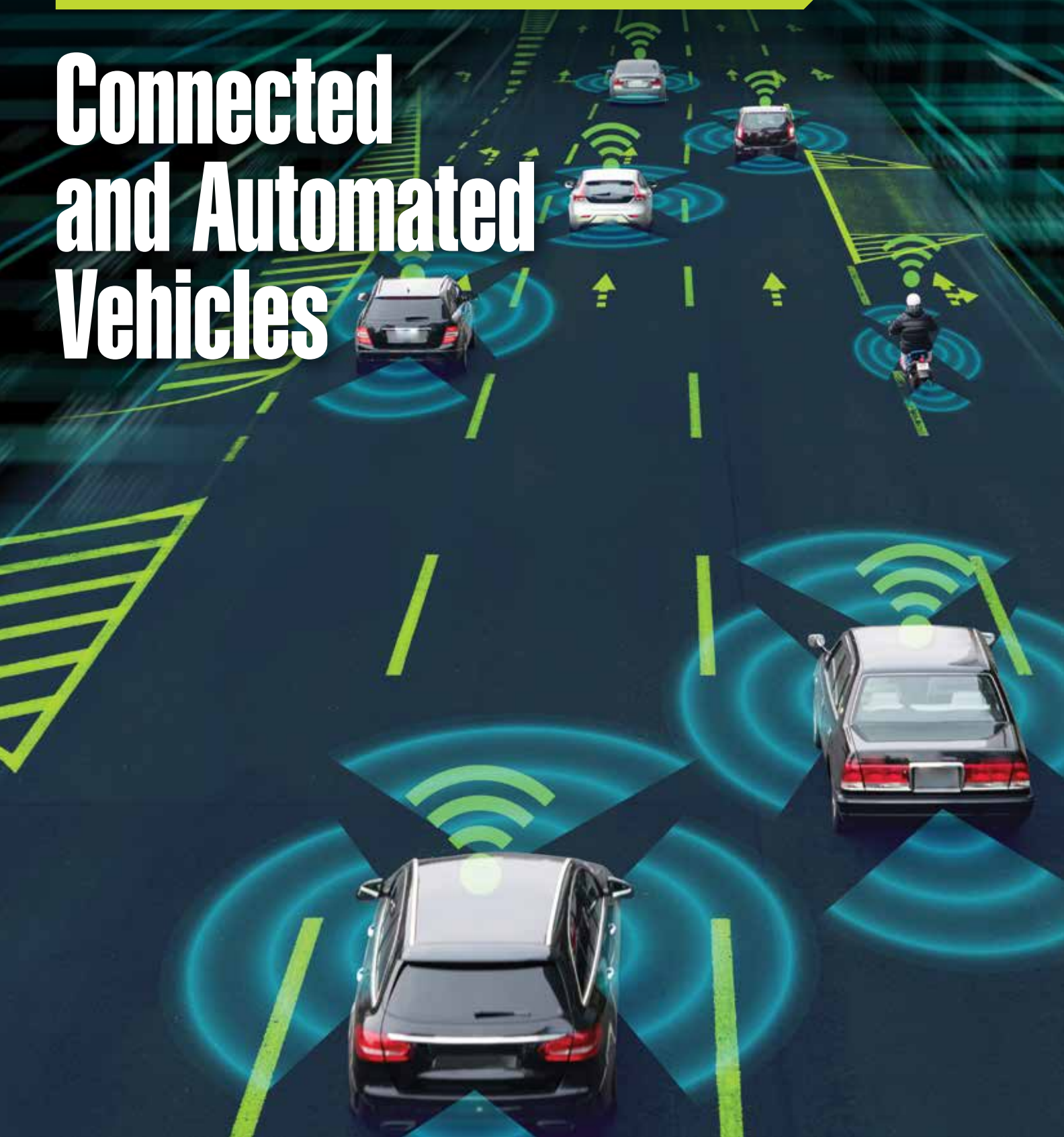
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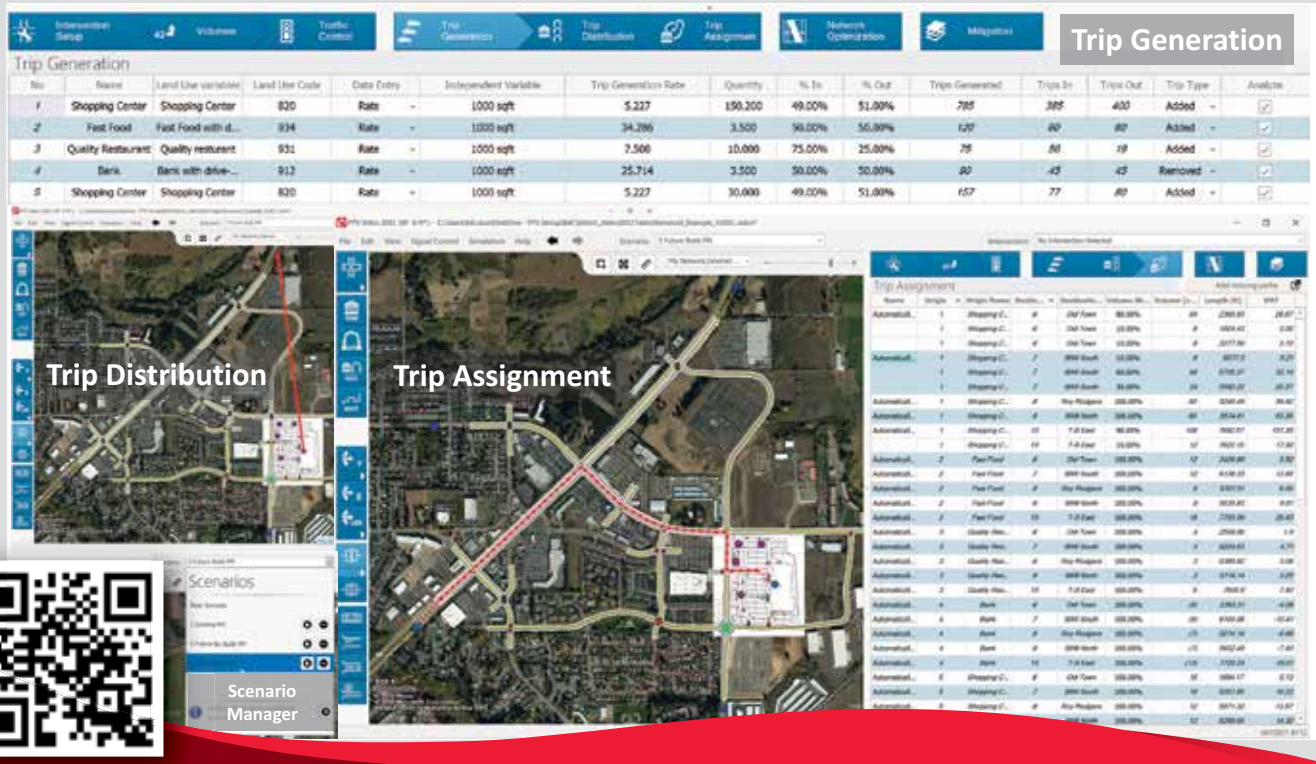
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Transportation Impact Analysis with PTV Vistro.

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PTV Vistro's scenario manager allows you to model limitless scenarios. New developments require several scenarios to evaluate traffic impacts and operating conditions. These include fluctuations during different times of day, and varying traffic levels between existing conditions, plus project conditions, and cumulative conditions. Moreover, PTV Vistro Scenario Manager easily enables you to evaluate phased projects and sensitivity testing of different development intensities, all within a single file.

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PTV Vistro's trip generation accommodates ITE and custom trip generation rates, as well as direct trip entries. Trip generation calculations can reflect both added or removed trips, so redevelopment sites can be accurately evaluated. Distribution and assignment of trips are completely under the analyst's control, allowing for maximum flexibility for assignments throughout the network, including project driveways. PTV Vistro's robust TIA workflows account for internal trip capture, pass-by, and diverted trips. Last-minute changes to the project description? Need to test alternative land uses? PTV Vistro's integrated workflow makes changes to the trip generation and resulting assignments a snap! Want to know how much VMT your project trips add, or how VMT differs between scenarios? PTV Vistro's detailed trip assignment table calculates VMT for new project trips.

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The Promise of a Smart Community



ALYSSA A. RODRIGUEZ, P.E., PTOE (F)
ITE International President

The pandemic paused many smart city and smart community programs, and recent restarts have a new focus—delivering on resident services, experience, inclusion, and equity. Early efforts in smart communities were solution-driven: a sensor was installed in search of a problem to solve, or data were collected in anticipation of organically generating new insights. However, technology only helps if it measures what is important and prompts action. The action only creates efficiencies if it can be automated and prevent tedious repetition. Once the tedium is removed, there is more room for innovation. The pandemic reset allows time to focus on the promise of a smart community, rather than technology for technology's sake.

A community can be defined fairly simply, "It's just a group of people…There's always a shared identity if you get broad enough…The question is whether or not the shared identity is meaningful to them," David Spinks wrote in a January 2018 article on *Medium*, "The Definition of Community." Meaning is developed through a narrower focus and generated through shared interests and goals. When it comes to transportation, more finely defined groups are endless, but—as an example—may include people who live in the community, people who maintain the community, people who invest in the community, and people who direct the funding for communities. A truly smart technology serves these communities and facilitates purpose and meaning.

At a recent meeting of the Missouri Valley District of ITE, I attended several excellent presentations on placemaking and the development of meaning in public spaces. Imagine a technological application that could identify right-of-way spaces that experience the most physical intersections within the neighborhood. An automated review of history within the records of the community could reveal several possible common experiences and triumphs to be celebrated within the space. An outreach system could utilize proxy measures and non-invasive, privacy-controlled methods for gathering input from everyone. The amount of interaction and activity within the space could be mapped and shared with the business community or a targeted group based on the needs of the residents to encourage development. Automated alerts for maintenance crews could tailor work orders to quickly identify issues and address them to keep the shared space beautiful and operational. Lastly, the changes over time can be monitored automatically to prove the value in placemaking and encourage decision makers to continue investment. While this is all theory, that is the promise of a truly smart community.

Curiously, connected and automated vehicles (CAVs) could create an artificial community bond on the roadways. In his book *Why We Drive the Way We Do*, Tom Vanderbilt discusses how humans have not evolved to communicate at high speeds. As a result, we assign behavior and motivation to other drivers without truly understanding their intentions. His prime example is the efficient zipper merge; some interpret the late merge as aggressive. However, "the seemingly selfish strategy keeps traffic moving for all," ("Tom Vanderbilt's *Why We Drive the Way We Do* Unlocks How to Unclog Traffic." *Wired*, Josh McHugh, July 21, 2008). CAVs communicate and/or sense each other's actual intention to fulfill the driving community's goals: safety and efficiency. As transportation professionals, we must work together to ensure that we create meaningful connections in these emergent smart communities as technology continues to advance.



Alyssa A. Rodriguez, P.E., PTOE (F)
ITE International President

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director's message



1627 Eye Street

This address probably doesn't mean much to most of you, unless you are a former Traffic Bowl participant. Then you probably know the correct answer to this Traffic Bowl clue: "What is the address of ITE Headquarters?"

Since 2011, ITE Headquarters has been in the Army-Navy building in downtown Washington, DC, USA, just north of the White House. This is the home base for our 25 staff, where the ITE International Board of Direction often meets and where we collaborate with our many association partners. Each year during the Transportation Research Board Annual Meeting, our offices bustle with activity as the Board, Council Leadership Team, *Leadership*ITE, and many technical Councils and Committees all meet here. Many of our student members also join us for our annual student reception.

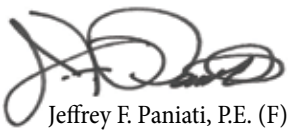
While our location works well for all of these activities, for some time we have had an excess of space. When our current lease was signed, various services once performed by ITE staff on-site are now provided by others under contract with ITE. We also recently moved to a hybrid work schedule due to COVID-19, with employees in the office two-to-three days per week and working remotely the remaining time.

Even prior to the current environment, where many businesses and organizations are looking to reduce their footprint and save money, ITE was looking for an opportunity to reduce our space and costs. Fortunately, another tenant in our building requested additional space, and we have reached an agreement with the building owner to amend our lease, releasing one-third of our space and consolidating our offices in the remaining space. As part of this agreement, ITE will receive a refurbished office space, fully paid for by the building owner, along with some months of free rent. In exchange, we will extend our current lease.

This means that 1627 Eye Street will remain our home (and a Traffic Bowl clue) through at least 2030, but at a significantly reduced cost. It also means that we will be undergoing quite a bit of transition over the next nine months or so. This month, we are consolidating our operations into the reduced space. In March 2022, we will move to temporary "swing" space for four months while our space is being rebuilt. And, if everything goes according to plan—does that ever happen?—we expect to move back to our new offices in June 2022.

I wanted to share this good news with you so that you are aware of our continuing efforts to reduce operating costs and enhance the efficiency of our operations, and also inform you of the disruptions that will be going on this winter and into 2022. COVID-19 has forced us to learn many important lessons on how to provide strong member support from wherever we are located. With the technology and tools utilized by ITE, I am confident you will continue to receive high quality member service even during this period of disruption. I also ask for your patience if we have a hiccup or two along the way.

If you happen to be in Washington, DC for business or pleasure, we hope you will stop by 1627 Eye Street for a visit. We always enjoy seeing our members in person, and look forward to showing you around our "new" ITE Headquarters next summer. As always, you can reach me on the ITE e-Community or on Twitter @JPaniatiITE.



Jeffrey F. Paniati, P.E. (F)
Executive Director and Chief Executive Officer

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Volume 91 | Issue 11

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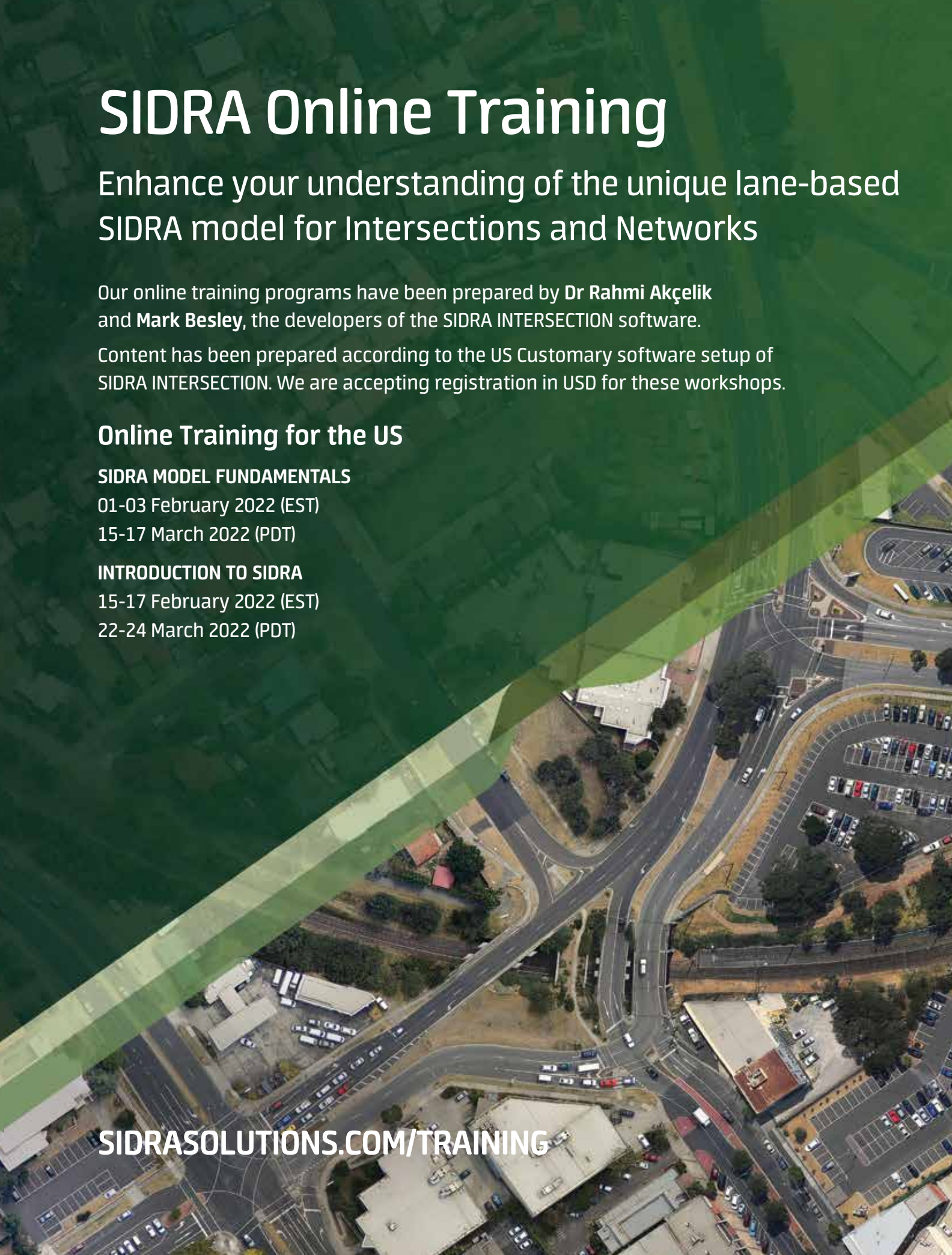
Our online training programs have been prepared by **Dr Rahmi Akçelik** and **Mark Besley**, the developers of the SIDRA INTERSECTION software.

Content has been prepared according to the US Customary software setup of SIDRA INTERSECTION. We are accepting registration in USD for these workshops.

Online Training for the US

SIDRA MODEL FUNDAMENTALS
01-03 February 2022 (EST)
15-17 March 2022 (PDT)

INTRODUCTION TO SIDRA
15-17 February 2022 (EST)
22-24 March 2022 (PDT)



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PEOPLE IN THE PROFESSION

New Members

ITE welcomes the following new members who recently joined our community of transportation professionals.

Canadian
Atm Abir
Ainsley Brown
Bryan Kelly, E.I.T.
Viktoriya Zaytseva

Florida Puerto Rico
Kennia Alonso
Kelly Farabee, P.E., PTOE
Cali Anne Lopez
Kiara Perez-Valle
Katherine Teipel

Global
Sabeena Abdulnasir Kunju
Saleh M. Al-Kuwaiflie
D M Ghius Malik
Tsz Kin Lo
Adam Lynch
Marco Pasetto, P.Eng.
Tayebeh Saghapour

Great Lakes
Ross Baker, P.E.
Nils Jordahl
Kirit Patel
Richard L. Record
Mitchell Sforzini

Mid-Colonial
Xueyu Gao, P.E., PTOE
Joshua Killian
Jana B. Potvin
Shane Rufenacht

Missouri Valley
David Glabas, P.E.

Mountain
Muhanned Adeeb
Steffen Horwath
Daniel W. Larson
Jared Fred Law
Stephanie Lopez
Angela Parsons
Alfred Ramos
Vanessa Rodriguez

Northeastern
Randy Bragg
Keyan Cody
James John Czach
Arianna Mickee-Seguin

Southern
Mark Ryan Casson
Jeffery Dale
Robert P. Hanson, P.E.
Nicole Harmon
Mitchal Lee Johnson
Sarah Jane Lowentritt
Andrew Sanders
Jeffrey Weisner

Texas
Michelle Canton
Brittany Darrah
Yara Doumit
Sara Hamza
Taylor Li
Francisco Mendoza

Western
Hannah Lee
Pratiik Malik
Samantha Miller
Linda Myers

Letters in parentheses after individuals' names indicate ITE membership status: S - Student Member; IA - Institute; M - Member; F - Fellow; R - Retired Member; and H - Honorary Member. Information reported here is based on news releases, and other sources. If you have news of yourself or the profession that you would like considered for publication, please send it to Holly Stowell, hstowell@ite.org.

Member Updates

Mayor of City of Seattle, Jenny Durkan, recently recognized ITE member **Dongho Chang, P.E. (F)** in a special way upon his departure from the city, declaring September 14, 2021 as "Dongho Chang Day." According to the official proclamation, "Dongho Chang, the City of Seattle's Traffic Engineer, has inspired and worked alongside an efficient and dedicated department for the past 9 years...His list of accomplishments are lengthy and impressive, and his leadership on many policies and projects such as lowering speed limits on arterial streets, safety improvements on high-crash corridors throughout the city, improvements for transit riders including bus-only lanes, and pedestrian first traffic signals…are just several of


City of Seattle
PROCLAMATION
Dongho Chang Day

ITE Talks Transportation Podcast



Evolution of Urban Form and Function *Special Joint Episode with CIHT*

Noreen McDonald, University of North Carolina, Chapel Hill

Host Bernie Wagenblast is joined by special guest co-host Justin Ward, Head of Policy and Practice, CIHT (Chartered Institution of Highways & Transportation), London, UK. They speak about the evolution of patterns and trends related to transportation and movement in urban areas with Noreen McDonald, Chair, Department of City and Regional Planning, University of North Carolina, Chapel Hill.

All episodes available at www.ite.org/podcast/ | Subscribe for free via iTunes at http://apple.co/2hOUz8t

the many achievements Chang completed during his time in the Department of Transportation." Chang is now serving as the state traffic engineer and director of Transportation Operations Division at the Washington State Department of Transportation.

Soumya Dey, P.E., PMP (F) has joined firm Sam Schwartz as vice president and national director, Intelligent Transportation Systems (ITS). Dey has three decades of experience in ITS, systems management and operations (TSMO), smart cities, data analytics, safety, traffic engineering, transportation planning, and asset management. For the past 16 years, he has held several leadership roles at Washington, DC, USA's District Department of Transportation (DDOT), where he led the agency's ITS program at both the strategic and tactical levels and helped integrate the city's automated traffic enforcement into safety and Vision Zero program.

ITE Journal Senior Editor and Writer **Holly Gilbert Stowell** gave birth to a baby girl, Macy Wade Stowell, on July 3, 2021.

Obituaries

ITE recently learned of the passing of the following member. We recognize him for his contributions to ITE and the profession, and send condolences to his family.

Robert P. Sands, P.E. of Minneapolis, MN, USA, passed away on March 8, 2021. He was a Fellow and Life Member of ITE. **itej**

ITE NEWS

Go Green with *ITE Journal*

Not in the office to get your mail, or would you like to be more "green?" You can choose to stop the mailed delivery of *ITE Journal* by completing a quick online survey at http://bit.ly/ITEJGoGreen. You will still get the emailed version of *ITE Journal* that goes out on the first or second of each month and have full access to the digital edition.



New ITE Quick Bite: Connected and Automated Vehicles



The goal of the Safe System Approach is to design and operate roadways in a manner that anticipates human error and accommodates human injury tolerances with a goal of eliminating fatal and serious injuries. Because autonomous vehicles (AVs) present an opportunity to achieve safe speeds and safe vehicles through automation, the Safe System Approach is relevant today and in an AV future. This new Quick Bite from ITE, *Autonomous Vehicle Considerations under the Safe System Approach,* explores the potential benefits, risks, and key considerations related to AVs under the elements of the Safe System Approach. Access the Quick Bite at http://www.ite.org/AVQuickBite. **itej**

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RSP1

RSP (Road Safety Professional), Level 1 For a broad audience of professionals who in the performance of their work make decisions or take actions that potentially impact the safety of the traveling public

RSP2

RSP (Road Safety Professional), Level 2 Geared toward professionals whose primary job functions are directed at improving the safety performance of the surface transportation system. Prospective certificants will select between a Level 2 certification with a "behavioral specialty" or Level 2 certification with an "infrastructure specialty."

For more information and applications, visit www.tpcb.org

THE DEADLINE TO APPLY FOR THE FEBRUARY 2022 EXAM PERIOD IS DECEMBER 1, 2021

ITE STEM Committee: Inspiring the Next Generation of Transportation Professionals

Why is ITE interested in K-12 STEM outreach?

K-12 STEM outreach by ITE members builds awareness of transportation as an exciting and rewarding STEM career choice so that our industry has a strong pipeline of diverse, bright, and thoughtful future transportation professionals.

About the ITE STEM Committee

The ITE STEM Committee of the ITE International Board of Direction is tasked with developing and growing ITE's involvement in science, technology, engineering, and math (STEM) outreach to K-12 students.

The ITE STEM committee is composed of passionate ITE members who enthusiastically volunteer their time to advance this cause through a variety of different efforts. Read more below about what we've been up to lately and what activities we're currently pursuing.

New STEM Activity: Snow Plowing!

In January, the ITE STEM committee developed the "Roadway Maintenance: Plowing Snow" STEM activity for the K-5 elementary school age group. In this activity, kids first create their own snow with shaving cream and baking soda, then practice clearing the roadway with miniature snowplow trucks while they learn the importance of clearing shoulders, bike lanes, and sidewalks.





This activity was adapted from a method used by the staff at the City of Boulder, CO, USA to show a group of professionals from WTS how their snowplowing work gets done. It seemed like something kids would enjoy doing as well!

Check out our website at www.ite.org/STEM for other fun activities for all ages.

Have an idea for a STEM activity or want to share your experience of doing STEM outreach events with students? Send us an email at STEM@ite.org.

National Engineers Week and Introduce a Girl to Engineering Day

The ITE STEM Committee partnered with the Women of ITE Committee to celebrate Engineers Week (February 21–27) and Introduce a Girl to Engineering Day (February 25) by putting out a call for video resources to help K-12 students considering engineering careers.

Women (both students and professionals) created short videos to answer questions such as how they got into the field, why they chose to study engineering, what attracted them to transportation engineering, their favorite part of their job, and advice for kids considering careers in transportation engineering. Thank you to all the women who submitted their videos and helped to create this fantastic resource! *Be sure to share these videos with K-12 students in your communities!*

The 15 short videos are now posted to the following YouTube playlist: https://bit.ly/STEMeweek.

The STEM Committee also hosted a Women in Transportation virtual panel on February 26 where K-12 students, teachers, and ITE community members joined a lively discussion.

ITE members **Marsha Anderson Bomar, AICP ENV SP/Trainer (H)** (MARTA), **Lindsey Klein (M)** (Imperial Traffic and Data Collection), **Suzanna Set, P.E., PTOE (F)** (Harris County Engineering Dept.), and **Gaby Tassin, P.E., PTOE, PTP, RSP1 (F)** (Alliance Transportation Group, Inc.) shared stories of their journeys from college to career, challenges they faced along the way, and the ways they make a positive impact in their communities through transportation engineering. Thank you to our panelists for an engaging session—we received rave reviews from the K-12 participants!



Check out the recording: https://bit.ly/WomenTranspoPanel.



Partnership with D&I Committee

Promoting and supporting diversity and inclusion in the transportation field is an important part of being an ITE member. The ITE STEM Committee will be working with the ITE Diversity & Inclusion (D&I) Committee to develop guidelines and content related to incorporating D&I into STEM outreach programs and activities.

It is essential that we create a diverse and inclusive environment for all ITE-sponsored activities, particularly so for outreach activities as they engage the transportation professionals of the future. ITE strives to provide an opportunity for ALL students to learn about the transportation profession (and engage in STEM outreach projects and programs) and to make sure that ALL participating students feel welcomed, included, and respected. The ITE STEM Committee is proud to partner with the ITE D&I Committee on this important effort.

ITE Spotlite Featurettes

For the past several months, each edition of ITE's biweekly newsletter *Spotlite* has featured a STEM outreach-related write-up, such as a description of a STEM activity hosted by a District, Section, or Chapter, or the promotion of STEM resources. These *Spotlite* write-ups have provided a great avenue to share STEM activities with the wider ITE membership, encouraging others to get involved or share their own resources with the STEM Committee.

Want to share your experience of doing STEM outreach events with students, and potentially get it featured in a future ITE Spotlite *write-up? Send us an email at STEM@ite.org.*





Future City Competition

Future City Competition (FCC) is a project-based learning program where students in sixth, seventh, and eighth grades imagine, research, design, and build cities of the future. FCC is one of the nation's leading engineering education programs and has received national recognition and acclaim for its role in encouraging middle school students to develop their interest in STEM. ITE is involved with FCC in multiple ways:

ITE sponsors a Special Award, titled "Best Transportation System for the Community," at the National FCC Finals, which were held virtually this year in March.

This year's overall Future City Theme was "Living on the Moon," where students were tasked with designing a lunar city. Warwick Middle School in Lititz, PA, USA captured the title for the special award with their city named "Chóros." We were so impressed by this team's unique idea to use a lunar skyhook to catapult objects between the moon and earth for inexpensive travel!

Multiple ITE Districts, Sections, or Chapters sponsor regional FCC awards—such as the Arizona Section's "Best Multimodal Transportation System" award or the Idaho Chapter's "Most Multimodal Transportation Network" award.

How to Get Involved: Sponsoring regional awards and volunteering as judges are just some of the countless ways ITE Districts, Sections, Chapters, and members can get involved. Contact your FCC Regional Coordinator at www.futurecity.org/regions for more information.

STEM Outreach Part of Criteria for Section Award

In 2019, the ITE STEM Committee developed and successfully advocated for the inclusion of STEM outreach into the annual awards criteria. Now, every Section's involvement in K-12 STEM outreach is included as part of the scoring for the Section Activity Award. *When two Sections are neck-and-neck in the scoring, a couple of K-12 STEM outreach events could make a big difference.* The ITE STEM Committee annually reviews these entries to identify outreach stories to feature in future *ITE Spotlite* or *ITE Journal* articles. Next year, when your Section prepares its Section awards submittal, what K-12 STEM activities will you include?

STEM Committee Members

Jennifer Warner Hayman, P.E., ENV SP – **Chair**
Karen Aspelin, P.E., PTOE – **Vice Chair**
Mojtaba Ale Mohammadi, Ph.D, P.E.
Rebecca Brown, P.E.
Alvaro Calle, P.E.
Nancy Dutta, Ph.D.
Melisa Finley, P.E.
Tim Foster, P.E.
Adam Greenstein, P.E., PTOE
Colleen Hill-Stramsak, P.E., RSP1
Stephanie Ivey, Ph.D.
Ravali Kosaraju, P.E., P.Eng., PTOE
Beverly Kuhn, P.E.
Ryan Martinson, M. Eng., P.Eng., RSP1
Lia Michaels, P.E., RSP1
Joey Paskey, P.E.
Asheque Rahman, ENV SP
Suzanna Set, P.E., PTOE
Dara Soum
Charles Stevens, P.E.
Gaby Tassin, P.E., PTP, PTOE, RSP1
Anamaria Torres, P.E., PTOE

STEM 101 Workshop



In August, the ITE STEM Committee led a lively and highly interactive "STEM 101 Workshop" that featured presentations from its members on how to make K-12 STEM outreach both valuable and fun, while avoiding some common pitfalls.

Attendees learned:

- How to build outreach partnerships with local organizations and schools
- How to provide high-value STEM content
- Common challenges experienced during STEM outreach (and the solutions!)

The workshop recordings and presentation slides are available on the ITE STEM Resources webpage: www.ite.org/stem.

FHWA STEM Lessons on Pedestrian Safety



The University of North Carolina (UNC) Highway Safety Research Center, as part of a larger FHWA Safe Transportation for Every Pedestrian (STEP) initiative, developed K-8 STEM materials focused on pedestrian safety.

The ITE STEM Committee was invited to review the five lessons and provide feedback. The lessons include activities with names like "Let's Connect Our Community," "Need for Speed," and "Can I Get There from Here?"

According to FHWA: "Each STEM lesson is an easy-to-follow format with step-by-step instructions, lists of suggested materials, and visual aids [. . .] The lessons are designed for in-classroom, afterschool events, and smaller group activities. People with experience in the transportation or a related field are well-suited instructors."

These five STEM lesson plans on pedestrian safety are available on the FHWA STEP Program STEM Lessons webpage: https://safety.fhwa.dot.gov/ped_bike/step/stem_lessons/.

Innov8 with ITE in Celebration of National STEM Day



The ITE STEM Committee encourages our fellow ITE members to hold transportation-themed K-12 STEM outreach events throughout the month of November in celebration of National STEM Day.

National STEM Day is held annually on November 8 (aka "Innov8 Day"). This day inspires kids to explore and pursue their interests in science, technology, engineering, and math. It's a great opportunity for STEM professionals to hold outreach events.

The ITE STEM Committee has compiled STEM outreach resources for National STEM Day, highlighting the FHWA STEM Lessons on Pedestrian Safety (described above) and providing some general tips for STEM outreach. Find them at www.ite.org/STEM. **itej**

Innovating Transportation



Raj Ponnaluri, Ph.D., P.E., PTOE, PMP (M)
State Connected Vehicles, Arterials, and Managed Lanes Engineer
Florida Department of Transportation

Experience

More than 25 years in traffic engineering and operations, CAV, TSM&O, ITS, highway safety, and public transportation in public and private domains.

Awards

ITE Coordinating Council Best Project Award, 2020
AASHTO Sweet Sixteen Award, 2020, 2019
Federal Highway Administration, National Roadway Safety Awards, 2017
ITE Safety Council Edmund R. Ricker Award, 2017

Professional Leadership

Chair, ITE Connected and Automated Vehicles (CAV) Standing Committee
Co-Chair, The Working Group on ITS, AASHTO's Committee on Transportation Systems Operations

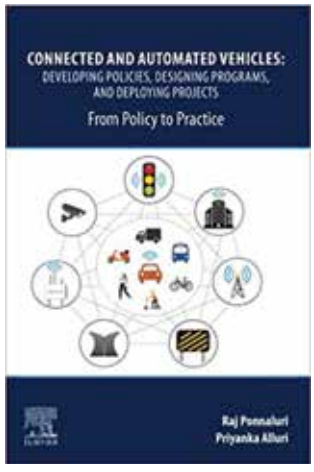
Fun Fact

In addition to authoring the book *Connected and Automated Vehicles: Developing Policies, Designing Programs, and Deploying Projects: From Policy to Practice* (as well as dozens of research papers), Raj writes poetry, and attempts to "read" the Voynich Manuscript.

ITE JOURNAL: **Throughout your career in Intelligent Transportation Systems (ITS), how have you managed expectations and kept your work focused on real world applicability?**
PONNALURI: Our industry has evolved from focusing on civil engineering to interdisciplinary engineering, where our many functional areas interact to create safety- and mobility-centric solutions. The focus has also shifted from using historical information to real-time data and predictive analytics, which support decision support systems and visualization-enriched dashboards. The name of the game is *SPACE—Speed, Production, Accuracy, Consistency, and Excellence*. Everything has to be quick and agile, produce accurate results, show consistent performance, and drive towards excellence. This requires coordination, consultation, and cooperation across disciplines. As I look back at my 26-year career, I cannot help but list out the many great women and men who influenced not just my career but that of my friends and colleagues. This recognition is for the work we all put in collectively. Now is the best time to deploy emerging technologies as there is a think-tank convergence from the public agencies and private entities.

ITEJ: **You wrote a book on connected and automated vehicles (CAVs). Who is your audience for this publication and what did you hope to achieve by writing this work?**
PONNALURI: This book is for everyone interested in CAVs! My co-author, **Priyanka Alluri, Ph.D., P.E., RSP2IB (M)**, and I hope that it will excite the policymakers who craft the vision, mission, and objectives toward creating sustainable transportation systems. This book can guide professional engineers in designing sustainable emerging technology systems, help the practitioners consider deployable frameworks, and assist the project managers to efficiently oversee systems deployment. The private sector, industry partners, and consultant professionals will get to know the frameworks they want to adopt for converting policy to practice. It will also guide the researchers in evaluating the project benefits and documenting lessons learned. Finally, it will benefit the students who want to understand how agencies develop policies, design programs, and deploy CAV projects.

ITEJ: **As Chair of ITE's CAV Standing Committee, what would you say to others who are considering volunteer leadership positions within ITE?**
PONNALURI: The ITE CAV Standing Committee provides a great platform to engage ITE membership in cutting-edge technology practices with ideation and implementation. ITE membership from state and local agencies, the consulting and technology vendor industry, faculty and researchers, and ITE's sister entities like AASHTO collaborate and share ideas, develop lessons learned, and forge ways to efficiently deploy CAV technologies. ITE members can leverage our Committee meetings, discussion forums, publications, webinars, and other activities to stay current on the CAV topics. We host bi-monthly calls, providing an excellent opportunity for the membership to have their voices heard. ITE members are welcome and requested to serve as volunteers in leadership or support roles; we thrive because of outstanding leadership from ITE, the opportunities for all to contribute, and the focused progress we collectively achieve. **itej**





ite Learning HUB

Upcoming Live Webinars

Gotcha! – The Evolving World of Automated Enforcement of Speed and Red Light Running
Tuesday, November 2, 2021
4:00 - 5:30 p.m. ET
Led by the ITE Traffic Engineering Council

Expanding Vision Zero to Small and Medium-Sized Communities
Tuesday, November 16, 2021
2:00 - 3:30 p.m. ET
Led by the ITE Safety Council Vision Zero Subcommittee

Improving Pedestrian Safety at Signalized Intersections: Impacts of Corner Radius
Wednesday, November 17, 2021
2:00 – 3:30 p.m. ET
Sponsored by FHWA

Innovation in Transportation Education – Big Data, Elevator Pitches, and More
Thursday, November 18, 2021
2:00 – 3:00 p.m. ET
Led by the ITE Transportation Education Council

Student to Professional Video Resource Library

ITE's Women in ITE Committee and Student to Younger Member Transition Task Force recently collaborated on this project to assist students and young professionals as they navigate the beginning stages of careers in transportation.



Our District Rising Stars and 2021 Young Leaders to Follow were interviewed on a variety of topics noted below, ranging from career options to the importance of certifications. Visit ITE's YouTube Channel (www.youtube.com/c/ITEHQ/videos) to watch these informative videos on the following topics:

- Career Options
- Certification
- Interviewing
- ITE Membership and Why You Should Get Involved
- Member Resources (Including Student Resources)
- Continued Education
- Things to Consider about a Job
- Mentorship
- What Skills Do You Need
- Work/Life Balance
- And More!

On-Demand Webinars Available!

Missed a webinar? No problem!

Take a look at the webinars still available to view on-demand on the ITE Learning Hub at www.pathlms.com/ite/events/.

calendar

2021 EVENTS

TEXITE/ITS TEXAS JOINT MEETING
November 3-5 | Dallas, TX, USA

IOWA SECTION ANNUAL MEETING
November 16 | Ames, IA, USA

WASHINGTON DC SECTION ANNUAL MEETING
November 17-18 | Virtual Meeting
Visit www.wdcsite.org for more information

2022 EVENTS

WESTERN DISTRICT VIRTUAL SLS HOSTED BY SAN JOSE STATE
January 28-30
Visit https://bit.ly/SanJoseSLS for more information.

SDITE STUDENT LEADERSHIP SUMMIT AT VIRGINIA TECH
February 25-27 | Blacksburg, VA, USA
Visit www.itesls2022vt.com for more information.

SOUTHERN DISTRICT ANNUAL MEETING
March 26-30 | Louisville, KY, USA

MID-COLONIAL DISTRICT ANNUAL MEETING
April 10-12 | Baltimore, MD, USA

TEXAS SPRING MEETING
May 4-6 | Corpus Christi, TX, USA

NORTHEASTERN DISTRICT ANNUAL MEETING
May 11-13 | Ithaca, NY, USA

CANADIAN DISTRICT ANNUAL MEETING
May 29-June 1 | Vancouver, BC, Canada

2022 ITE INTERNATIONAL ANNUAL MEETING AND EXHIBITION
July 31-August 3 | New Orleans, LA, USA

WHERE IN THE WORLD?

Can you guess the location of the "Where in the World?" photo in this issue? The answer is on page 50. Feel free to send in your own photos to hstowell@ite.org. Good luck! **itej**



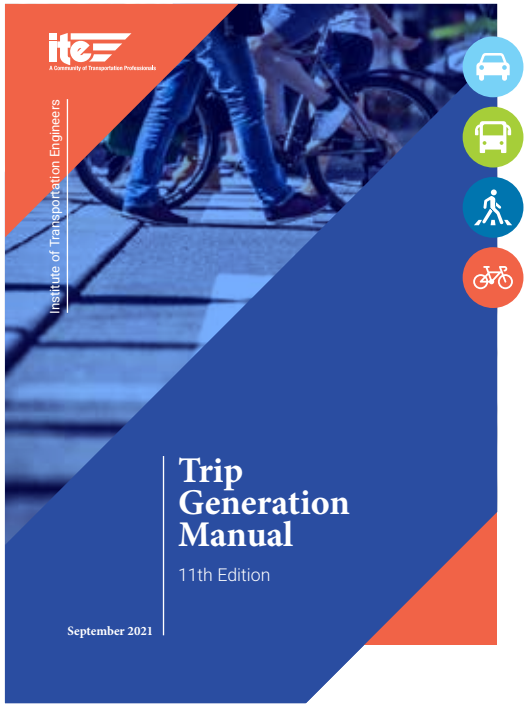
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NOW AVAILABLE!

The **Next Step** in Trip Generation Estimation

ITE, the leader in Trip Generation, has released the 11th Edition of the *Trip Generation Manual* (TripGen11). This new edition enhances the 10th Edition's modernized content, data set, and contemporary delivery—making it an invaluable resource.



The 11th Edition features:

- All the latest multimodal trip generation data for urban, suburban and rural applications
- Reclassified land uses to better meet user needs
- Integrated digital copies of all land use definitions, plots and supporting materials
- Full ability to filter the data to match local conditions

Available in Multiple Formats at the same price of $895 for members

- Digital – All plots, descriptions and references available electronically
- Hard Copy – A full printed version of the 11th Edition including, all plots and descriptions
- All-in-one-Bundle – A single user license and hard copy are available at a discounted price of $1,290 for members

Significant Member Discounts for Multi-Users

- Additional user licenses only $395
- 5-Pack — Five user licenses for $1,675
- Office Bundle — Five user licenses and one hard copy for $1,995

Volume Purchasers should email membership@ite.org for pricing information.

Questions? Email membership@ite.org.

TripGen 11 is Your One-Stop for All Your Trip Generation Needs!

https://bit.ly/Trip_Gen11

ITE Gateway Section—A History of Service

Former logos for the TEAM Chapter of ITE before it became the Gateway Section.

The history of ITE's Gateway Section dates back decades before it formally became a part of the Missouri Valley District of ITE (MOVITE). The group that became the Transportation Engineering Association of Metropolitan St. Louis (TEAM) first convened in 1958 when several area transportation engineers met informally to discuss local transportation issues in St Louis, MO, USA. The then "Metropolitan St. Louis Traffic Engineers" chose the name "TEAM," and voted to accept their first formal organizational charter at its December 15, 1960 meeting.

Because the mission and purpose of TEAM closely reflected the mission and purpose of ITE, the TEAM membership voted on April 16, 2002 to petition MOVITE to become an ITE Chapter. After reviewing their proposed charter and bylaws, and after having received the petition from the TEAM membership, at its April 24, 2002 meeting the MOVITE Board of Directors voted unanimously to accept TEAM as a chapter.

This year, the organization welcomed a new change in status, and was elevated to a Section of ITE under the Missouri Valley District, rebranding as Gateway ITE.

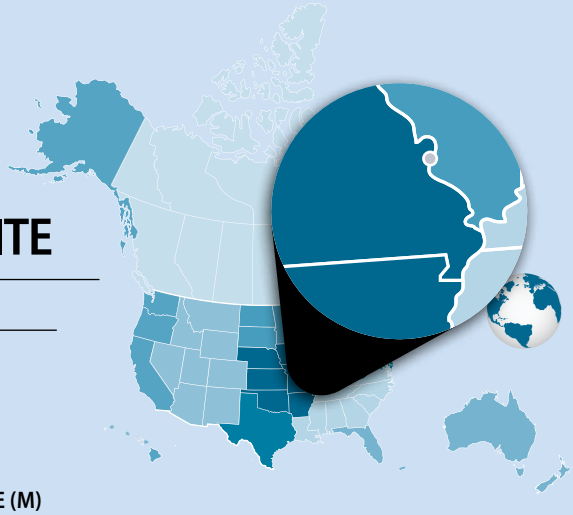


As with any transition, there were some hurdles to overcome. The Section needed to change the names for its officer positions to be consistent with other ITE Sections. It also created an officers' manual, which will now serve as a great resource for future chapter leadership. Although revising bylaws and policies isn't everyone's cup of tea, the Section's leadership says the process gave members a chance to learn from others and reconsider options for the future. ITE Headquarters was also very helpful throughout the Section's transition, answering questions and providing training to its membership.



Sign-in table for the TEAM StL Transportation Fair in 2019.





Gateway Section of ITE

Missouri Valley District

Membership
Approximately 233 members

Board and Committee Members
Past President – **Ryan Pierce, P.E. (M)**
President – **Michelle Schwierjohn, P.E., PTOE (M)**
Vice President – **Dr. Ryan Fries, P.E. (M)**
Secretary – **Justin Wagner, P.E. (M)**
Treasurer – **John Klein, P.E. (M)**
Director I – **Kelly Schaefer, P.E., PTOE (M)**
Director II – **Mike Erdtmann, P.E. (M)**
Section Representative – **Carrie Falkenrath, P.E., PTOE, PTP, RSP1 (F)**
Section Administrator – **Shawn Leight, P.E., PTOE, PTP (F)**
Website Administrator – **Brian Eads, P.E., PTOE (M)**
Young Professionals Committee Lead – **Phil Pierson, E.I. (M)**

Serving the St. Louis Area
After becoming TEAM in 1960—although not a formal part of ITE— this new organization played an active role in bringing the 37th ITE Annual Meeting to St. Louis in September of 1967. The group also co-hosted several joint meetings with MOVITE over the years.



Photo from an early TEAM meeting.

Between 1960 and 2002, TEAM grew into a strong organization of more than 100 members. This group continued to gather regularly at lunch to further traffic and transportation knowledge and stimulate professional improvement of its members; foster closer association between persons with mutual interest in the traffic and transportation field; and develop cooperation for the betterment of traffic and transportation in the St. Louis metropolitan area.

Awards
In years past, Gateway ITE has awarded a TEAM StL Award for the Professional and/or Project of the Year Award. This year, the board is discussing potentially naming the award after a past member.

As an added benefit, the transition to a formal Section has encouraged more of the affiliate members—known as "Friends of Gateway ITE"—to become ITE members. The Gateway Section and its members are now better connected to ITE International, providing access to many benefits and resources.

One of the Section's goals is to develop cooperation among members for the betterment of traffic and transportation in the St. Louis metropolitan area. The Section enjoys strong participation from both public and private sectors. Monthly meetings provide great opportunities for members to learn about regional and national efforts in transportation and traffic. Both public and private speakers present case studies that illustrate the importance of public-private partnerships, showing how they can produce effective results for the traveling public.

With several engineering schools in the region, Gateway ITE encourages student attendance at monthly meetings by offering them freely. The group also arranges a student poster competition at its annual conference, which includes cash prizes for the top three. Gateway ITE leadership has also arranged friendly traffic bowl scrimmages to encourage student participation in the organization.

The Section helps support local ITE Chapters financially with funds included in its yearly budget. Gateway ITE encourages ITE Student Chapters engaged in ITE Chapter, Section, District, and International activities with financial reimbursement. The Section



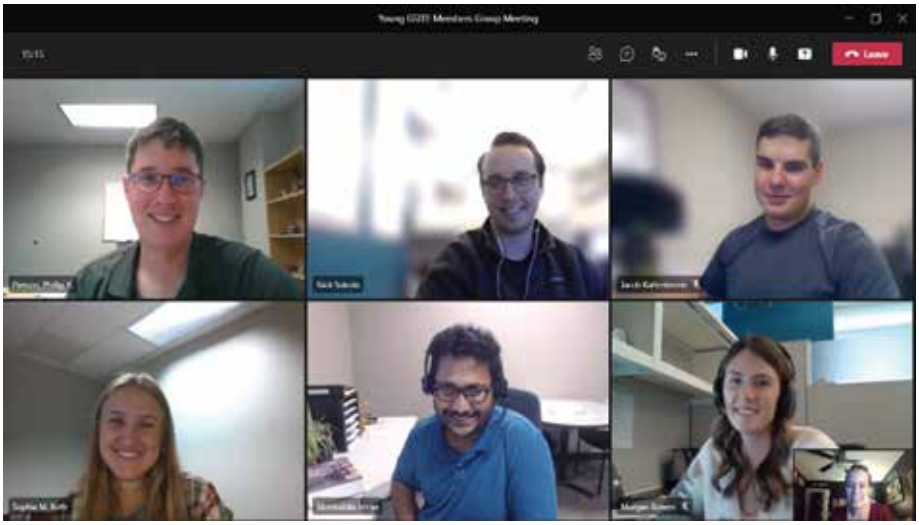
Members of the then-TEAM Chapter of ITE taking a tour of I-64 in 2009.

also looks for opportunities to team with other local St. Louis organizations by hosting joint happy hours, including with the American Public Works Association.

The Section has a strong sponsorship program, and offers different options for organizations looking to support Gateway ITE. The most popular choice is the basic Sponsorship, which includes being featured on its website and at the annual conference on the miscellaneous materials. The next level includes being a vendor, which allows the sponsor to have a networking table at the annual conference. Most sponsors have multiple employees who are active members and Friends of Gateway ITE. These sponsorships support requests Gateway ITE receives from Student Chapters, usually for ITE conference travel.

Though COVID-19 put a strain on the Section's ability to host in-person events, Gateway ITE has come up with creative ways to engage its membership and attract newcomers. The organization is relying on virtual tools to offer its monthly meetings, and it has leveraged those tools to bring in guest speakers from Texas, California, and Michigan, USA—to name a few. This virtual tool also enabled Gatway ITE to host its TEAM StL All-Day Fair last year. Recognizing that virtual formats are not as ideal for networking as being face-to-face, the Section is beginning to host some outdoor events at local parks, including a BBQ hosted by the Young Professionals group.

With a legacy more than 60 years in the making, the original TEAM petition currently hangs at the Missouri Department of Transportation's Information Center, a testament to its longstanding connection to the greater St. Louis area. Now a formal Section of ITE, the Gateway Section looks forward to many more years of connecting transportation professionals to ITE International, and to one another. **itej**



Young Professionals of the Gateway Section attending a biweekly virtual meeting.

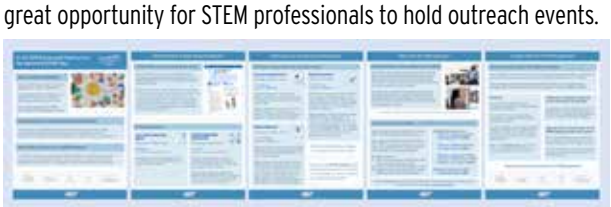
Celebrating the Transportation Community

ITE SEEKS TO RECOGNIZE OUR MEMBERS and their contributions to the transportation industry as well as to encourage participation in promoting our profession. This fall has given us ample time to do so with Hispanic Heritage Month (September 15 – October 15), Community Planning and Pedestrian Safety Months (October), and Innov8 Day (November 8). The next few pages showcase some of the projects in local communities and efforts by our individual members in support of these activities. In addition, you can find out how you can support STEM by participating in Innov8 Day activities. ITE extends thanks to our members and their communities for making a difference through these various contributions.

Innov8 with ITE in Celebration of National STEM Day

We encourage you to hold transportation-themed STEM outreach events throughout the month of November in celebration of National STEM Day.

National STEM Day is held annually on November 8 (aka "Innov8 Day"). This day inspires kids to explore and pursue their interests in Science, Technology, Engineering, and Math. It's a great opportunity for STEM professionals to hold outreach events.



The ITE STEM Committee has compiled some STEM outreach resources for National STEM Day, including a series of pedestrian safety-themed STEM activities for kids of all ages (developed by the FHWA STEP Program) and general tips for STEM outreach. Visit www.ITE.org/STEM for more on these exciting intiatives!

Hispanic Heritage Appreciation Month

National Hispanic Heritage Month traditionally honors the cultures and contributions of both Hispanic and Latino Americans as we celebrate heritage rooted in all Latin American countries. The date was selected in recognition of the independence days shared by El Salvador, Guatemala, Honduras, and Nicaragua. Now commonly referred to as Latino History Month–or the gender-neutral Latinx History Month–the month celebrates the culture, history, and people of Latin America, as well as the impact of Latin America and Latin Americans in the United States.

ITE joins its Hispanic and Latino members in celebrating their rich cultural heritage and many contributions to the transportation industry and the communities they serve. Visit www.ite.org/membership/hispanic-heritage-appreciation-month for more information.



Sebastian de la Rica
President, ITS Spain
Global District
Spanish – Spain



Daniela Gonzalez
Traffic Engineer, WSP USA
Missouri Valley District, Kansas Section
Venezuelan



Kennia Grisell Alonso
CADD Technical Specialist II, Sarasota County Government
Florida Puerto Rico District
Born and raised in Puerto Rico



Anamaria Torres
Lead Designer/Project Engineer, Stantec
TexITE, Capital Area Section
Mexican and Puerto Rican



Alejandro Angel
Corporate Director of Engineering - Public Works, Psomas
ITE Mountain District, Arizona Section
Colombiano



Gaby Tassin
Deputy Director of Engineering, ATG - Alliance Transportation Group
TexITE, Dallas Section
Honduran, or as we say in Honduras, I am a proud "catracha!"

Pedestrian Safety Month

October is Pedestrian Safety Month. As in the past, ITE is recognizing projects from our public agency members, which have implemented projects in their communities to improve safety and mobility for pedestrians. Here are just a few of the submissions. For more details and to view all of the featured projects, visit www.ite.org/technical-resources/topics/transportation-safety/pedestriian-safety-month/.



City of Thornton, CO, USA
Raised Pedestrian Crossing with Bike Diversion



Greenwich, CT, USA
Greenwich Avenue & Elm Street Intersection Improvement Project

ite
A Community of Transportation Professionals



City of Santa Monica, CA, USA
Pedestrian Improvements in School Zones



Logan Circle, Washington, DC, USA
Pedestrian Safety Improvements



Orange County, FL, USA
Raised Pedestrian Crossings at School Zones



City of Edmonton, Alberta, Canada
Vision Zero School Kit



Halifax, VA, USA
Sinai Rd. Pedestrian Lane Project



Grand Rapids, MI, USA
Safety and Visibility of Pedestrians Crossing Jefferson Avenue

National Community Planning Month

October is Community Planning Month hosted by the American Planning Association. Planning is more important than ever as communities continue to navigate the disruptive changes brought about by the pandemic. From economic development and transportation planning to reinventing what our communities look like post-COVID-19, this October we asked cities and agencies to share how planning and planners are leading the way forward for all in your community. This page features a few of the submissions. For more details and to view all submissions, visit www.ite.org/technical-resources/topics/transportation-planning/community-planning-month/.



Turk Play Streets and Safe Passage Park – San Francisco, CA, USA
COVID-19 disproportionately impacted people in the Tenderloin neighborhood, which is home to San Francisco's most underserved communities. In collaboration with the Tenderloin Community Benefit District and Livable City, the San Francisco Municipal Transportation Agency's Play Streets program created space for families and children to play.



Adaptive Roadways Program – Calgary, Alberta, Canada
To help provide Calgarians with the space needed to social distance and be able to walk, run, skateboard and cycle, the City of Calgary has implemented an Adaptive Roadways Program (ARP) in 2020. Under the program, road lanes are closed to motor vehicle traffic so they can be used by people who are walking, running, cycling, and rollerblading.



Pedestrian-Only Plaza – City of Alexandria, VA, USA
One of the city's most successful placemaking and COVID-19 recovery initiatives during the pandemic has been the conversion of the 100-block of King Street into a pedestrian-only plaza. This plaza is the first of its kind in Alexandria, features in-street dining options, and has been incredibly popular with residents.



Range Line Road Description – City of Carmel, IN, USA
The City of Carmel transformed Range Line Road from a 5-lane roadway to a pedestrian-friendly, tree-lined, multimodal roundabout corridor with protected bicycle and pedestrian pathways.



Pedestrian Master Plan – Costa Mesa, CA, USA
The City of Costa Mesa was able to collect community input during the pandemic for its citywide Pedestrian Master Plan. A series of walk audits at six locations were conducted both in-person and virtually in early 2021.

Elevating Transportation in 2021: Now is the Time to Plan for Urban Aerial Mobility

By Sean Laffey, Engineering Associate, Kittelson & Associates, Inc.

There are many ways that transportation agencies are actively reducing congestion facing urban areas. These include encouraging non-auto trips, providing accessible and frequent public transit options, managing curbside space, charging for parking, and investigating congestion pricing to discourage car use in crowded areas during peak periods.

At the same time, in the search for more space to efficiently move people and goods, both governments and private companies are starting to look somewhere new: to the skies.

Urban Air Mobility (UAM) refers to carrying passengers or cargo by air at lower altitudes within urban and suburban areas through highly automated aircraft, such as drones and vertical takeoff and landing (VTOL) vehicles.[1] UAM is a subset of the Advanced Air Mobility (AAM) initiative being developed by the U.S. National Aeronautics and Space Administration (NASA), the U.S. Federal Aviation Administration (FAA), and industry partners.[2]

UAM has potential to bring significant changes to the transportation sector through aerial vehicles moving cargo and passengers. One day soon, companies may be able to choose between moving people and cargo on roads or in the sky. And with recent action by FAA and a profusion of innovations by startups and well-established aviation companies, that day may be sooner than we think.

The transportation space is rapidly evolving, and cities should be planning now so they are prepared for UAM.

Recent Advancements in Urban Aerial Mobility

2020 and 2021 have been pivotal years for urban transportation by air.

In 2020, FAA published two important documents related to UAM. The FAA Next Generation Air Transportation System Office released *Concept of Operations for Urban Air Mobility* (ConOps 1.0) to describe the operational environment they envision to support the expected growth of flight operations in and around urban areas.[3] This document outlines how UAMs can operate in different environments. (Kittelson and Associates summarized key takeaways from this document in a white paper earlier this year.)[4]

The U.S. Department of Transportation (USDOT), FAA, and the U.S. Office of the Secretary of Transportation also released an amendment to Title 14 of the Code of Federal Regulations (CFR) Parts 11, 21, 43, and 107: Operation of Small Unmanned Aircraft Systems Over People.[5] This document allows for the "operation of small unmanned aircraft systems over people" at night, under certain conditions, beginning March 16, 2021. This rule is significant because it shows that policies are adapting to new inputs from existing stakeholders and increasing demands for operational flexibility.

Key Industry Players

In addition to key policy documents, the UAM sector has advanced in the last several years through private partnerships, acquisitions, and certifications. Private companies have been taking steps to deploy aerial vehicles and integrate them into the transportation network. Here are a few examples:

- In March 2016, Flirtey completed the first fully autonomous FAA-approved urban drone delivery in the United States.[6] In 2020, Flirtey partnered with Vault Health for drone delivery of COVID-19 test kits.[7]
- In April 2019, former USDOT Secretary Elaine Chao announced that Google's drone startup Wing was awarded the first air carrier certification ever given to a drone company, effectively recognizing Wing as an airline.[8]
- In June 2019, Kitty Hawk Corporation formed a partnership with Boeing to collaborate on urban air mobility projects.[9]
- In October 2019, UPS Drone Delivery was the first to receive full Part 135 certification from FAA.[10] This certification allows UPS to deliver goods beyond the visual line of sight (BVLOS) of the remote pilot.
- In January 2020, Hyundai teamed up with Uber to develop electric air taxis (which they call Personal Air Vehicles).[11] Hyundai is working to



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Urban Air Mobility has the potential to transform the transportation sector.

take cargo into the skies locally by 2026 and put passengers in electric air taxis by 2028.[12]

- In August 2020, Amazon won FAA approval for its Prime Air drone delivery fleet.[13]
- In December 2020, Uber Elevate announced it will be acquired by Joby Aviation.[14] Uber Elevate had previously announced plans to launch air taxi service in Dallas, TX, USA; Los Angeles, CA, USA; and Melbourne, Australia by 2023.[15]
- In February 2021, United Airlines announced an investment in vertical takeoff and landing (VTOL) startup Archer and placed an order for 200 VTOL aircraft.[16]

Urban Aerial Mobility Working Groups

There are multiple UAM groups that are engaging public and private stakeholders to incorporate all interests into formal policies. Beginning in 2017, the Unmanned Aircraft System (UAS) Integration Pilot Program (IPP) brought governments and private sector entities together to test and evaluate the integration of drone operations into the national airspace system.[17] This group disbanded in October 2020, and FAA is now tackling UAS integration through a program called BVLOS-Expanding Your Operations Needing Drones (BEYOND). BEYOND is focusing on BVLOS operations that are repeatable, scalable, and economically viable with specific emphasis on infrastructure inspection, public operations, and small package delivery, as well as community engagement efforts to collect, analyze, and address community concerns.[18]

Policy Considerations

The transportation space is rapidly evolving, and cities should be planning now so they are prepared for UAM. After all, ride hailing companies and e-scooter companies have shown that private companies can rapidly disrupt the transportation space. At the same time, these companies have shown that they are willing to work with governments to pass meaningful and impactful legislation. And, as recent CFR amendments have shown, governmental policies and regulations can change as experience and demands increase.

Policies have the potential to speed up or slow down the adoption of UAM. As UAM continues to take up a larger share of the transportation conversation, government agencies should be thinking about:

- How UAM fits into the future transportation network
- How local regulations will impact UAM even if they're not intended to affect UAM
- What UAM groups such as BEYOND are talking about and how they affect local airspace
- Whether or not there are channels of communication already set up between the local and federal regulators
- Where the existing infrastructure is, and where new infrastructure will go
- What companies are already in/will come to the local area
- Their vision for UAM: people, cargo, or both? Is it "toys for the rich" or the future of personal mass transit and delivery?

UAM has potential to bring significant changes to the transportation sector through aerial vehicles moving cargo and passengers.

Conclusion

UAM has been developing rapidly over the last few years. This development only accelerated in 2020 as the federal government allowed and approved UAM and unmanned aircrafts and private companies formed partnerships, taking steps to integrate aerial vehicles into the transportation network.

Urban aerial mobility is here, and cities can—and should—be actively planning how they will utilize it.

We'd be glad to continue this conversation. To talk further about advancements in urban aerial mobility, get in touch with the author at *slaffey@kittelson.com*. **itej**

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INDUSTRY NEWS

Crash Responder Safety Week

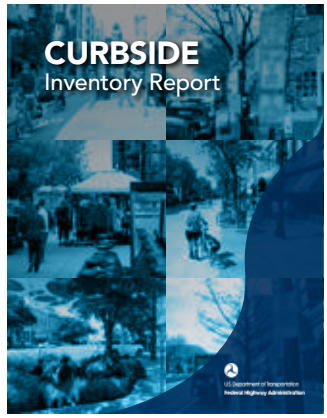
November 8-14, 2021 is Crash Responder Safety Week (#CRSW), and the National Operations Center of Excellence (NOCoE) is partnering with the Federal Highway Administration (FHWA) to host a series of webinars. Traffic Incident Management (TIM) professionals, state and local public information and communications officers, and response community leaders are invited to join. Each webinar will feature experts related to a key outreach mechanism for CRSW. For more information on these webinars and resources related to #CRSW, visit www.transportationops.org/TIM/CRSW.



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New Report from the National Cooperative Highway Research Program

Rural Transportation Issues: Research Roadmap

Although only 19 percent of the U.S. population lives in rural areas, more than 70 percent of the country's four million miles of roadways are in rural areas. The rural transportation system also includes numerous airports; railways; inland and coastal waterways; rural and intercity buses; and bicycle, pedestrian, and multi-use paths and trails. In addition, approximately 47 percent of the nation's motor vehicle fatalities occur in rural areas. The TRB National Cooperative Highway Research Program's pre-publication draft of NCHRP Research Report 988: *Rural Transportation Issues: Research Roadmap* is designed to assist state departments of transportation and other public agencies and help inform policy-driven investment decisions. Access the report at https://bit.ly/NCHRP988.



2021 Roadway Safety Foundation Winners Announced

The Roadway Safety Foundation (RSF) and Federal Highway Administration (FHWA) announced the seven winners and three Honorable Mentions of the 2021 National Roadway Safety Awards on October 6, 2021. U.S. Secretary of Transportation Pete Buttigieg keynoted the event, and FHWA's Associate Administrator for Safety Cheryl Walker joined RSF's executive director to present the awards to the honorees at a virtual ceremony broadcast from Washington, DC, USA. Visit www.roadwaysafety.org/awards to read more about each winner. **itej**


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Connected Vehicles and the Safety Spectrum



By Steve Kuciemba (F)

SHUTTERSTOCK/ANDREY SUSLOV

In August 2012, the Connected Vehicle Safety Pilot was launched in Ann Arbor, MI, USA. The research program was designed to demonstrate the readiness of Dedicated Short-Range Communication (DSRC)-based connected vehicle communications, using dedicated spectrum in the 5.9 GHz Safety Band. Overall, the Safety Pilot program was deemed a major success—and led the U.S. Department of Transportation (USDOT) to initiate a proposed rulemaking in late 2016 that would create a new Federal Motor Vehicle Safety Standard (FMVSS) requiring vehicle-to-vehicle communication capability for all light duty vehicles and to create minimum performance requirements for devices and messages.

Five years have now passed since that proposed rulemaking was announced, and connected vehicle communications in the dedicated 5.9 GHz Safety Band remain in a state of research and regulatory limbo. Advancements have been made technologically, but policy and regulation have slowed the mainstream deployment of vehicle-to-everything (V2X) devices and applications that might capitalize on their existence. Where did we go wrong, and what does the future look like?

What Is the Safety Band?

The 5.9 GHz spectrum, commonly referred to as the Safety Band, is a portion of bandwidth that was specifically reserved for transportation-related communication in 1999 to support safety-related applications. The primary use for this spectrum is intended to be V2X, which has been identified by USDOT as having tremendous life-saving potential. The National Highway Traffic Safety Administration (NHTSA) has supported a number of connected and automated vehicle research projects, and has publicly stated that V2X communications "will provide drivers with the tools they need to anticipate potential crashes and significantly reduce the number of lives lost each year."[1]

Soon after the U.S. Federal Communications Commission (FCC) approved the request to dedicate this bandwidth, work began on developing the foundational elements such as standards, rules, and regulations, along with technology development that prior to this allocation was still in its infancy. In the early 2000s, investments into proving the concepts, refining the standards, and emphasizing pilot deployments led to a proposal by USDOT to mandate V2X communications in new car production. The industry was poised to advance this effort, and many state and local transportation departments invested heavily into planning and preparing for this eventuality. However, the wheels seemingly came off the proverbial bus.

Where Did We Go Wrong?

Part of the problem was self-inflicted. One segment of the transportation industry was making advancements with dedicated short-range communications (DSRC), with cutting-edge pilot demonstrations, device innovations, roadside deployments, and application development. At the same time, another segment of the industry had developed an alternative to DSRC that they felt had a better long-term deployment path—cellular vehicle-to-everything (C-V2X). Instead of figuring out a mutually agreed-upon migration path for the technology, this issue became a visible debate and a distraction from the regulatory uncertainty that was brewing.

Part of the problem was time. From a developmental perspective, this isn't a consumer convenience product—years of thorough development and testing is a necessity before these systems can hit the market. USDOT was actively conducting extensive research in cooperation with the automotive industry to ensure safety applications would work 100 percent of the time, not 95 percent or even 99 percent. When lives are at stake, careful deliberation is a must. If an in-home Wi-Fi device encounters interference or congestion, it can be rebooted without consequence. If a V2X device encounters interference or congestion, a crash could occur and lives could be lost.

But the biggest problem was in the regulatory realm. While this important safety testing was going on, the dedicated safety spectrum was eyed by wireless and Wi-Fi providers as bandwidth they wanted—and they worked to convince the FCC that DSRC was not being utilized. FCC didn't seem to appreciate the difference between consumer and safety devices or the need for 100 percent assurance, and agreed that it was taking too long. They initiated a rulemaking to reallocate 60 percent of the dedicated bandwidth and make it available to unlicensed Wi-Fi devices, leaving only 30 MHz of dedicated bandwidth available for V2X device utilization. The FCC also decided to resolve the technology debate and dictated

that C-V2X would be the future technology of choice for use in the remaining dedicated spectrum in the United States.

The proposed reallocation of dedicated spectrum drew universal condemnation from across the transportation industry, safety advocates, public safety personnel, and portions of the private sector. ITE actively engaged in submitting public comments expressing concern about insufficient dedicated bandwidth, potential interference issues from allowing unlicensed devices in a portion of the band, an unclear transition path for those that have already deployed, and the negative impact on international competitiveness. Over the past 22 months, industry representatives from a wide array of stakeholders have attempted to divert the FCC's course, including a lawsuit filed by the American Association of State Highway and Transportation Officials (AASHTO) and the Intelligent Transportation Society of America (ITS America). As of publication time of this article, the direction has not yet changed, and the industry is facing a laundry list of potential challenges going forward.

Looking Ahead: Challenges

There remains uncertainty from both a regulatory and technical standpoint.

Regulation Challenges. The FCC has published a first Report & Order (R&O) that establishes their intentions with the reallocation, immediately allows unlicensed Wi-Fi devices in the lower portions of the band, and sets a one-year time limit for existing V2X deployments to vacate the lower portions of the band. For now, this R&O is the new rule, and the industry must figure out how to work within its many uncertainties. However, there are multiple petitions for reconsideration filed with FCC and no action has been taken. There is also ongoing legal action by AASHTO and ITS America that will likely see some activity in early 2022. And there has been vocal concern from members of Congress who have authorized a study by the U.S. Government Accountability Office (GAO) as well. Results will likely be published in early 2022, which could trigger further action by Congress.

The FCC also published a Further Notice of Proposed Rulemaking (FNPRM) that seeks to define the many significant details not covered in the first R&O, including details about the transition from DSRC to C-V2X, technical parameters for the remaining 30 MHz of dedicated spectrum, and reimbursement for those that already deployed DSRC. The result of this FNRPM process will likely be a second R&O to clarify the technical and regulatory scenarios. The timeline for that will likely coincide with all of the above actions in early 2022 and could be subject to further petitions for reconsideration and legal actions.

Technology Challenges. Working with the first R&O as a guide, the V2X industry is now faced with figuring out how to best move forward. There are significant concerns with only having 30 MHz available, and equally significant concerns with potential interference from the unlicensed Wi-Fi devices using the spectrum.

To best evaluate the impacts of FCC's actions, V2X communications can be viewed as three legs of a stool: the communication device, the message set that gets transmitted by the device, and the application that uses the message set to perform an action or deliver a piece of information.

The communication device could be DSRC or C-V2X; both are impacted by FCC's reallocation of the Safety Band.

The message set is one of many that have already been developed or will be developed. It is important that these message sets are industry standardized so that they can work across any device, any vehicle, or any application.

The applications themselves could be standardized in certain safety instances, but likewise enjoy opportunities for customization for competitive reasons.

Table 1 presents a high-level overview of the impacts from the FCC's actions across the three legs of the V2X stool and shows the amount of uncertainty that must be addressed in upcoming research.

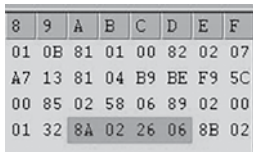
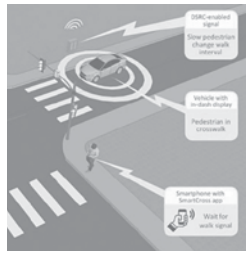
Looking Ahead: Opportunities

Despite all these challenges and uncertainty, the need for V2X communications and safety-related applications remains unwavering. Traffic crashes account for a significant number of fatalities, injuries, and economic losses each year. As noted previously, NHTSA has already established that V2X communications "can significantly reduce the number of lives lost each year."[1] The industry must continue to push forward and adapt to the changes in the event that all the procedural and legal challenges don't change FCC's reallocation of the Safety Band.

Infrastructure V2X. A recent report from the National Cooperative Highway Research Program (NCHRP) project 23-10 noted that the effects of FCC's reallocation transcend far beyond existing DSRC deployments—it is also impacting infrastructure owners/operators (IOOs) that are in the process of planning new projects, identifying funding for new projects, and in some instances, currently procuring new projects.[2]

Many V2X projects being pursued by IOOs are much more than simply purchasing and installing a roadside unit regardless of whether it is DSRC or C-V2X. Many of these projects will require the installation or upgrade of backhaul communications, network architecture upgrades, and serve as a critical training activity for existing staff. If an agency wishes to broadcast traffic signal phase and timing messages—as many have been doing—it often requires upgrades to traffic signal controllers, which, along

Table 1. The impacts of FCC's allocations across the three legs of the V2X stool.

			
	Communication	**Message Set**	**Application**
Examples	Dedicated Short Range Communication (DSRC) Cellular Vehicle to Everything (C-V2X)	Basic Safety Message (BSM), Signal Phase & Timing (SPaT), MapData Message (MAP), Personal Safety Message (PSM), Roadside Safety Message (RSM) *	Red Light Violation Warning, Reduced Speed Zone Warning, Intersection Collision Avoidance, Traffic Optimization for Signalized Corridors
Structure	Industry Standardized	Industry Standardized	Customizable or Standardized
Impact of change to 30 MHz	Next generation C-V2X (5GNR) has no dedicated spectrum	Data packets may be dropped due to channel congestion	Timeliness of message set delivery may be degraded
Impact of potential interference	Might require hardware or firmware redesign to compensate	Data packets may be dropped due to interference	Accuracy of message set delivery may be degraded
Impacts to security	Might require hardware or firmware redesign to compensate	Certification may be degraded, potentially resulting in messages being ignored or bad actors slipping through	Ability to deliver message sets may be degraded
Impact of regulatory uncertainty	Deployment has stalled, device development has slowed, vendors are changing	New message sets still evolving (RSM, PSM, payment), but might stall now	Hard to develop applications amidst uncertainty

with upgraded communications, will typically have a net positive impact on their ability to provide coordinated or more efficient traffic signal timing routines.

A commitment to V2X services by an IOO sends a clear signal that safety is important, and they're taking every possible step forward even if it means some risk. However, nothing happens quickly, and several agencies report that the lessons learned, benefits gained, and infrastructure installed can have longer-term payoffs by starting now and not waiting for the uncertainty to subside.

A commitment to safety by an IOO also has led many agencies to explore and implement other connected vehicle services such as data portals for traffic signal or work zone information. This data exchange may not be high-speed/low latency, and it may not serve the entire market universally, but it is an important step forward in providing data and information that can have a net positive safety impact. Whether or not these projects are in partnership with the private sector, the existence of such data services will undoubtedly open the door to new partnerships if they don't currently exist.

Vehicular V2X. The deployment of any device or service in a newly manufactured vehicle requires significant testing, proof of concept, and a long-term business case to support it. The ongoing uncertainty created by FCC's reallocation has caused several U.S. automakers to put a hold on their plans for V2X technology. For example, in April 2018 Toyota announced it would begin the installation of DSRC technology by model year 2021 "with the goal of adoption across most of its lineup by the mid-2020s."[3] Not long after Toyota's announcement, two FCC commissioners sent a letter to Toyota signaling the agency's interest in opening the 5.9 GHz band for unlicensed use, referring to the 5.9 GHz spectrum

as "lying fallow" and to DSRC as a "promise unfulfilled."[4] In April 2019, Toyota announced it would halt its plans to install DSRC across its vehicle fleet, stating that the decision was based on "a range of factors, including the need for greater automotive industry commitment as well as federal government support to preserve the 5.9 GHz spectrum band for DSRC."[5]

As recently as July of 2021, Ford noted in a submission to FCC that it "remains steadfast in its commitment to begin deploying C-V2X in our U.S. vehicles beginning in 2022."[6] They added, however, that if unlicensed use is allowed in the lower 45 MHz, harmful interference must be mitigated to not allow any degradation in C-V2X performance—and that an "additional 40 MHz of spectrum, free from harmful interference, will be needed to accommodate advanced C-V2X applications and future AV use cases." Actions taken by Ford will be closely monitored by others in the automotive industry and could trigger additional announcements, potentially impacting V2X deployment nationwide.

USDOT Leadership

During the first 15 years of the Safety Band's existence, significant leadership from USDOT was instrumental in driving advances in technology, standards, and policy. However, since its decisions in 2017 and 2018 to no longer pursue the proposed rulemaking that would mandate V2X technology in new vehicles, USDOT has generally taken a much less visible role in the policy and regulatory aspects of the Safety Band.

The Department has remained vocally opposed to FCC's reallocation proposal throughout the entire process. They went so far as to suggest a negotiated rulemaking with FCC, bringing both parties to the table to work out differences in opinion. USDOT has continued to pursue important V2X research that would help further refine standards, document deployment lessons learned, and advance technology development. But they have not been able to turn FCC's reallocation proposal around.

As the issues in this space continue to evolve, it will be important for USDOT to demonstrate significant and visible leadership in both resolving the challenges and leveraging the opportunities outlined in this article.

ITE's Role

ITE's Connected and Automated Vehicles (CAV) Standing Committee has played an active role throughout the past several years of Safety Band uncertainty. It has drafted the policy principles in this space adopted by the organization, drafted comments and reply comments to FCC at various checkpoints in the process, and met with automakers and private entrepreneurs to understand all aspects of the issue. It has organized sessions at ITE meetings, held multiple webinars, and written articles for *ITE Journal*. Most recently, Committee members have worked with Headquarters staff to provide input to GAO to support their investigation of the overall situation, as well as provide material support to AASHTO and ITS America's brief for their ongoing legal appeal. The CAV Standing Committee will continue to monitor the progress and challenges of vehicle connectivity as this situation plays out. **itej**

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Preparing for Safe and Successful Truck Platooning on Public Roads:

Collaboration between the United States and the European Union

By Stephanie Roldan, Christophe Jallais, Marika Hoedemaeker, and Michelle Arnold



SHUTTERSTOCK/5M3PHOTOS

The development of automated trucking technology is progressing rapidly, with partially automated platoons expected to deploy on public roads in several countries within the next few years.[1] In the United States and the European Union, where truck platoons are being prepared for commercial deployment, platoons typically consist of two or more trucks equipped with cooperative adaptive cruise control (CACC).[1] Trucks equipped with CACC use wireless communication systems to automatically coordinate braking and acceleration among the group. This technology allows trucks to safely and autonomously maintain following over long distances.

In the United States, truck platoons typically focus on achieving short following distances to reduce fuel use and emissions over long trips.[2] One three-truck CACC platoon cruising at 65 miles per hour (104.6 kilometers per hour) yielded fuel savings of about 6 percent at 0.6 seconds following gaps and 5 percent at 1.5 seconds following gaps.[1] In the European Union, where platooning is primarily pursued as a driver support function, platooning trucks may maintain following distances similar to those of conventionally driven trucks. However, the faster and coordinated braking responses of partially automated trucks are expected to significantly improve traffic safety on high-volume European roads compared to conventionally driven trucks.

Although truck platooning offers potential advantages for traffic safety and efficiency, multi-truck platoons operating on shared roads may present challenges for other drivers. Truck platoons may block nearby drivers' views of the roadway and roadside signing.[3] Platoons consisting of closely grouped trucks may also interfere with other vehicles' ability to change lanes or exit or enter the highway.[4] A group of closely following trucks may also contribute to enhanced feelings of discomfort and perceived risk already associated with conventionally driven trucks.[5,6] On the other hand, longer following distances between platooning trucks risks inviting frequent cut-ins from other drivers, which could disrupt platoon stability and fuel efficiency over time.[4,7] Other driver behaviors, such as abrupt cut-offs, inappropriate following distances, and sudden braking ahead of the platoon may also disrupt platoon safety and efficiency.

This article describes an international partnership between U.S. and EU organizations that are conducting research to prepare for the public deployment of partially automated truck platoons. The two groups seek to ensure the safety and comfort of other drivers near partially automated truck platoons by exploring how drivers perceive and navigate near platoons on high-speed freeways. The preliminary research described here shows that drivers tend to view closely following trucks as dangerous or risky. However, novel signing strategies may reduce negative perceptions and encourage safe driving behaviors near platoons. These studies, and the upcoming driving simulator studies based upon their findings, will guide policies that improve non-truck driver safety and comfort near truck platoons, thus promoting public acceptance and success of commercially deployed truck platoons.

Project Goals

In the United States and the European Union, where truck transportation services are in high demand, governmental agencies and industry owner-operators are working together to support the safe and successful development and operation of truck platoons. The U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) has been working with technology developers to shape and test platooning technologies and architecture for several years.[8] Similarly, the Enabling Safe Multi-Brand Platooning for Europe (ENSEMBLE) project, organized by the European Commission (EC), is dedicated to paving the way for the adoption of multi-brand truck platooning in Europe. The ENSEMBLE initiative brings together a diverse group of leaders in technology and policy, including several major truck manufacturers, to address the challenges faced by operating trucks from multiple manufacturers across country borders and prepare paths to standardization. In addition to focusing on technology, safety, and operations, both FHWA and ENSEMBLE are addressing the yet untested safety issues that other drivers may face when traveling near truck platoons. The research focus of these groups is also influenced by the anticipated role of truck platoons, the

policies expected to govern automated trucking operations, and local driving culture in their respective regions.

Representatives from the FHWA and ENSEMBLE groups established a twinning arrangement in 2018 that allows the groups to coordinate and exchange information on their parallel research questions. Twinning agreements were established in the 2013 Implementing Arrangement between EC and USDOT to support cooperative activities in research, development, technology and innovation for all transport modes.[9] The Horizon 2020 Work Programme for "Smart, green and integrated transport" further identified several topics in the areas of safety, infrastructure, intelligent transport systems, and road automation for potential twinning with USDOT projects. The purpose of twinning is to establish a structured, but not contractual, partnership to maximize research outcomes, promote the exchange of knowledge and experience, and exploit synergies.

Based on consultations with industry owner-operators, the FHWA and ENSEMBLE research teams established the likely characteristics of early deployment truck platoons in their respective countries (Table 1). From these, the teams independently identified common research questions regarding driver behavior when traveling near truck platoons on high-speed freeways (Table 2). Considering the differences in anticipated platoon operating characteristics and locations, the teams have additional distinct research questions, such as the influence of platoon signing or traffic volume on driver behavior.

Table 1. Anticipated truck platoon characteristics.

Project	Operating Characteristic	Anticipated Outcome
FHWA (U.S.)	Operating locations	Existing truck corridors (rural, high-speed freeways)
	Human drivers in every truck	Yes
	Technology	CACC
	Platoon length	2–3 trucks
	Following distance	0.6-2 sec.[10]
	Specialized markings	None
ENSEMBLE (EU)	Operating locations	High-speed, mixed-use freeways
	Human drivers in every truck	Yes
	Technology	CACC
	Platoon length	3-7 trucks
	Following distance	1.5 sec.
	Specialized markings	None

Table 2. Research questions.

Organization(s)	Research Questions
FHWA, ENSEMBLE	How will drivers navigate around truck platoons when entering, exiting, and traveling on two-lane freeways?
	How will truck platoon characteristics (i.e., length, following distance) affect driver behavior and experiences?
FHWA	Does driver awareness of truck platooning operations influence driving behavior and navigational decision-making when traveling near a truck platoon?
ENSEMBLE	How will high and low traffic volumes affect driver behavior and emotions when traveling near truck platoons?

Preliminary Research and Results

To provide a foundation for the overall research plan, the FHWA team conducted preliminary behavioral and survey studies to learn more about how drivers regard and understand conventionally driven and automated trucks. First, FHWA's team assessed drivers' perceptions of, and naming preferences for, groups of conventionally driven and automated trucks. Survey results were then used to develop a set of novel signing options to identify partially automated platooning trucks that were evaluated by a new set of participants in a behavioral study. These studies are described below.

Perception of Trucks Survey

Fifty adult participants (32 females, 18 males, majority under 46 years old) were asked to describe their attitudes and behaviors near single and grouped conventionally driven and partially automated trucks.[6] The results showed that 54 percent of survey respondents associated driving near or around single heavy trucks with negative feelings such as anxiety or fear. A large portion of drivers (44 percent) described having neutral reactions, sometimes stating caution or awareness. Most participants (91 percent) reported they drive more cautiously around trucks compared to other passenger vehicles.

The survey also revealed that drivers' experiences with conventionally driven trucks biased them to expect trucks to operate independently of one another and even competitively, thus leading them to see trucks—especially those following other vehicles at short distances—as potential aggressors. Respondents used spacing between trucks, travel in inner or outer freeway lanes, and branding or markings in their judgements of whether trucks were intentionally following one another. The term "platoon," although widely used in the transportation industry to describe groups of partially automated trucks, was neither familiar nor readily understood by participants.

Instead, most participants (72 percent) chose "convoy" when asked to select a term from a predefined list to label a group of partially automated trucks (Figure 1). The term "linked" was most frequently selected (29 percent) to describe a single automated truck operating within a group of other automated trucks. In 16 percent of survey responses, participants noted that, because truck platoons would be expected to remain in a consistent formation and lane for an extended duration of time, they would be more predictable and thus safer and more comfortable to travel near than conventionally driven trucks. The research team applied these findings when selecting content, wording, and intended messaging for the novel signs and indicators evaluated in the novel sign evaluation experiment.

A. Group of automated trucks. *B. Individual automated trucks.*

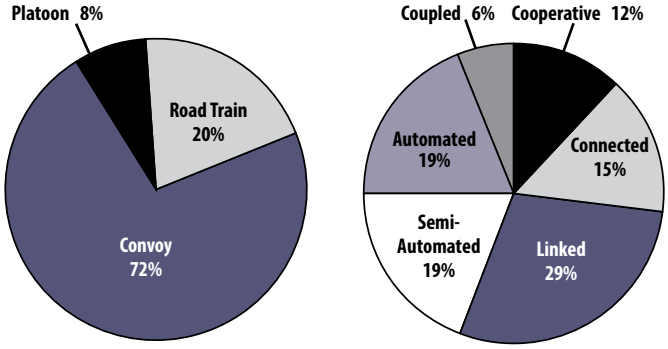


Figure 1. Distribution of terms selected to describe grouped or individual automated trucks.

Novel Sign Evaluation

The novel sign evaluation presented 48 new participants (24 females, 24 males, mean age of 44.8) with images depicting simulated scenarios of a two-truck platoon with and without novel signs developed from the survey findings. An illuminated indicator (light bar) mounted on the rear of the trucks was also tested for comparison with conventional signing options. All participants in the experiment first viewed and answered questions regarding four scenarios without signs or a light bar (i.e., the control condition). Next, participants viewed the same four scenarios with one set of novel roadside-mounted and truck-mounted signs or truck-mounted light bars. The research team evaluated the effects of the novel signs and light bars on participant judgements regarding navigation around the trucks, safety, and expectations for platoon operations.

Results showed that participants were more likely to expect trucks to execute lane change maneuvers in tandem when signs or light bars were included in the simulated scenarios compared to without. Participants also rated trucks with signs or light bars as safer than unsigned trucks with the same following distance. Signs or a light bar also influenced participants' understanding of trucks following in tight groups, awareness of the use of connected or automated technologies, and willingness to cut-in between the trucks in the platoon. Overall, the combination of roadside-mounted and truck-mounted signs shown in Table 3 was most successful at communicating the presence of trucks traveling together in a close group. The combination of signs also increased drivers' ratings of how safe they felt near the trucks and how safe they judged the trucks to be in general. In addition, these signs were measured to be legible and comprehensible at greater distances than the other roadside- and truck-mounted signs. Finally, participants rated these signs as the most preferred and effective among the six novel signs and the light bar tested.

Table 3. Signs selected for further study based on the results of the behavioral sign experiment.

Sign Type	Roadside-mounted	Truck-mounted
Sign		

The results of the experiment provided evidence that signing can influence drivers' perceptions of truck operations and the relationship between multiple trucks. Due to their ability to support positive and accurate perceptions of truck platoons, the roadside- and truck-mounted signs shown in Table 3 will be used in a driving simulator experiment to further investigate how drivers understand and interact with signed and unsigned platoons.

Findings and Conclusions

The results of the experiments showed that short following gaps alone were not sufficient to imply intentional cooperative following or active truck platooning. These preliminary studies yielded informative trends in participant responses. However, further research is needed to explore the effects of partially automated truck platoons on non-truck driver behavior among a larger sample size representative of the general driving population. Although the survey revealed that drivers are likely to be uncomfortable around closely grouped heavy trucks, behavioral testing showed that signing may support driver comprehension, safety, and acceptance of heavy-truck automation.

Next Steps

The studies conducted by FHWA provide a foundation for understanding driver attitudes towards and behaviors near truck platoons upon which to plan and interpret future

experiments. Upcoming driving simulator experiments conducted by the FHWA and ENSEMBLE groups will explore realistic scenarios to investigate the research questions described in Table 2.[11] As illustrated in Table 4, the variables of interest for both projects are overall quite similar, while also reflecting subtle but meaningful differences stemming from the expected role and conditions of automated truck platoon operations in each respective region.

The studies will be conducted in the Université Gustave Eiffel's (UGE) full-cab, fixed-base driving simulator in Lyon, France and FHWA's quarter-cab miniSim™ fixed-base driving simulator at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, USA (Figure 2).

Table 4. Summary of key variables.

Project	Variables	Levels
FHWA (U.S.)	Platoon size	2 or 3 trucks
	Truck following distance	0.6, 0.9, or 1.2 sec.
	Platoon signing	Truck-mounted, roadside-mounted, both, or none
	Traffic volume	Not manipulated
ENSEMBLE (EU)	Platoon size	3 or 7 seven trucks
	Truck following distance	0.8 or 1.5 sec.
	Platoon signing	Not manipulated
	Traffic volume	High or low



Figure 2. Full-cab driving simulator at UGE (above) and quarter-cab miniSim™ driving simulator at TFHRC (below).

The results of the driving simulator experiments will provide further insight into driver behavior across a range of platoon characteristics. Although a simulated truck platoon may be perceived as less dangerous or risky than a real one, these studies represent the first systematic investigation of how drivers may respond to platoons and the factors that may influence their behavior around platoons.

By working together, the FHWA and ENSEMBLE groups have gained a more global perspective on driving automation technology that is poised to have worldwide impacts. Together, the results from both research efforts are strengthened by their collaboration and will provide more robust outcomes upon which to guide future policy and practice to ensure the safe and efficient operation of truck platoons on international roadways. **itej**

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ITS JPO 30th Anniversary:

Celebrating the Past and Looking Toward the Future

By Egan Smith, P.E., PTOE, PTP (M)

The U.S. Department of Transportation (USDOT) Intelligent Transportation Systems Joint Program Office (ITS JPO) celebrates 30 years of service this year! That is three decades of innovative research and development initiatives that have helped increase the safety of travelers both inside and outside the vehicle, advance roadside communications infrastructure, and expand mobility options for Americans across the nation. As ITS JPO ushers in a new era, this is the opportune time to reflect on past successes with an eye on emerging trends that have the potential to disrupt the transportation system of the future.



SHUTTERSTOCK/JAMESTEOHART

1990s – The Beginning: The Rise of ITS JPO

In the early 1990s, the nation was on the cusp of a technological revolution. Rapidly improving technologies—such as advances in computing, sensing, and communications—were opening up new opportunities for a safer and more efficient transportation system. However, their implementation across the nation's large and multifaceted transportation system presented new challenges such as ensuring widespread buy-in, recognition of their importance, successful deployment, and realization of benefits.

To solidify the role and importance of ITS in maintaining, improving, and growing the nation's transportation systems, the 1991 reauthorization of federal surface transportation programs made a significant public commitment to institutionalize intelligent transportation systems. This crucial step established the foundation for the federal ITS JPO program and the public-private partnerships that have continued to this day.

Additionally, when the Intermodal Surface Transportation Efficiency Act (ISTEA) was signed into law in 1991, it established policies that focused on the operational management and maintenance of that system. ISTEA encouraged the development and application of advanced ITS technologies and established a program that fostered the development of ITS through:

- Basic research and development,
- Operational tests that served as the bridge between basic research and full deployment, and
- Various technology transfer activities that facilitated the implementation of ITS technologies.

During this time, ITS JPO focused on developing and standardizing a national systems architecture along with standards to promote interoperability and a coordinated national ITS approach to encourage the widespread use of the concept. The resulting national ITS architecture provided the framework for integrating transportation and communication technologies into applications such as traveler information, variable message signs, ramp metering, electronic tolling, and vehicle safety systems. ITS JPO also pursued major ITS deployment initiatives to address the challenges of developing an integrated, multimodal intelligent transportation infrastructure, and to provide more efficient transportation systems and better traveler information.

The year 1998 marked another pivotal moment in ITS JPO's history—the passage of the Transportation Equity Act for the 21st Century (TEA-21). TEA-21 provided ITS JPO with funding for research, training, and standards development; metropolitan and rural systems; and deployment of a commercial vehicle ITS infrastructure. As a result, ITS JPO focus was transformed from managing a moderate research program to one that works to advance its research into deployment of ITS technologies.

2000s and 2010s – Continuing the Push to Deploy ITS: Advancing Mobility and Connected Vehicle Technologies

In the 2000s, a variety of forces–including the economic downturn–focused increased attention on making the most efficient use of the highway system and vehicle fleets. At the same time, communications and information technology, systems, and applications evolved at a rapid rate. These factors ultimately led to innovative research initiatives and an explosion of new transportation apps, often combining the use of vehicles as probes with enhanced geographic location and mapping systems in the form of user-friendly mobile and in-vehicle user interfaces. ITS JPO recognized the potential to propel ITS forward by connecting vehicles, roads, and travelers' personal devices and began to focus on the significant safety and mobility benefits that could result.

In 2011, ITS JPO sponsored the Connected Vehicle Safety Pilot. At the time, it was the largest real-world test of connected vehicle technology—with more than 2,700 participating vehicles in Ann Arbor, MI, USA using wireless safety technology to help everyday drivers avoid crashes as they traveled along their normal routes. The Safety Pilot program paved the way for the more robust, nationwide Connected Vehicle Pilot Deployment Program.

This program awarded cooperative agreements collectively worth more than $45 million USD to three pilot sites in New York City, NY, USA; Wyoming, USA; and Tampa, FL, USA to implement a suite of connected vehicle applications and technologies tailored to meet each region's unique transportation needs. Each site worked to design, build, and test deployments of integrated wireless in-vehicle, mobile device, and roadside technologies. The sites are currently operational and system impact is being monitored through key performance measures. By uncovering and addressing barriers to deployment, documenting lessons learned, and providing a template for other early deployments, the pilots have established the base for growing a nationwide connected vehicle system.

2020s – The Way Forward: Putting People First

ITS JPO will continue to provide a focused role for USDOT in supporting development and deployment of new technologies as well as adopting and adapting innovative technologies from other industries to meet the specific needs of the surface transportation system. By working with industry partners, academia, and stakeholders through cooperative agreements and grant programs, ITS JPO will continue to develop intelligent and advanced technologies that address some of the more intractable transportation-specific problems.

To fulfill its mission, ITS JPO is guided by the *ITS JPO Strategic Plan 2020–2025,* which outlines a focused set of strategies to lead collaborative ITS research, development, and implementation across USDOT. ITS JPO will capitalize on past

investments in key research areas, including automation and connectivity, while exploring new emerging technologies that will impact and transform transportation. The program remains committed to advancing the deployment of innovative ITS that provide safety, accessibility, and efficiency benefits for all travelers across the country.

To learn more about ITS JPO, visit www.its.dot.gov. **itej**



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ITE and ITS JPO: Partnering for Success

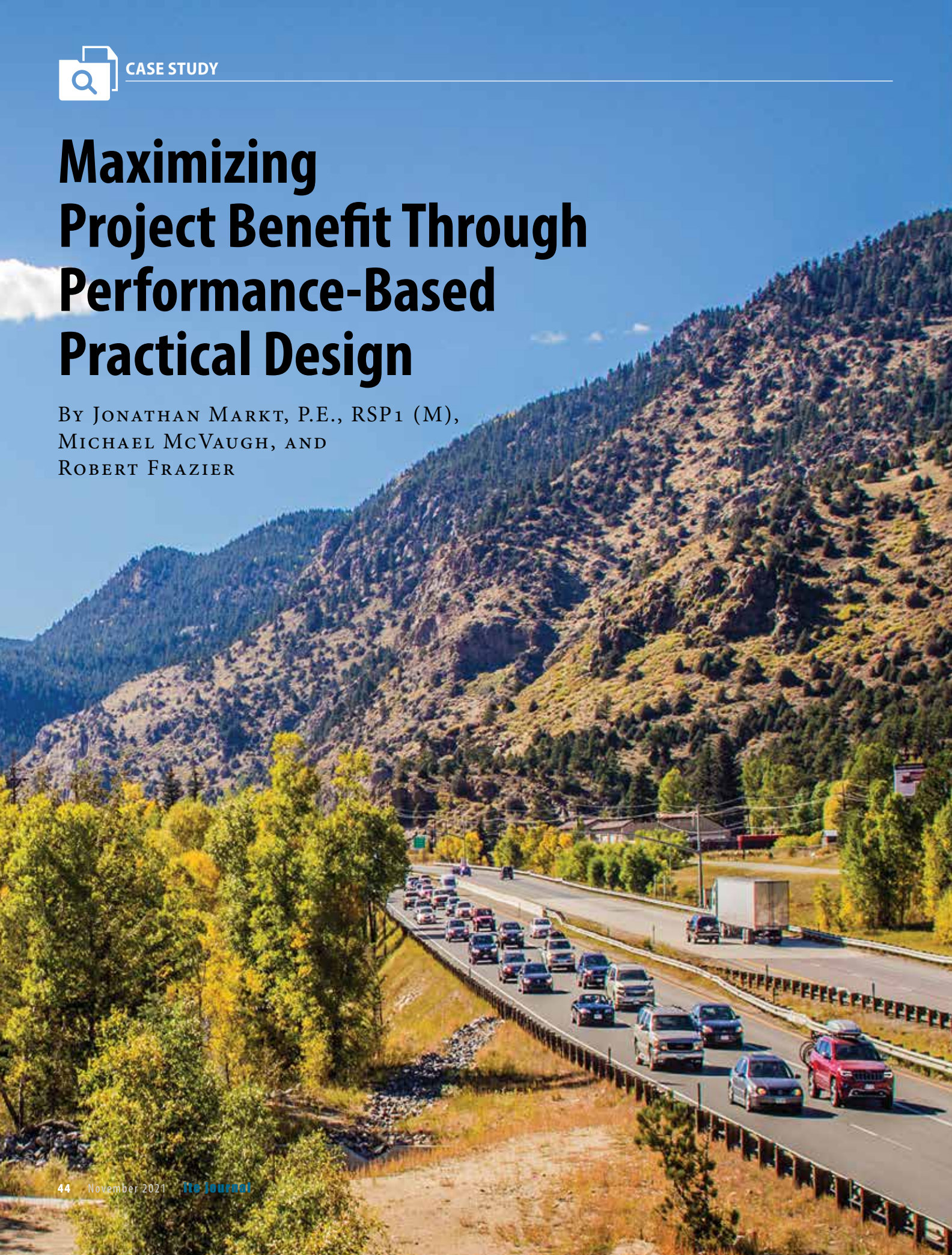
ITE has enjoyed a long and productive working relationship with ITS JPO throughout its 30-year history. Throughout the years, ITE has worked with ITS JPO to develop technical products such as the ITS e-primer, several ITS standards in the Connected Vehicle space, numerous ITS Professional Capacity Building standards and transit standards training course and modules, and other material designed to help accelerate the deployment of ITS technology and services. ITE has also helped manage the technical activities of the ITS JPO-sponsored Transportation Safety Advancement Group (TSAG) and for the last 4 years has conducted the National Rural ITS Conference, either as a standalone event or in conjunction with the ITE Annual Meeting (which will take place again in 2022). ITE has also worked with ITS JPO staff to ensure that relevant ITS content is delivered at ITE Annual Meetings and other ITE technical conferences and events. ITE congratulates ITS JPO for 30 years of progress in developing and implementing ITS technologies and services!



CASE STUDY

Maximizing Project Benefit Through Performance-Based Practical Design

By Jonathan Markt, P.E., RSP1 (M), Michael McVaugh, and Robert Frazier



A 1.2-mile [1.9 kilometer (km)] stretch of the two-lane U.S. Route 550 was set to be widened in southwest Colorado, USA, providing safety and mobility improvements for the corridor used by tourists and for gas and oil transportation out of the San Juan Basin. This strategic project had been envisioned since the early 1990s to provide a four-lane highway with a grade separated interchange where US 550 and US 160 meet.

Colorado Department of Transportation (CDOT) officials realized the connection to the interchange as proposed would entail moving 1.2 million cubic yards of embankment—an expensive prospect that had transportation officials recognizing taxpayer funds could be better spent to enhance other project features, rather than simply moving earth. As part of the design-build process, the project team took a fresh look at the proposed customer and agency benefits of the improvements through a performance-based lens to maximize the value gained while staying within the project's target budget.

The project's purpose and need was to improve safety, mobility, and access control. Following traditional American Association of State Highway and Transportation Officials (AASHTO) design standards meant widening the highway to the full extent, which resulted in substantial right-of-way impacts and earthwork. CDOT began looking at the 2018 seventh edition of *A Policy on Geometric Design of Highways and Streets* (The AASHTO "Green Book") more closely and chose to use a flexible, performance-based design approach to narrow the roadway template while still staying true to the purpose and need. Using a data-driven analysis process to

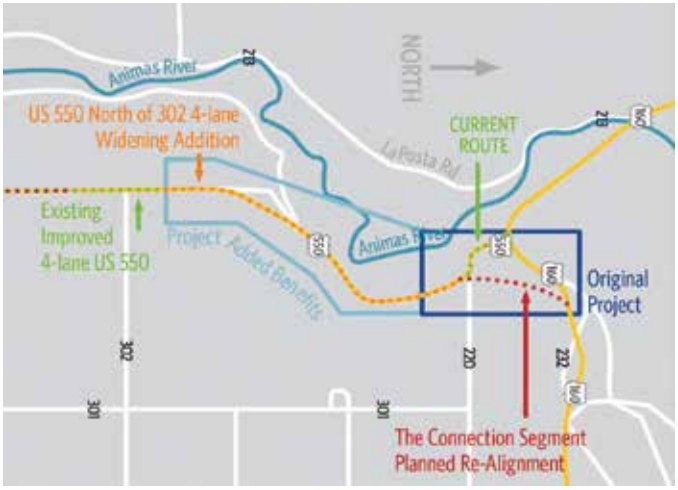


Figure 1. Performance-based practical design thinking allowed CDOT to improve 4 miles (6.4 km) instead of the original 1.2 miles planned.

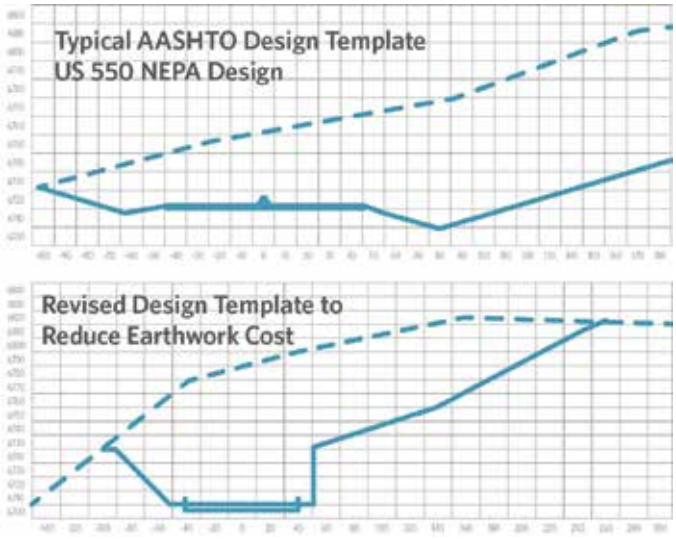


Figure 2. Using the flexibility within AASHTO standards, CDOT reduced earthwork costs by 40 percent.

What Is Performance-Based Practical Design?

Performance-based practical design is a flexible approach that takes into account the most pressing needs of a project. The approach encourages targeted improvements that accomplish the project's purpose and need—say, decreasing crashes or delays—through a data-driven analysis of needs and performance, rather than simply conforming to a traditional full criteria design.

This can be applied to a variety of assets to maximize user benefits of the roadway. Using a targeted approach to improve performance without unnecessary construction costs can save substantial portions of a project's budget—and that's money that could fund additional safety upgrades or other needed improvements.

inform their decisions, CDOT officials realized they could meet the project goals while reducing the earthwork quantity by 40 percent. The cost savings would in turn allow them to extend the widening project an additional 2.8 miles (4.5 km) within the existing budget constraints. Those extra miles extended the project to where the highway already had four lanes. The overall benefit of this design flexibility was being able to improve more roadway, which provided greater safety and mobility benefits to the user without increasing agency and taxpayer cost.

Maximizing Project Value

CDOT's example embodies the principles of performance-based practical design, an approach that empowers agencies and the public to get the most value for their transportation dollars, regardless of funding levels.

"Through those engineering decisions, and with the input from the project team, we were able to dramatically increase the scope of the design-build project while still meeting the project goals," said Kevin Curry, CDOT's Region 5 Program Engineer. While remaining within the target budget, the new project design more than doubles the length of the wider, safer highway, resulting in projections to reduce crashes by 50 percent.

This performance-based practical design approach gives agencies and engineers proven methods to target the most effective and cost-efficient upgrades, rather than simply applying a standard template approach to roadway design.

"We're always looking to maximize project value to our customers out of every project," said Curry. "At the same time, we certainly always have safety in the forefront of every design."

New Data and Tools, Same Consistent Design Framework

The industry shift toward performance-based practical design is enabled, in part, by tools and data collection capabilities that have come into common use in the past decade.

Agencies seek to make defensible decisions and use design manuals and project development processes to foster consistency in design. As performance-based practical design emerges, a common process or framework for data and tools is being used to establish consistency in process. A recommended framework designers and owners can follow uses these five steps:

1. Data and design impacts
2. Performance models
3. Outputs/metrics
4. Benefit/cost analysis
5. Data-informed decisions

Using traditional AASHTO design standards, a designer may select a design parameter from a table and move straight into detailed design. This approach skips the performance modeling through benefit/cost steps, which quantify the benefits and drawbacks of that design decision. The performance-based practical design framework instead assists the designer in consistently applying all five steps for more nuanced decision-making based on project-specific outputs.

Industry advancements enable a comprehensive examination of the predicted outcomes for a range of possible design options. The engineering profession now has safety performance functions to predict crashes and cost beneficial mitigation strategies for many types of roadways and intersections thanks to the AASHTO *Highway Safety Manual* (HSM) and the Crash Modification Factors (CMF) Clearinghouse. Designers have more effective operational models that can predict how transportation professionals will impact the system both at a system level and a local level. And designers have new ways of quantitatively predicting travel time reliability developed in the last decade, such as the Second Strategic Highway Research Program (SHRP 2) Reliability Data and Analysis Tools that are now being more broadly applied.[1] These new methods and data sources allow designers to better predict the actual impacts of their decisions on the number of crashes, travel time reliability, asset life cycle, emissions, and other important metrics.

Where to Start

If your agency does not yet use PBPD, these are some of the types of projects your agency might want to start with.

- Shoulder and lane width improvements are a common place to start using performance-based practical design as described in examples in this article.
- Pavement asset management for resurfacing projects show that it is often more cost-effective to maintain pavement than to wait to reconstruct the pavement, and data can help prioritize areas to maximize the longevity of the pavement.
- Safety projects can use crash data, information, and analysis to allow a laser focus on the biggest problem spots and the most cost-effective solutions.
- Intersection design is a good place to optimize mobility and reliability—the simple addition of a turn lane or conversion to a roundabout can reduce the number and duration of vehicle stops and improving safety, thereby maximizing user benefit.

If you are a practitioner, you should think through the metrics that are critical for your project and how you can apply the PBPD framework to evaluate them and make effective decisions. A practitioner should start by learning what the underlying conditions are that the roadway is experiencing. Is it a failing asset, or does it have safety deficiencies, operational deficiencies, or a combination of problems? Once this is understood, then using the data, analysis, and mitigation tools, the practitioner should begin identifying the most cost beneficial solutions to use to maximize user and agency benefit.

Iowa DOT's Shoulder Design Analysis

Another example of applying a performance-based practical design approach was on a roadway project in Iowa, USA. The project design included full depth pavement reconstruction and increased shoulder width with flattened sideslopes. The increased shoulder width and sideslopes were selected from a standard design parameter table. Without performance models, the design process would not have considered that the existing gravel shoulder and sideslopes had a history of limited crashes. Thus, a performance-based practical design process using AASHTO HSM methods was conducted. Using HSM Part C methods, the existing 6-foot (ft.) gravel shoulders and 3:1 slopes were found to have CMFs of 1.01 and 1.0 for shoulder width and type and roadside design, respectively (see inset). The build condition of 6-ft. paved shoulders and 6:1 slopes yields CMFs of 1.0 and 0.87. While a reduction in crashes of 14 percent ((0.87-1.01)/1.01) was calculated, further evaluation showed the predicted safety performance function (HSM Equation 10.6) yields a predicted crash frequency of 2.5 crashes per year over the project length due to low average daily traffic.

The analysis identified that the project benefits were not consistent with the project costs. The user safety benefits for the shoulder and side slope enhancements was $700,000 USD based on a benefit monetization process. In the benefit/cost analysis, the safety benefits for shoulders and side slopes were far less than the project costs to construct these enhancements. This Iowa DOT "post-construction" quantitative analysis confirmed the assumption of the agency that the user benefits of the improvements were out of sync with the project costs. This resulted in a reexamination of the scoping process to best suit the project's overall purpose and need and maximize value to the users. This successful application provided the basis for the use of a performance-based practical design approach on future rural projects.

Focusing on Safety Performance

Existing Shoulder CMF

Shoulder	1.01
Roadside 3:1 slopes	1.0

Build Condition CMF

Shoulder	1.01
Roadside 6:1 slopes	0.87

Calculated crash reduction 14 percent ((0.87-1.01)/1.01).

With ADT = 1,200 vehicles/day, predicted crash frequency of proposed shoulder and side slope improvement is minimal (2.5 crashes per year).

Nebraska DOT's Experience

The examples of design beyond the defined purpose and need are plentiful; this fact was made clear through an experience with the recent design policy study for Nebraska DOT. The project team looked at six projects comparing a traditional design that employed the standard state design parameter table to a performance-based practical design evaluation. The projects reviewed were largely driven by the need to maintain the pavement asset. All were two-lane highways where our analysis focused on how shoulders and roadside earthwork were designed. The primary approach at the design stage was to avoid additional earthwork from a pavement grade-raise by introducing a slight shoulder reduction to tie grading into the existing foreslope. Reduction in shoulder width can be offset by increasing the paved portion of the shoulder and/or adding rumble strips.

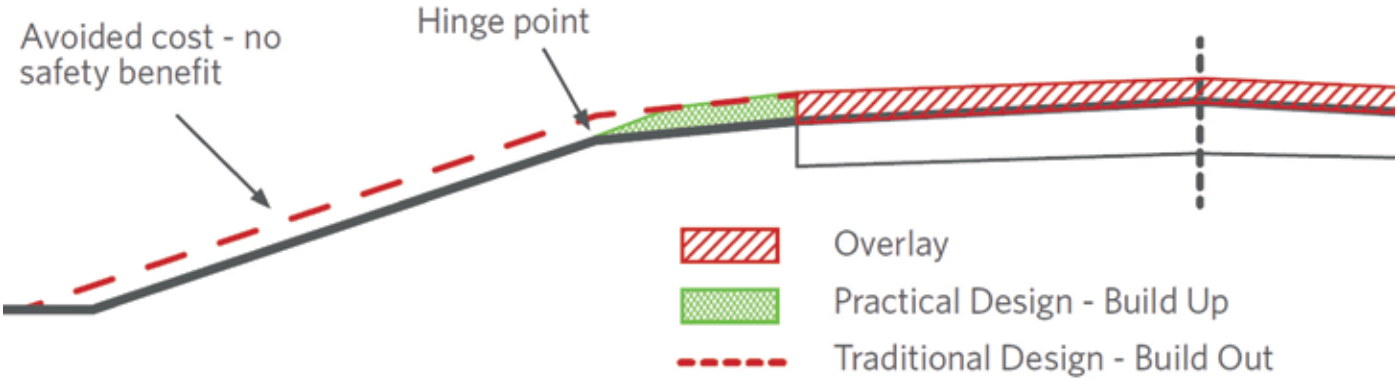


Figure 3. Careful analysis of safety benefits supported practical design decisions.

The review team used the existing HSM tools like the NCHRP 17-38 Smart Spreadsheets to complete crash prediction analysis of geometric improvements including shoulder type, shoulder width, and roadside slope and to consider the effect of recent crash history.[3] Across these projects, the enhancements under consideration were predicted to prevent less than 0.1 crashes per year regardless of the design. The safety analysis justified a less aggressive design that was slightly different from the applicable design standards. This was because the more costly improvements were found to provide a limited, measurable safety benefit over the alternate performance-based practical design.

At the corridor level, the user benefits and agency costs were combined to establish a net present value (NPV) for the proposed projects assuming one alternative as a traditional design and the other as a practical design. To answer the policy question "Is practical design a better investment for this corridor than a traditional, standards-based design?" the team combined the present value (PV) calculations as follows:

$$Incremental\ NPV = (User\ Benefits_{PV,\ Practical} - Construction\ Safety\ Costs_{PV,\ Practical}) - (User\ Benefits_{PV,\ Traditional} - Construction\ Safety\ Costs_{PV,\ Traditional})$$

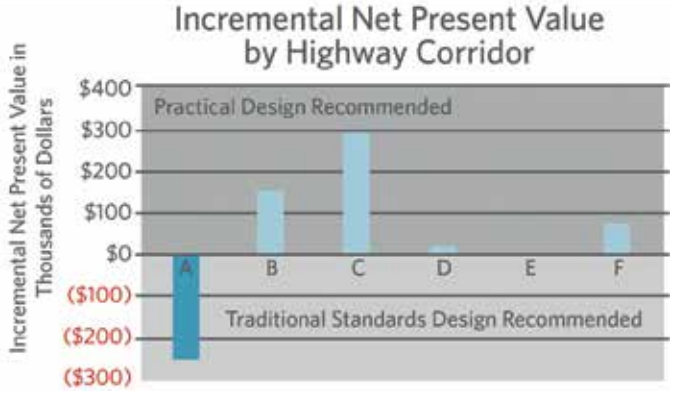


Figure 4. In five of six corridors, the process recommendation identified the performance-based practical design as the preferred option by benefit-cost analysis.

The results of the quantitative corridor level analysis (shown in Figure 4) indicated decreased corridor construction costs ranging from $40,000 to $300,000 in five of the six corridors by using the performance-based practical design approach. Based on the performance-based practical design efforts to date, Nebraska DOT is implementing a revised design policy and has developed a performance-based practical design spreadsheet tool for roadway designer use.

Industry-Wide Shift

The U.S. Federal Highway Administration (FHWA) embraced performance-based practical design concepts in its *Flexibility in Highway Design* document, and AASHTO reflects this in the HSM.[3] In late 2020 when announcing rulemaking on *Design Standards for Highways*, FHWA said, "These proposed design standards provide a range of acceptable values for highway features, allowing for flexibility that best suits the desires of the community while satisfying the purpose for the project and needs of its users."

AASHTO's Green Book is increasingly referring to performance-based design, allowing state DOTs flexibility to adapt and apply the spirit and intent of industry standards in a more context-sensitive approach rather than simply the rigid letter of the standard. States frequently confer with their counterparts in other states who are moving forward with adopting these approaches and can share how modeled outcomes compare to real outcomes. In 2020, a synthesis of published state practices in performance-based practical design was compiled for Kansas DOT, including 16 states in gray on the map below (Figure 5).



Figure 5. Sixteen U.S. states were surveyed to assess their use of performance-based practical design techniques.

The synthesis found that to be successful, it helps to have a champion at the agency level. And it's imperative to create data-driven tools that are useful to the design workforce to help guide the engineering judgement and consistent data-driven and research-based application of performance-based practical design that is needed. For example, a tool that allows designers to input information they already have, such as lane width, and then calculate cost/benefit, can expedite the analysis for the engineer while standardizing the process and making it accessible across the agency (see Figure 6). This approach improves benefits across the system, targeting funding only to necessary improvements and using the remainder for additional projects that also need those dollars.

Step 7 - Design Mode: Refine Design Alternatives

Define design alternatives and project costs. it is recommended left shoulder width be set equal to right shoulder width for design. The output results are shown in the table in "Macro Output" tab.

Design Geometry	Alternative 1 ☑	Alternative 2 ☑	Alternative 3 ☑	Alternative 4 ☑
Lane Width (ft)	11.0	11.0	11.0	12.0
Right Shoulder Width (ft)	3	3	3	6
Right Shoulder Type	Turf	Paved	Turf	Composite
Left Shoulder Width (ft)	3	3	3	6
Left Shoulder Type	Turf	Paved	Turf	Composite
Sideslope	1V:3H	1V:3H	1V:4H	1V:3H
Construction Cost ($)	$5,193,037.39	$5,894,080.94	$5,278,201.20	$6,243,228.12
Total Project Length (mi)	13.017	13.017	13.017	13.017

Figure 6. Calculator tools such as this streamline designers' work by estimating costs based on design parameters.

Benefits

Our industry is in the midst of a strategic shift to make better use of data and analytics, allowing progress toward performance-based practical design. Agencies around the country are seeing benefits—cost-effective projects resulting in focused improvements that prevent severe crashes and increase reliability systemwide. As Colorado's US Route 550 project shows, funding can beneficially impact much more of the system when the design is targeted to solve the major challenges. The results are strong evidence of this tool; reducing the earthwork saved more than $7.5 million USD, which allowed CDOT to more than double their roadway improvements, creating greater benefits that will benefit users systemwide.

That's sound engineering economics. **itej**

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Jonathan Markt, P.E., RSP1 (M) *is a traffic engineer and transportation planner with HDR whose models focus owners on data that enables them to choose transportation projects with impactful benefits. An ITE member, he presented Iowa's take on performance-based design during the Transportation Research Board's 2017 annual meeting. Jon is managing the development of performance-based practical design calculation tools for Nebraska DOT and Kansas DOT.*



Michael McVaugh, P.E., *is a senior project manager for HDR on the western slope of Colorado. Building on a 28-year career with Colorado DOT covering 15 counties in Southwest Colorado, he delivers transportation improvements thoughtfully targeted for maximum public benefit. Currently he is helping to rewrite CDOT's* Roadway Design Manual *to better introduce performance-based practical design into its engineering culture at a grassroots level.*



Robert Frazier, P.E., AICP, *is a senior transportation engineer with HDR in Kentucky who applies a wide body of experience in traffic engineering, planning, and project programming and financing to rural and urban corridors nationwide. His strength is applying data sets, tools, and analytical methods to address transportation needs and achieve project results for an owner. Currently he is developing performance-based practical design tools for Kansas DOT.*

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Answer to "Where in the World" on page 16: Sunrise on the National Mall in Washington, DC, USA. Photo submitted by Joe Balskus, P.E., PTOE, RSP1 (M).

Why I Joined ITE's Mentoring Program

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Bryce Grame (S)
Montana State University

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