



On November 14, 2019, Remezova (shown here in 2017) received the USDOT Secretary’s Equal Employment Opportunity/Affirmative Action Award for her work with the FHWA Women’s Forum. The award recognizes achievement in supporting the agency’s efforts to identify, recruit, and retain diverse employees.

© Valeriya Remezova.

back to what is the most important for me—finding inner power to balance my personal and professional life.”

For women interested in a career with FHWA, Remezova says, “Go for it—I promise you will not regret it....One

cannot have a better job anywhere else. The work schedule flexibilities, emotional intelligence support from your peers and supervisors, and opportunity to grow professionally while earning a great pension are outstanding.”

Gail Edwards



Gail Edwards is a communications specialist in FHWA’s Office of Public Affairs.

Source: FHWA.

Gail Edwards has been part of the FHWA family since 1991. She currently works in FHWA’s Office of Public Affairs, handling social media and editing a variety of publications. In her free time, she is an accomplished marathon runner and, though deaf, she has run six marathons since 2017 as a guide for a deaf-blind runner.

“I’m not sure I love running even to this day,” she says. “I’m not very natural at it. I used to play racquetball and tennis a lot....I played competitively in college one season. After college, I started working at FHWA, and, after a while, I found myself out of breath just climbing two flights of stairs. That bothered me so much that it spurred me into working out and running. The rest is history!”

In her many years of running, Edwards has completed a full “century”—sports parlance for a ride that is 100 miles (160 kilometers) or longer—and several “metric centuries”—rides that are 62 miles (100

kilometers) or longer. In 2018, she ran three marathons within a few weeks of each other. “I’ve gotten better over the years, but not faster,” she says. “That’s perhaps my next goal.”

Growing up on Long Island, NY, and in south Florida, Edwards said her parents never pushed her into a specific career. “They just wanted me to be financially independent and comfortable,” she says.

For 2 years, she studied architecture at the University of Florida, but explains that her interest was actually in historic preservation. “[The university] didn’t have that concentration until later,” she says. “Otherwise I probably would have stayed. I transferred to Gallaudet University in Washington, DC, and graduated 3 years later with a degree in English writing with a minor in TV, film, and photography. I’m not going to mention how many goal and major changes I’ve made along the way, but law school was one of them.”

She explains that when she began work at FHWA, it was at the end of a predominantly male engineering climate. “The Interstate [system] was more than 95 percent complete then, so I’ve constantly seen

female leadership within the agency ever since,” she says. “During that time, we’ve had several female administrators and deputy administrators, and many female associate administrators and directors. We

have good career programs for newcomers and career employees, such as professional and leadership development. All I can say is the agency is one big welcome mat for women who want to make a difference.”

Jasmy Methipara

If knowledge is power, Jasmy Methipara is one of FHWA’s most powerful people. She has earned an impressive trio of master’s degrees: one in chemistry from the University of California–San Diego, another in engineering from the University of Maryland, and a third in teaching from the City College of New York. Additionally, when she lived in Santiago, Chile, she earned a certification to teach English as a foreign language.

“I don’t think very many people wake up and decide to enroll in three separate graduate programs,” she says. “I did not plan this—life took me along various twists and turns. I’ve never shied away from learning and school, so I followed interests and opportunities as they presented themselves.”

When she is not busy with a women’s basketball league or her school’s parent-teacher-student association, Methipara (who joined FHWA in 2017) is an active member of Women’s Transportation Seminar (WTS) International. In 2018, she was named Member of the Year by its DC chapter.

“The mission of WTS is to advance women in the field of transportation,” she says. “Though it is important to provide



Jasmy Methipara discusses the summer Transportation YOU Summit to recruit applicants at a January 2017 event at Dunbar High School in Washington, DC.

Source: FHWA.

mentorship to professionals who are already in the field, it is also important to plant the seed early so young ladies envision themselves as transportation professionals from a young age.”

“As a former high school teacher,” Methipara says, “I understand the need for students to not only master academic curriculum, but also see how various classes can be applied in the real world by real people.”

Between her many family, work, and personal obligations, she says her time-management skills are constantly put to the test. “Basketball has contributed to my ability to work in a team in addition to

improving my overall physical and mental health, but I also enjoy crocheting and cooking, which teach me creativity and resourcefulness,” she says. “Mentoring and parenting teach me patience, communication, time management, negotiation, and—after multiple broken bones—crisis management as well.”

Her experiences have given her insights into how to succeed in balancing family and work. “It is important to pull from all your experiences, both professional and personal,” Methipara says. “Most of your life experiences contribute to your set of skills.”



Gloria Shepherd

Associate Administrator Gloria Shepherd just celebrated her 20th anniversary working for FHWA and demonstrates an impressive diversity of accomplishments. She has run marathons; earned a master of law degree, juris doctorate, and a doctorate of humanities; and climbed Mt. Kilimanjaro only days after having appendicitis.

“The main reason I climbed it was to honor my best friend of more than 30 years who had recently died of ovarian cancer,” she says. “I thought that because I was fit that I could make it even if it was a week or two after surgery. It was a journey I needed to take from a spiritual

Gloria Shepherd, currently the Associate Administrator for Planning, Environment, and Realty, has been with FHWA for two decades.

Source: FHWA.

perspective. Also, it takes a long time to prepare for Mt. Kilimanjaro.”

“The preparation of the gear, especially clothing, is challenging because of the number of climate zones,” she says. “Hikers begin in fairly warm weather and have to adjust to rain, hail, snow, and, of course, freezing temperatures near the summit. I did not want to wait another year, because I had prepared and was mentally psyched to do it.”

Shepherd’s interests vary widely. Apart from running, mountain climbing, and traveling, she also enjoys reading history, particularly about events from the 18th and early 20th centuries. “I really enjoyed reading Robert Massie’s *Peter the Great: His Life and World*,” she says, adding that she

also likes music, “especially gospel, modern jazz, and rhythm/blues.”

“Being a lawyer definitely helps me because of the policy work we do—such as drafting language for reauthorization, congressional requests, and the like,” she says. “Also, because I like to read, I think reviewing language thoroughly helps to find flexibilities in areas that we administer.”

Shepherd advises women to be choosy about their mentors. “Chemistry is important, so people should choose mentors with whom they can work well,” she says. “I also encourage women to learn as much as they can or need about other disciplines, especially ones that interact with theirs. An employee is more attractive if they have broad knowledge and skills rather than

being pigeonholed. This agency rewards multiskilled staff.”

“Finally,” she says, “I read a saying that ‘A person should chase performance and not success because, if you perform, success will come.’”



Amy Lucero with Transportation Secretary Elaine L. Chao and FHWA Administrator Nicole R. Nason.

Source: FHWA.

Amy Lucero Earns Inaugural Award

In 2019, FHWA introduced the Women Leaders in Transportation Award. The award aims to honor female FHWA employees who serve as outstanding role models in transportation through their extraordinary contributions, personal passion, and commitment to advancing the agency’s mission. FHWA grants the award to individuals who have demonstrated outstanding contributions to the transportation industry and have advanced women and minorities through programs or opportunities in the transportation field. These women have made a significant impact toward the accomplishment of the strategic goals of FHWA, USDOT, and the transportation industry.

In a ceremony on December 4, 2019, FHWA Administrator Nicole R. Nason presented Amy Lucero with the inaugural award. Lucero, who joined the agency in 1989, currently

serves as FHWA’s first Chief Technical Services Officer. In this role, she is responsible for the FHWA Resource Center, the National Highway Institute, and the agency’s focus on knowledge management, assuring a coordinated approach across FHWA for developing and enhancing the transportation workforce through technical training, technical assistance, and technology deployments.

In her remarks, Administrator Nason said that Lucero’s “outstanding leadership and vision have played a critical role in building and strengthening the Nation’s transportation workforce....Her contributions are helping to ensure that FHWA’s employees and the Nation’s transportation workforce are prepared to meet current and future transportation challenges and demands.”

Pam Kordenbrock and Sabrina David: The Tennessee Titans



Pam Kordenbrock (left) and Sabrina David (right) made FHWA history as the first two women to serve together as Division Administrator and Deputy Division Administrator.

© Pam Kordenbrock. © Sabrina David.

Pam Kordenbrock and Sabrina David—FHWA's Tennessee Division Administrator and Deputy Division Administrator, respectively—are the first two women to ever lead a division office. This year, they will celebrate their 10th anniversary of working together in leadership roles. When FHWA partnered them together as Division Administrator and Deputy Division Administrator (then titled Assistant Division Administrator), it was the first time in the agency's history that had happened.

"I didn't think FHWA would ever put two women together," says Kordenbrock, who also speaks Spanish, "but here we are 10 years later, still together."

"The Tennessee Department of Transportation celebrated us for this achievement," she said, "as did the Tennessee Road Builders Association, which even put us on the cover of its magazine. By the way, it is only the second time women have ever been on the cover of that magazine."

Paving the Way to a Better Tomorrow

FHWA's Offices of Human Resources and Civil Rights are actively working to attract, recruit, and retain more women—from visiting job fairs at more colleges and universities to running a progressive social media campaign to boost the agency's online presence.

"At the peak of the 2016–2017 construction season," Administrator Nason says, "there were more than 25,000 Federal-Aid Highway projects underway—employing

nearly 389,000 journey-level men and women. Despite all those thousands of jobs, on thousands of projects, women made up less than 7 percent of the workforce."

"That is obviously too low, and it is something I plan to address," she says. "As Administrator, I want to do everything I can to ensure FHWA reflects the population it serves. Our agency's workforce should mirror that of the American people."

Women make up a third of all positions at FHWA. "Without question, the roles

for women in transportation are growing," says Administrator Nason, "but making it possible for women to build the future is up to each of us."

DOUG HECOX is the senior career spokesman with FHWA's Office of Public Affairs. He has a journalism degree from the University of Wyoming, has published two books, and teaches journalism and public relations writing at American University.

EXPANDING the ROLE of WOMEN in TRANSPORTATION PROFESSIONS

Connecticut's WTS chapter offers professional guidance and opportunities for women to pursue careers in transportation.

by **AMY JACKSON-GROVE**

How does the transportation industry attract women to careers in its sector? The Women's Transportation Seminar (WTS) aims to provide answers. An international organization dedicated to building the future of transportation through global advancement of women, WTS boasts a network of more than 6,500 members (women and men), 79 chapters around the world and outreach to 40,000 transportation professionals. Begun in 1977 and based in Washington, DC, WTS provides professional development through mentorship, networking, lectures, and chapter events.

Each WTS chapter is unique. The WTS Connecticut Valley Chapter, now known as WTS-Connecticut (WTS-CT), was formed in 1992. In Connecticut, the chapter created its niche with programs that draw women and men to work together for the benefit of underrepresented female transportation professionals. Providing work opportunities, encouragement, and recognition to support women's advancement in transportation careers constitutes the chapter's long-standing mission.

"Women have gained a small foothold in transportation vocations in Connecticut," says Bonnie Damato-Torres, president of the WTS-CT Board of Directors. "Volunteer chapter leaders and members have successfully initiated several key transportation education projects."

Primary programs include the Transportation Mini-Series, a 1-day annual conference; the Student Outreach Program; a local scholarship program; and the recent Leadership Program.

WTS-CT comprises more than 100 active members, 25 corporate sponsors, and supporting public agencies. The chapter strives to create an inclusive environment for women in transportation statewide. WTS-CT has grown by presenting enriching activities and information to



Cheryl Malerba, chief of staff at the Connecticut Department of Transportation, speaks at the WTS Leadership Program in 2018.

© Connecticut Department of Transportation.

meet the changing career needs of women working in various transportation modes and sectors at the local, State, and Federal levels. The following examples show how.

Transportation Mini-Series

The pinnacle program of WTS-CT is its Transportation Mini-Series. Held annually since 2007, this program brings in experts from around the country to speak on current and emerging topics and draws attendance from across the transportation industry. Subjects range from the latest on connected and autonomous vehicles and what they mean for infrastructure, safety, and transit, to drones, accelerated bridge construction techniques, and implementing urban bike networks. The conference captures interest from, and participation by, a wider audience with every year. In 2019, the program drew more than 150 attendees.

Student Outreach Program

WTS-CT's Student Outreach is designed to improve science technology engineering and math skills at the high school level, by informing students about exciting jobs in

transportation and encouraging them to take transportation-related college curricula in pursuit of a transportation career.

College, high school, and middle school girls and women in Connecticut, along with their teachers, have been successfully participating in WTS-CT events and activities related to transportation careers since 2011, and momentum is building. In all, approximately 800 students have participated during 9 years of the Student Outreach Program.

The chapter's success in identifying partners with similar goals is the foundation of the work of the Student Outreach Committee. WTS-CT has formed strong educational partnerships with the University of Hartford, Trinity College, Central Connecticut State University, University of Connecticut, Mitchell College, University of St. Joseph, Naugatuck Valley Community College, Connecticut Science Center, New England Air Museum, and Belden Public Library in Rocky Hill, CT. The chapter has also forged important partnerships with organizations such as the Girl Scouts of Connecticut, Connecticut



WTS-CT organized this tour of the Groton-New London Airport for a group of local Girl Scouts during a student outreach event.

© Central Connecticut State University.

Women's Education and Legal Fund, and Society of Women Engineers, as well as with State agencies such as the Connecticut Department of Transportation (CTDOT) and Connecticut Airport Authority, and the regional planning government councils.

The WTS-CT Student Outreach Committee's main objective is to encourage young women to pursue careers in the transportation industry and to see themselves as unlimited in their potential to change the future. To that end, committee members were particularly inspired during a recent chapter-sponsored field trip to Bradley International Airport. The students expressed amazement upon learning how their State was the first in the country to use the "extradosed" design method at the Pearl Harbor Memorial Bridge on I-95 in New Haven, CT. The innovative extradosed design, a hybrid between cable-stayed and box girder bridge designs, enables the bridge towers to be shorter, which is necessary for the air traffic in and out of the nearby airport.

Scholarship Program

In 2007, WTS-CT started a local scholarship program for undergraduate women interested in careers in the transportation industry. For the inaugural year, the chapter awarded one \$1,000 scholarship. Since its inception, the scholarship program has grown considerably and now includes two graduate scholarships, each in the amount of \$1,000; two undergraduate scholarships, each in the amount of \$1,000; and a community college/trade school scholarship in the amount of \$500. To date, WTS-CT has awarded scholarships to a total of 24 women pursuing careers in transportation.

Leadership Program

In January 2017, WTS-CT launched its newest program—the WTS Connecticut Leadership Program. "This exciting homegrown program empowers WTS-CT members by providing speakers and programs that focus on core competencies necessary to become effective leaders and managers," says Cheryl Malerba, chief of staff at CTDOT. "WTS-CT membership and networks provide talent and expertise to locate pro bono services and low-cost programs."

Each module runs approximately 90 minutes to 2 hours in length and links to one of the core leadership competencies such as professional accountability, technology, critical thinking and decisionmaking, and strategic planning. When a participant

completes 5, 10, or 15 modules, she or he is awarded with certificates at the silver, gold, or platinum level, respectively. In 2 years, WTS-CT has awarded nine silver and three gold certificates and will award its highest recognition, the platinum award, this year in 2020.

Looking to the Future

WTS-CT looks forward to celebrating women in transportation for years to come. In 2017, to celebrate its accomplishments, the chapter hosted a 25th anniversary gala where past board members, corporate sponsors, partners, and advocates came together to toast a quarter century of achievements. Damato-Torres says, "The WTS-CT chapter remains steadfast in its goal to advance women in transportation and prides itself in the growth of the chapter's programs to support this mission."

AMY JACKSON-GROVE is the Division Administrator for the Federal Highway Administration's Connecticut Division. In this position, she leads a staff of 19 professionals and works closely with the leadership at the Connecticut Department of Transportation, metropolitan planning organizations, local government, and the Local Technical Assistance Program at the University of Connecticut in implementing the Federal-Aid Highway Program in Connecticut. Amy holds a bachelor's degree in civil engineering from the University of New Hampshire.

For more information, visit www.wtsinternational.org/connecticut.

Conference attendees mingle at the WTS Transportation Mini-Series in October 2019.

© Connecticut Department of Transportation.





EXAMINING INSIGHTS, INCLUSION, AND IMPACT ACROSS THE GLOBE

The 6th International Conference on Women's Issues in Transportation put gender-specific challenges in the spotlight.

by SHARI SCHAFTLEIN and JASMY METHIPARA

The Federal Highway Administration has long demonstrated through policy, programs, guidance, and research the importance of the Nation's transportation system to support users of all ages and abilities. Continuous and deliberate efforts must occur to meet this goal, particularly to achieve a seamless multimodal system. Through various multi-stakeholder workshops, conferences, and initiatives, the transportation industry is breaking down user groups by factors such as age, ability, ethnicity, geography, and income to evaluate how well it is serving the needs of identified groups.

In 2005, the number of female licensed drivers eclipsed males in the United States. The workforce gender gap has steadily narrowed. Both of these factors have contributed to the overall rise in both vehicle trips and person trips. Because women are an increasing segment of transport system users and also most at risk for harassment and trafficking, it is imperative that efforts be made to improve their safety and security.

Gender-specific aspects of travel and transportation were the focus of the 6th International Conference on Women's Issues in Transportation hosted by the Transportation Research Board in

September 2019 in Irvine, CA. Little research has been done to understand the major obstacles and constraints encountered by women travelers and women workers in the transportation industry. This conference aimed to focus on and explore in depth the need and opportunity such research affords to improve policies, actions, and outcomes for individuals facing gender-based disparity in transportation.

"Today's society continues to set expectations for transportation to demonstrate inclusion, diversity, and equity in all that

we do," says Therese McMillan, executive director of California's Metropolitan Transportation Commission and a conference co-chair.

After five previous conferences documenting gender differences since 1978, this conference emphasized a focus on not only insights and inclusion, but also on impact. Is the acquired knowledge and awareness, along with society's attention on gender equality, influencing progress on issues important to women? Through plenary, technical, poster, and social events, 349 participants (including 71 international participants and 60 students) reflected on a variety of topics such as personal safety, travel behavior, workforce development, new technologies, biking, policy, and inclusion/equity.



ABOVE: The 6th International Conference on Women's Issues in Transportation focused on gender-specific challenges, insights, and impacts.

© TRB.

LEFT: Gwen Kash, a Postdoctoral Fellow at Georgia Tech, presents a poster at the conference.

© TRB.



© TRB.

USDOT Participation

Beyond financial sponsorship through FHWA, participants from FHWA, the Federal Transit Administration (FTA), and USDOT's Office of the Secretary (OST) attended the conference and contributed in many ways.

To promote awareness of the conference, *TR News* dedicated its May-June 2019 issue to women and gender in transportation. In the issue, FHWA's Wesley Blount, Jr., a transportation specialist with FHWA's Office of Human Environment, authored an article titled "Challenges of Bicycling and Walking Faced by Minority Women in Low-Income Communities." The article describes how bike organizations are providing safe spaces for minority women to ride together to enhance skills and develop relationships. Also highlighted is FHWA's role in providing technical assistance to State departments of transportation to improve

safety and equity in low-income areas. The May-June 2019 issue of *TR News* is available online at www.trb.org/Publications/Blurbs/179900.aspx.

Shari Schaftlein of the FHWA Office of Planning, Environment, and Realty served as liaison to the Standing Committee on Women's Issues in Transportation (ABE70), which organized the conference. Schaftlein also moderated the opening plenary, designed to gain insights on how women's travel behavior has changed in the past 30 years in Asia, Europe, and the United States. The most notable trend is the change in commute patterns that reflects women's increased role in the workplace. All presenters agreed that more nuanced data collection schemes must account for multimodal trip generation associated with caregiving roles and other trip chaining. These travel patterns are very common for

workers involved in the gig economy where jobs are typically temporary or part time.

Panel Discussion on Collaborative Research

In a panel discussion, Danyell Diggs, a senior transportation program analyst from the FTA Office of Research, Demonstration, and Innovation; Patricia Hu, director of the Bureau of Transportation Statistics; and Jasmy Methipara, a research analyst from the FHWA Office of Transportation Policy Studies, framed the future for women in transportation through collaborative research with their counterparts in the European Commission.

Diggs presented FTA's approach to integrated mobility innovation, which fosters the complete trip. The complete trip is a holistic concept. If one link in a trip chain is not accessible or achievable, the chain is broken, the trip effectively ends, and an opportunity is lost.

Methipara shared gender insights from Federal data, specifically from sources such as FHWA's National Household Travel Survey, the National Highway Traffic Safety Administration's Fatality Analysis Reporting System, and the U.S. Census Bureau's American Community Survey. Methipara emphasized understanding new data and opportunities and combining them with existing data sources to improve insight into travel behavior trends.

"Separating data by gender tells a more complete story and is very important to fully meet the travel needs of the American people," says Methipara.

Emphasizing the theme of the conference, Methipara's presentation reminded attendees how good data improve women's inclusion in the transportation space, provide insight into their travel behavior, and impact service quality for female travelers.

The related work

underway at the European Commission is well described in the 2019 report, *Women in European Transport with a Focus on Research and Innovation* (EUR 29833 EN), available at https://publications.jrc.ec.europa.eu/repository/bitstream/JRC117687/kjna29833enn_1.pdf.

In addition to the presenters, FHWA's Francine Shaw Whitson, then a senior advisor with FHWA's Office of Infrastructure (now retired), recorded the session. Shaw Whitson compared what she heard from the panelists with her experience of representing FHWA with the World Road Association (PIARC). Many of the issues identified during the panel are similar to issues faced in Africa, Asia, and Europe, including the employment of women in the road sector, gathering data on women as road users, and improving accessibility to economic opportunities and services for women.



ABOVE: The accessibility of a complete trip can be defined in terms of an individual's ability to go from origin to destination without gaps in the travel chain.

Source: FHWA.

LEFT: Representatives from FHWA, FTA, and the Bureau of Transportation Statistics of the European Commission participated in a panel on possibilities for collaborative research.

Source: FHWA.

Combating Human Trafficking

OST's Office of International Transportation and Trade took the lead in coordinating a session on combating human trafficking in the transportation sector. Panelists spotlighted USDOT's counter-trafficking initiatives, early results from a National Cooperative Highway Research Program study on State DOTs, and the efforts of the Pennsylvania Department of Transportation's (PennDOT).

On behalf of Julie Abraham, the director of the Office of International Transportation and Trade, panelist Maha Alkhateeb, a transportation research analyst in the same office, provided an overview of USDOT's human trafficking initiative and the final report from the USDOT Advisory Committee on Human Trafficking (ACHT). Alkhateeb highlighted USDOT's efforts to combat human trafficking in the transportation sector by working with public and private stakeholders through leadership engagement, employee training, public awareness, and funding. The ACHT report includes useful tools and resources to bolster countertrafficking efforts by transportation stakeholders, including a model comprehensive strategy with associated policies and protocols, training and awareness best practices, quick implementation guides, and sample materials. The report is available at www.transportation.gov/administrations/office-policy/advisory-committee-human-trafficking.

Potential research opportunities exist for public and private research partners to collectively close the data gap on the intersection of human trafficking and transportation. Opportunities include the method and frequency of transportation used during recruitment and operations, victim interactions with transportation stakeholders, modal indicators of trafficking, and survivor transportation needs. NCHRP 20-121, State DOT Contributions to the Study, Investigation, and Interdiction of Human Trafficking, found that State DOTs are interested in understanding how their organizations can help combat this crime. Panelist Chris Baglin, the principal investigator for the study, described various approaches that State DOTs can take to support law enforcement and assist victims, such as training to identify the signs of the crime in a transportation setting and instituting processes for reporting suspected incidents.

In 2014, Pennsylvania passed comprehensive anti-trafficking legislation. In 2018, the National Human Trafficking Hotline received 630 calls from the State resulting in 275 pursued cases. To combat trafficking, PennDOT provides interactive web-based training to all DOT and transit agency employees, distributes Truckers Against Trafficking wallet cards at all driver license centers, posts public service announcements on all social media



From left to right, Chris Baglin; Elizabeth Connell (moderator), a transportation engineer with a consulting firm; Emma Lowe, the special assistant to Pennsylvania's Secretary of Transportation; and Maha Alkhateeb, a transportation research analyst with USDOT's Office of International Transportation and Trade, spoke on a panel about combating human trafficking in the transportation sector.

Source: FHWA.

channels and the televised Motor Vehicle Network, and partners with other transportation entities to spread awareness.

Gender Differences in Driving, Biking, and Safety

A popular poster at the conference was "Gender Trends and

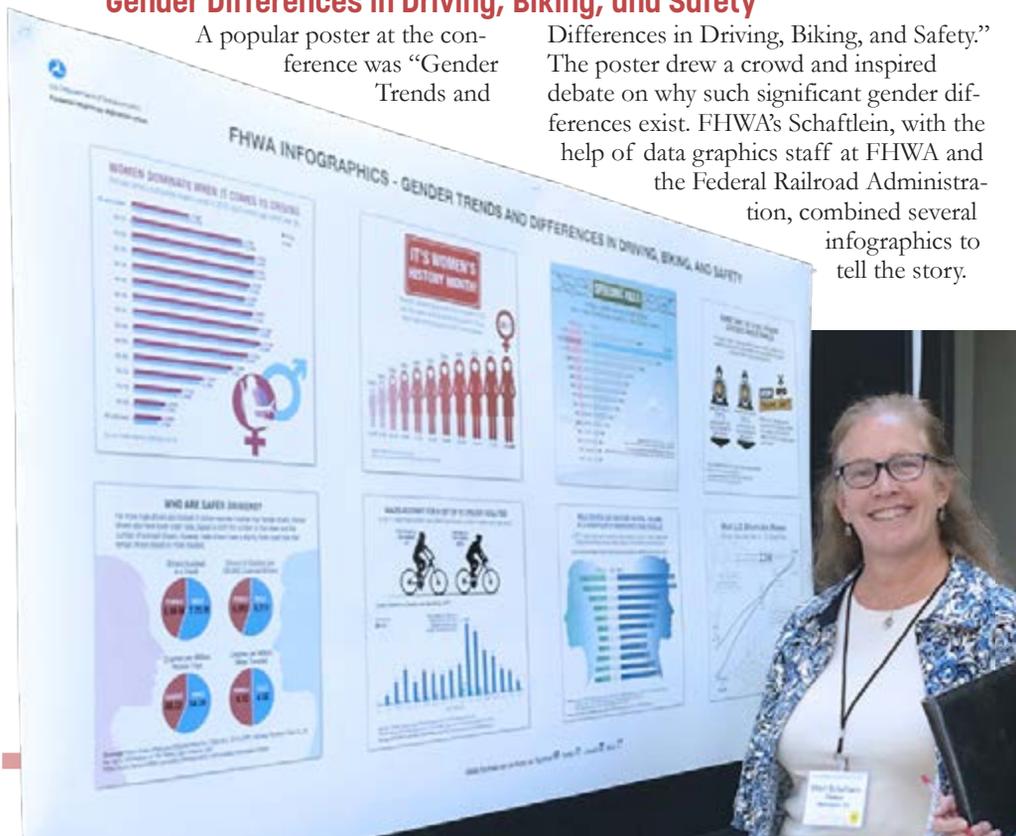
Differences in Driving, Biking, and Safety." The poster drew a crowd and inspired debate on why such significant gender differences exist. FHWA's Schaflein, with the help of data graphics staff at FHWA and the Federal Railroad Administration, combined several infographics to tell the story.

The poster highlighted statistics such as:

- In fatal crashes, more males were speeding than females, and males are involved in fatal crashes at a significantly higher rate.
- Fewer than 3 in 10 railroad crossing fatalities involve women.
- In 2017, women drivers outnumbered men for the twelfth straight year. The number of women drivers has doubled in the last 50 years and exceeds men in every cohort group over 34 years of age.
- Women are generally safer drivers based on total crashes, trips taken, and number of licensed drivers, but slightly worse for miles traveled.
- Men account for 9 out of 10 cyclist fatalities.

Shari Schaflein displays USDOT's poster on "Gender Trends and Differences in Driving, Biking, and Safety."

Source: FHWA.



Safety and Security

The most jarring statistics, which show how far we must go to ensure safe travel for women, come from the reports on harassment and violence against women in transport and public spaces. The challenge spans across the globe in transit, walking, and biking.

A 2014 survey of 16 major cities worldwide found that women in Latin American cities suffered the highest rates of harassment, with about 6 in 10 women physically harassed on transport systems. In Mexico City, 64 percent of women said they had been groped or physically harassed on public transportation. An onboard passenger survey by LA Metro in 2018 found 26 percent of female riders and 21 percent of male riders had experienced sexual harassment on transit over the 6 months prior. An online survey of 1,000 riders by the Washington Metropolitan Area Transit Authority in 2018 found 21 percent of respondents had experienced sexual harassment on public transportation and that women were nearly twice as likely as men to be victims. Across the literature, sexual crime against women in transit (cases of staring, touching, groping, ejaculation, exposing genitalia, and full rape) is highly underreported, and can occur when walking to and from bus or subway stops, as well as while waiting for and riding on public transit.



FHWA helped produce a video about women's transportation security issues titled, "Women's Safety & Security," which was shown at the conference.

Source: FHWA.

To help draw attention to the issue, FHWA's Office of International Programs and TRB program staff identified contacts across the world working on women's transportation security issues to share their stories via video. Participants received video instructions and interview questions and arranged local filming. Responses covered efforts to document harassment, lewd behavior, and violence; create awareness of the issue with decisionmakers; and advance security initiatives.

FHWA helped to compile the interviews and produce the 27-minute video with the San Francisco Metropolitan Transportation

Commission's videographer, Mark Johnson. The video includes content from Australia, Europe, India, the Philippines, South America, and the United States representing academics, nonprofits, national governments, cities, and international organizations. The concluding call to action for all transportation practitioners and young adults contemplating a career in transportation is to help women reach their potential by not limiting their travel choices because of fear. The video is available at www.cvent.com/events/6th-international-conference-on-women-s-issues-in-transportation/custom-113-c01736980c964d8093c8e32fc031e3b2.aspx.

Framing the Future

USDOT participants took turns staffing an information booth during the conference. The resounding sentiment was that it was a pleasure to network with students and young professionals who came to visit the booth. It provided a chance to educate them about the range of career opportunities and academic pathways to enter and to

thrive in a transportation career.

Increasing the number of women in the transportation workforce in all modes and at all levels is integral in the advocacy for women's issues as transportation users. Women's voices must help frame the future of the U.S. transportation system through greater awareness and understanding regarding women's travel behaviors, safety and health considerations, technology, engineering and infrastructure impacts, and policies addressing gender in transportation.

Asha Weinstein Agrawal, PhD, the director of education for the Mineta Transportation Institute and the conference's co-chair, says, "Whether it is through scooters, electric bikes, automated vehicles, microtransit, or other mobility on demand services, there is still a lot of work to do

to ensure that the mobility of the future will, out of the gate, meet the needs of women."

SHARI SCHAFTLEIN is the director of FHWA's Office of Human Environment. She has 34 years of public service spanning Tribal, State, and Federal governments and nonprofits. She has held leadership positions in the FHWA Office of Planning, Environment, and Realty for the past 16 years.

JASMY METHIPARA is a research analyst in FHWA's Office of Transportation Policy Studies. She is leading research efforts that use data in innovative ways to identify and analyze transportation policy issues. She has a master of science in engineering from the University of Maryland.

For more information, see www.cvent.com/events/6th-international-conference-on-women-s-issues-in-transportation/custom-113-c01736980c964d8093c8e32fc031e3b2.aspx or contact Shari Schaftelein at 202-366-5570 or Shari.Schaftelein@dot.gov.



Eileen Ryder speaks at the 6th International Conference on Women's Issues in Transportation.

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Public Information and Information Exchange

USDOT Combats Human Trafficking

In January, U.S. Transportation Secretary Elaine L. Chao called on transportation leaders to help “put the brakes on human trafficking” and announced \$5.4 million in grants awarded through the Federal Transit Administration’s Human Trafficking Awareness and Public Safety Initiative.

Secretary Chao says that USDOT “is committed to working with our public and private partners to fight human trafficking on America’s transportation system.” More than 440 organizations have signed on to the Secretary’s “Transportation Leaders Against Human Trafficking” pledge.

A number of USDOT initiatives are underway to increase awareness of human trafficking and equip transportation industry employees and the public with strategies to fight it. More than 53,000 USDOT employees receive mandatory counter-trafficking training, including special instruction for bus and truck inspectors. The Department also works with Federal agencies and nongovernmental organizations to develop and distribute a suite of human trafficking awareness training tailored for the aviation, rail, motor coach, trucking, and transit industries.

For more information, visit www.transportation.gov/stophumantrafficking.



Source: USDOT.

Secretary Chao Announces New Safety Initiatives

At the Transportation Research Board (TRB) Annual Meeting in January, Secretary Chao announced transportation initiatives aimed at harnessing new and existing technologies to improve safety for the traveling public and first responders.

USDOT is beginning the next phase of the Partnership for Analytics Research in Traffic Safety (PARTS) program. PARTS II expands participation in the PARTS program to include almost 70 percent of the U.S. automobile market and will collect data on additional advanced driver-assistance systems, such as adaptive cruise control and lane keep assist. Results derived from analysis of up-to-date, real-world performance data will assist researchers in assessing the safety effectiveness of these systems. PARTS is a voluntary, data-driven safety partnership between USDOT’s National Highway Traffic Safety Administration and the automobile industry.

Secretary Chao also announced a new program designed to help avoid traffic accidents and save the lives of first responders rushing to aid in emergencies. The Department intends to invest up to \$38 million for the First Responder Safety Technology Pilot Program that will help equip emergency response vehicles and key infrastructure with vehicle-to-everything (V2X) communication technology. These systems will use the 5.9 GHz Safety Band of spectrum currently allocated by the Federal Communications Commission for use in transportation systems.

Finally, the Department is endorsing a standardized listing of terminology for recommended advanced driver-assistance systems through an initiative entitled Clearing the Confusion, spearheaded by the National Safety Council, American Automobile Association, Consumer Reports, and J.D. Power. Currently,

LEFT: Two new publications from the Pedestrian and Bicycle Information Center provide information about micromobility, including e-scooters.

© Joaquin Carbalan P / Shutterstock.

there is variance among manufacturers. Standard language will ensure drivers are aware that these systems are designed to *assist*, not *replace*, an engaged driver.

For more information, visit www.transportation.gov/briefing-room/us-transportation-secretary-elaine-l-chao-announces-new-initiatives-improve-safety.

Volpe Center Celebrates 50 Years

The year 2020 marks the 50th anniversary of USDOT's Volpe National Transportation Systems Center.

To commemorate the event, the Volpe Center unveiled new resources celebrating its five-decade journey addressing the Nation's most pressing transportation challenges. These include *Five Decades*, a retrospective publication showcasing the center's most innovative work; a visual 50-year timeline of events, project milestones, and points in time since the center's establishment in 1970; and a video celebrating Volpe's workforce. The center also hosted a special anniversary exhibit at the TRB Annual Meeting, USDOT Headquarters, and the Federal Aviation Administration in January.

USDOT Deputy Assistant Secretary for Research and Technology Diana Furchtgott-Roth says, "Volpe does unparalleled research. All of us at the Department of Transportation are fortunate to be able to have such a large pool of talent just a phone call away."

"Our 50th anniversary is an opportunity to look back on the impact of our accomplishments—and look forward to a bright future," says Volpe Center Director Anne D. Aylward. "We want to thank our USDOT partners and other dedicated colleagues who have been part of this amazing journey, and we look forward to celebrating with you over the next 50 years and beyond."

For more information, visit www.volpe.dot.gov/news/celebrate-50th-anniversary.



Source: Volpe Center

Interactive Map Aims to Encourage Investment in Underserved Communities

USDOT recently released a new interactive map highlighting Federal investment in major projects located in and around Opportunity Zones across the country. Opportunity Zones are economically distressed communities designated by the United

States Secretary of the Treasury to incentivize economic investment in these areas. The designation was created by the 2017 Tax Cut and Jobs Act.

The map provides detailed information about vital infrastructure resources located near Opportunity Zones to help determine the range of potential economic investments. It illustrates data sets for major Federal highway projects, interstate exits, National Highway System bridges, intercity bus stations, commuter and light rail stations, Amtrak, intermodal rail and marine facilities, major ports, airports, and more.

For more information, visit www.transportation.gov/opportunity-zones/opportunity-zones-interactive-map.

PBIC Releases New Micromobility Resources

Two new resources from the Pedestrian and Bicycle Information Center (PBIC) offer contextual and applied insight into micromobility, including e-scooters.

The Basics of Micromobility and Related Motorized Devices for Personal Transport provides an overview of powered forms of micromobility and compares features of micromobility with a spectrum of other traditional and emerging forms of transportation. With a surge of new personal transportation devices coming to the market, some integrated into shared ride systems (such as bikeshare programs), there is a need to establish a common vocabulary for these options and provide basic information about how these devices are classified and regulated. The publication is available at <http://pedbikeinfo.org/MicromobilityBasics>.

The second resource, *E-Scooter Management in Midsized Cities in the United States*, documents practices related to micromobility, specifically e-scooters, in nine midsized U.S. cities. The scan includes feedback from city staff about challenges and opportunities that emerged with e-scooter adoption, including permitting and regulatory issues, potential safety concerns, and infrastructure design observations. It documents anecdotal evidence and noteworthy practices, and also identifies issues for future discussion. The publication is available at <http://pedbikeinfo.org/E-ScooterManagement>.

Source: PBIC

Volpe Center Helps Preserve Natural Sounds in National Parks

Natural sounds are a vital part of a park visitor's experience. Whether it is the sound of an owl hooting, a stream running through a historical site, or wind blowing through vegetation, these sounds are a quintessential part of the visitor experience. USDOT's Volpe Center supports the Natural Sounds and Night Skies Division (NSNSD) of the National Park Service in its work to protect, maintain, and restore acoustical environments throughout the National Park System.

Traffic is one of the most common sources of noise that detracts from the natural soundscape. The National Park Service maintains approximately 5,500 miles (8,850 kilometers) of paved roads and 7,000 miles (11,300 kilometers) of unpaved roads. The traditional noise mitigation technique of building noise walls is not practical in the parks due to the long stretches of roadways that must be protected as well as disruption of views and animal movements. Quieter pavements provide a good alternative to noise barriers since they do not disrupt views or inhibit animal movement on already established roads. The challenges of quieter pavements include performance changes over time coupled with lifespan requirements that can be unique to national parks.



ABOVE: The Volpe team collected roadside pavement noise data as part of the study for the National Park Service.

Source: Volpe Center.



LEFT: The Volpe team used vehicle-mounted equipment as well as roadside equipment to study pavement noise in National Parks.

Source: Volpe Center.

The Volpe Center is supporting NSNSD in conducting a pilot study of common pavement resurfacing treatments in Death Valley National Park to determine which may provide the most benefit in terms of noise reduction over time. The study involves measuring the noise levels before and after applying four different surface treatments. Measurements a month after the treatments have been applied show a difference in noise levels of almost 3 decibels between the treatments, the equivalent of nearly a 50-percent reduction in traffic volume. The study is planned to

span 5 years, and researchers currently are preparing to measure the performance of the pavements after the third year.

For more information, contact Aaron Hastings at Aaron.Hastings@dot.gov.

Source: Volpe Center

Rhode Island Launches DUI Initiative

The Rhode Island Department of Transportation (RIDOT), Rhode Island State Police, and the Rhode Island Attorney General Office recently announced the creation of a new task force dedicated to reducing the number of tragedies associated with impaired driving. Despite recent strides in reducing deaths related to alcohol-impaired driving, Rhode Island is in the top third of States with the highest percentage of fatalities involving impaired drivers. In 2017 and 2018 combined, more than 50 people were killed by impaired driving on Rhode Island roads.

This new unit of the Rhode Island State Police, which began its work in mid-November, consists of a significantly increased overnight road presence. All State Police members assigned to the unit have been trained and certified in impaired driving detection techniques, including standard field sobriety tests, breathalyzer operation, and drug recognition. In the first month of operation, the unit completed 97 shifts, arrested 90 people—49 of them for driving under the influence—and issued 684 citations. In addition, responders investigated 56 crashes, with nearly 30 percent of them involving a suspected impaired driver.

Though RIDOT has traditionally provided funds to State and local police for specific enforcement periods, typically around holidays and busy travel periods, this marks the first time Rhode Island will have a year-round unit of troopers dedicated to enhancing public safety by enforcing impaired driving laws.

For more information, visit www.ri.gov/press/view/37356.

Source: RIDOT

Unmanned Boats Help with Michigan Bridge Inspections

When the water level in local rivers and streams rises during storm events, it can create concerns about the impact on high-way bridges. Inspectors need real-time data on what's happening beneath the turbulent surge, but getting into the water for a visual inspection is risky.

To address this safety concern, the Michigan Department of Transportation (MDOT) has been evaluating small remote-controlled boats for safer and more efficient bridge inspections. Scour, the erosion or degradation of the streambed around a bridge's substructure, is a leading cause of bridge failure. MDOT routinely inspects bridges for scour around abutments and piers. Typically, this involves inspectors launching a boat and probing the channel bottom with metal rods, weighted tape measures, or sonar devices. During high-flow events, this can be a dangerous task.

MDOT is strategically placing four unmanned surface vessels equipped with sonar units throughout the State to inspect bridges for scour during high-flow events. In addition, the agency plans to use the technology for other applications as appropriate, including getting images of bridge substructure below water, viewing the underside of bridges, and documenting performance characteristics.

For more information, visit www.michigan.gov/mdot/0,4616,7-151-9620-512162--,00.html.

Source: MDOT



Dr. Kelly Regal joined FHWA in January 2020.

Source: USDOT.

Personnel

FHWA Welcomes Dr. Kelly Regal

In January, Dr. Kelly Regal was named Associate Administrator for Research, Development, and Technology with the Federal Highway Administration.

Dr. Regal previously served as the Associate Administrator for Research and Information Technology in the Federal Motor Carrier Safety Administration (FMCSA). In that role, she acted as the principal executive and advisor to FMCSA leadership on commercial motor vehicle research programs, safety data statistical and analysis programs, carrier licensing and insurance requirements, and stakeholder customer service. Previously, Dr. Regal served as the FMCSA Chief Information Officer and the Director, Office of Information Technology, where she directed a comprehensive information technology modernization program.

Dr. Regal joined FMCSA in 2009 and has worked in the transportation industry for her entire career, beginning with the Federal Aviation Administration. She has more than 30 years of research, engineering, and information technology leadership and management experience from the private sector and in the Federal Government.

Dr. Regal holds a Ph.D. in transportation engineering from the New Jersey Institute of Technology, an M.S. in aviation science and management from Embry-Riddle Aeronautical University, and a B.S. in Computer Science from Seton Hall University.

Resources for Alternative Fuels and Vehicles

by **DIANE TURCHETTA** and **CARRIE BORIS**

Alternative fuel vehicles are becoming more and more common on U.S. roads. These fuel types include biodiesel, electric, ethanol, hydrogen, natural gas (both compressed and liquefied), and propane. But concern over the availability and convenience of charging and refueling stations may make some drivers hesitate to undertake long trips.

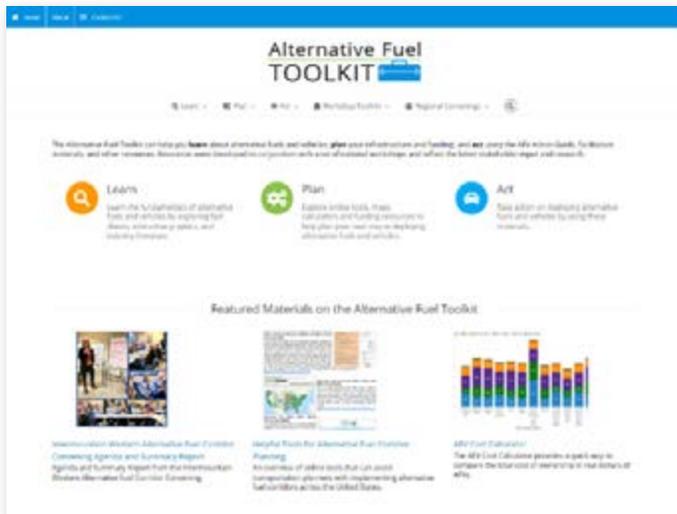
The Federal Highway Administration and its partners aimed to address these concerns by establishing alternative fuel corridors. These designated corridors on the National Highway System improve the mobility of passenger and commercial vehicles that employ alternate fueling technologies across the United States. For more information, see “Refueling America” in the Winter 2018 issue of *Public Roads*.

A One-Stop Reference

The variety of potential users of alternative fuel corridors means a lot of different questions. Where can I park my electric freight truck? Will a hybrid electric vehicle or a natural gas vehicle be more cost-effective? How can our county establish a clean freight corridor?

To help, FHWA supported a pooled fund initiative led by the Oregon Department of Transportation to produce the web-based Alternative Fuel Toolkit. The toolkit includes sections to Learn, Plan, and Act, as well as information about webinars and regional meetings. The toolkit is available at <http://altfueltoolkit.org>.

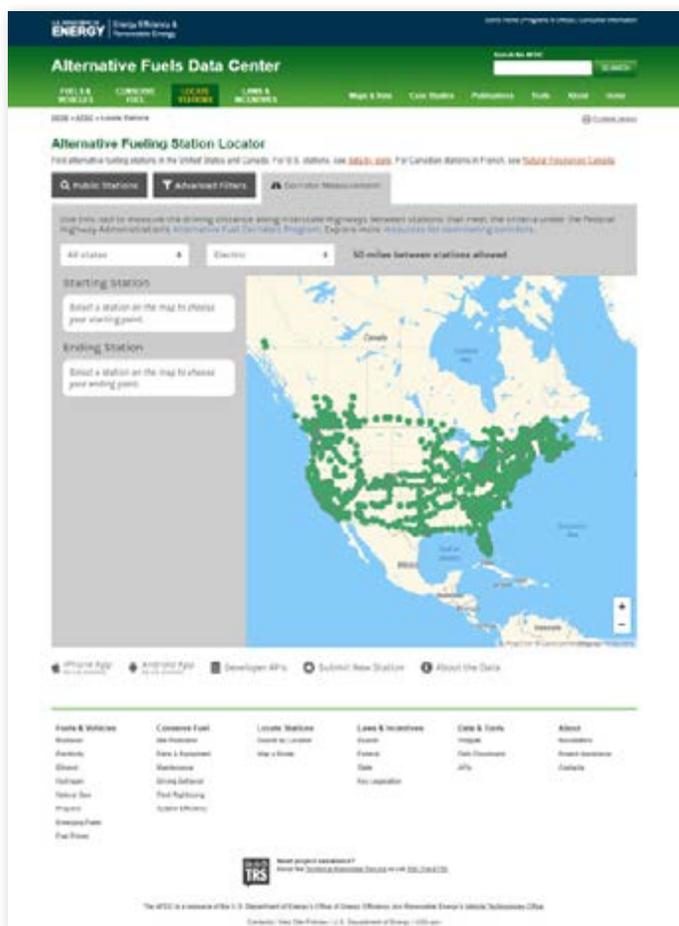
The Learn section provides the fundamentals of alternative fuels and vehicles with fact sheets, interactive graphics, and links to industry literature. The Plan section offers links to online tools, maps, calculators, and funding resources to help interested individuals and organizations create a plan for deploying alternative fuels and vehicles. The Act section provides additional materials including case studies, workshop summaries, webinars, and an interactive Action Guide to help users take action on deploying alternative fuels and vehicles. The team developed the resources in conjunction with a set of national workshops, so the resources reflect the latest stakeholder input and research.



Source: FHWA.

How Long Is that Drive?

One of the latest tools in the program’s arsenal is the Alternative Fuel Corridor Measurement Tool. Developed by FHWA in coordination with the Department of Energy’s National Renewable Energy Laboratory, the tool is intended to help State and local officials analyze alternative fuel corridors in their State or region. It can be used to measure the driving distance along interstate highways between stations that meet user-selected criteria for the various alternative fuels. The measurement tool is an expansion of the Alternative Fueling Station Locator tool available from the Department of Energy’s Alternative Fuels Data Center. It is available from the Plan section of the toolkit or directly at <https://afdc.energy.gov/stations/#/corridors>.



Source: FHWA.

For more information, visit www.fhwa.dot.gov/environment/alternative_fuel_corridors.

DIANE TURCHETTA is a transportation specialist in the Office of Planning, Environment, and Realty.

CARRIE BORIS is a contributing editor for *Public Roads*.

Establishing Public-Private Partnerships

by GAY DUGAN, VANESSA ALMONY, and AMBER CLARK

Addressing the complex transportation problems facing State and local governments has been the Federal Highway Administration’s focal point for improving project development. To address this issue, the National Highway Institute collaborated with the U.S. Department of Transportation’s Build America Bureau and FHWA’s Center for Innovative Finance Support in the Office of Innovative Program Delivery to offer a new instructor-led training: Public-Private Partnerships (FHWA-NHI-231033). Public-private partnerships (P3s) are an efficient, risk-aware contract method that can help overcome project development concerns. This course was designed to ensure that local, State, and regional transportation agencies gain the knowledge they need to incorporate P3s in their appropriate projects.

A Customized Program

The P3 course is unique in its modular approach, as it is customized to each agency’s training needs. Hosts may choose from 13 modules, which range from basic to advanced workshops. Participants at all levels of understanding benefit from this customized learning experience. An agency might choose the basic course, the basic plus some intermediate or advanced lessons, or only more advanced topics; the choice is made to meet the needs of each agency’s specific requirements. The basic modules teach participants how to successfully use P3s, while the more advanced courses integrate FHWA’s P3-VALUE Analytical Tool to better understand the analysis and evaluation of P3s from both public and private perspectives. The tool is intended to assist practitioners in the planning and high-level screening evaluation of P3 procurements, not the detailed evaluation of actual projects. Visit www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/p3_value for more information.

In addition to offering flexibility in the content selected, this course is available for as few as 20 participants in the introductory and intermediate-level programs and has a minimum of only 5 participants for advanced programs.



How to Attend or Host a Course

NHI invites professionals interested in earning continuing education units or professional development hours to visit their website and browse the complete digital course catalog, which lists more than 400 courses spanning 18 program areas. To sign up for alerts when a course session is scheduled, visit the individual course description page and select the “Sign Up for Session Alerts” link.

Interested hosts can submit a Host Request Form or find more information about hosting NHI courses by visiting www.nhi.fhwa.dot.gov/home.aspx.

NHI is approved as an Accredited Provider by the International Association for Continuing Education and Training (IACET). As an IACET Accredited Provider, NHI offers continuing education units for its programs that qualify under the ANSI/IACET Standard.

PUBLIC-PRIVATE PARTNERSHIPS (P3) ▶ NHI 231033

INTRODUCTORY MODULES



- Overview of P3s
- Successful P3 Practices

INTERMEDIATE MODULES



- Risk Allocation
- P3 Project Financing
- Evaluation Overview
- P3 Modal Contracts
- Tolling & Pricing
- Overview of the P3 Procurement Process:
 - A) Preparing for a P3 Procurement
 - B) Key P3 Procurement Structuring Themes
 - C) Key Procurement Steps

ADVANCED MODULES



- Financial Viability Assessment
- Value for Money Analysis
- Project Delivery Benefit-Cost Analysis
- Risk Assessment & Exercise
- Comprehensive Exercise (Custom)

FHWA Support

Depending on the options selected, the instructor-led training can range from half a day to 3 full instructional days. FHWA experts collaborate with each agency to develop an agenda and choose the training modules that best meet the agency’s needs. Once the courses are selected, one or two FHWA and contractor instructors will present the training at the agency’s site. As this training is tailored to address the needs of each requesting agency, the instructors’ expertise and the quality content provided are selected to help bridge the project development gap by drawing from both public and private sectors.

“States have appreciated the flexibility of the training agenda to meet the busy schedules of their staff and to target their specific needs relating to topic areas to be covered,” says Patrick DeCorla-Souza, a program manager at FHWA’s Center for Innovative Finance Support.

GAY DUGAN is an NHI training program manager.

VANESSA ALMONY and AMBER CLARK are contractors for NHI.

Source: NHI.

COMMUNICATION PRODUCT UPDATES

Below are brief descriptions of communications products recently developed by the Federal Highway Administration's Office of Research, Development, and Technology. All of the reports are or will soon be available from the National Technical Information Service (NTIS). In some cases, limited copies of the communications products are available from FHWA's Research and Technology (R&T) Product Distribution Center (PDC).

compiled by **LISA A. SHULER** of FHWA'S **OFFICE OF CORPORATE RESEARCH, TECHNOLOGY, AND INNOVATION MANAGEMENT**

When ordering from NTIS, include the NTIS publication number (PB number) and the publication title. You also may visit the NTIS website at www.ntis.gov to order publications online. Call NTIS for current prices. For customers outside the United States, Canada, and Mexico, the cost is usually double the listed price. Address requests to:

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For more information on R&T communications products available from FHWA, visit FHWA's website at www.fhwa.dot.gov, the FHWA Research Library at <https://highways.dot.gov/resources/research-library/federal-highway-administration-research-library> (or email fhwalibrary@dot.gov), or the National Transportation Library at ntl.bts.gov (or email library@dot.gov).

Safety Evaluation of Continuous Green T Intersections

Publication Number: FHWA-HRT-19-032

Continuous green T (CGT) intersections are an alternative to conventional signalized intersections with three approach legs.

The purpose of the study was to evaluate the safety effectiveness of low-cost safety improvement strategies through scientifically rigorous crash-based studies. One of the strategies evaluated for this study is the use of CGT intersections at three-leg locations. This treatment enables continuous through movement on the major street with a channelized left-turn movement from the minor street onto the major street.

This study examines the safety effectiveness of CGT intersections in terms of crash frequency using the propensity scores-potential outcomes framework. Researchers found that

CGT intersections reduced total crashes; fatal and injury crashes; and rear-end, angle, and sideswipe crashes.

Based on the findings of this research and the literature review, CGT intersections are likely to be effective when the following conditions exist: high through-traffic volumes on the major street approach on the far side of the intersection, low bicyclist demand, and no pedestrian demand or another type of pedestrian crossing nearby.

The TechBrief is available at www.fhwa.dot.gov/publications/research/safety/19032/index.cfm.



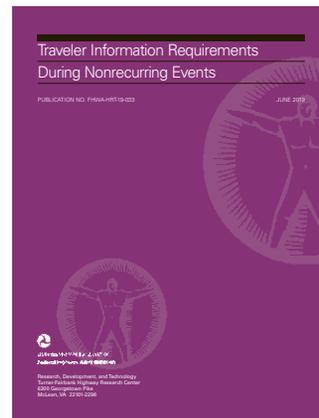
Traveler Information Requirements During Nonrecurring Events

Publication Number: FHWA-HRT-19-033

This report documents a series of experiments aimed at exploring the specific traveler information messages that are most likely to result in changes in traveler behavior during nonrecurring events. The study highlights the value of information in helping drivers make informed travel decisions. The report also provides information about how specific components of travel messages are interpreted by drivers and provides recommendations about the type of messaging that can be used to influence travel behavior.

This report is geared to traffic management center operators, agency leadership, transportation engineers and researchers, and others who share an interest in promoting safe and efficient traffic flow.

The report is available at www.fhwa.dot.gov/publications/research/safety/19033.



Safety Evaluation of Pedestrian Countdown Signals

Publication Number: FHWA-HRT-19-045

FHWA established the Development of Crash Modification Factors (DCMF) Program in 2012 to address highway safety research needs for evaluating new and innovative safety strategies by developing reliable quantitative estimates of their effectiveness in reducing crashes. The goal of the DCMF Program is to save lives by identifying new safety strategies that effectively reduce crashes and by promoting those strategies for nationwide implementation.

State transportation departments and other transportation agencies need to have objective measures for safety effectiveness and benefit-cost ratios before investing in broad applications of new strategies for safety improvements.

This study investigated the effectiveness of pedestrian countdown signals (PCS). These signals may reduce pedestrian crashes, but also affect other types of crashes. A before/after empirical Bayes analysis was performed using data from 115 treated intersections in Charlotte, NC, and 218 treated intersections in Philadelphia, PA, to evaluate the safety effects of PCSs.

The study results showed that after the implementation of countdown signals, pedestrian crashes decreased by 9 percent, total crashes decreased by 8 percent, and rear-end crashes decreased by 12 percent.

This report will benefit safety and traffic engineers and safety planners by providing greater insight into pedestrian safety.

The full report is available at www.fhwa.dot.gov/publications/research/safety/19045/index.cfm.



Strength and Fatigue Resistance of Clustered Shear Stud Connectors in Composite Steel Girders

Publication Number: FHWA-HRT-20-005

Accelerated bridge construction (ABC) is a technique in which large bridge elements are fabricated offsite or next to the site and are then connected onsite to complete the bridge. One ABC method is the use of full-depth precast concrete deck panels, which are placed on top of steel girders connected via shear studs. The precast concrete deck panels typically have pockets cast into them so that they fit around the shear studs. These pockets are then filled with grout to form the composite connection with the girder. Researchers conducted large- and small-scale fatigue and static tests in this study to evaluate the fatigue, strength, and spacing design provisions from the American Association of State Highway and Transportation Officials (AASHTO) for shear studs. The large-scale tests in this study were constructed with precast concrete deck panels and steel beams.

This report documents the fatigue and static testing of shear stud composite connections between steel girders and precast concrete decks. The static test results suggest that current AASHTO shear stud-strength design provisions are not conservative enough. This is balanced by fatigue test results indicating that current AASHTO shear stud-fatigue provisions are probably too conservative, which explains why there have not been widespread in-service performance problems.

This report will benefit those interested in the design, fabrication, and construction of steel bridges and PC concrete decks, including State transportation departments, bridge design consultants, and PC concrete facilities.

The full report is available at www.fhwa.dot.gov/publications/research/infrastructure/structures/bridge/20005.



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