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Reflections on the Annual Meeting

As I expressed in my presidential address, I am so grateful that technology affords us the ability to meet virtually when external conditions prevent large, in-person meetings. It is difficult to argue that ITE can deliver an exceptionally high-quality meeting with all the components of an in-person meeting. Kudos and thank you to staff who assembled and conducted every portion of the meeting; to the speakers, panelists, and moderators who delivered technical content and training; to the District and Section volunteers who added social entertainment elements to the meeting; and to all the attendees who enriched the content with questions and comments. Congratulations to the award winners who continue to prove that ITE is a world-class, cutting-edge organization.

And thank goodness for recorded content. On more than a few occasions, I was pulled away from the conference to deal with “real world” issues, only to return later for the recorded version. In addition, I’ve been able to return to a session and confirm my notes and recollections. This level of flexibility enhances the overall value of the meeting.

During the Annual Meeting, the Equity in Transportation listening tour ended with a Town Hall. During the event we provided a status update on the equity effort, offered draft recommendations, and solicited feedback. The session followed five online events in which hundreds of members participated. Overall, the findings concluded:

- ITE is uniquely suited to address the issue of transportation equity through our existing community, connections, and technical delivery program.
- Members want to do more about transportation equity but are unsure where to begin.
- The topics of diversity, inclusion, and equity are intertwined and somewhat difficult to address separately. Clear definitions are necessary.

So what’s next? A white paper is forthcoming with additional detail from the listening session and for future actions. A plan for delivery with defined roles and responsibilities matched to goals and objectives within the strategic plan will also be developed.

In addition to the Town Hall, many other portions of the conference covered equity. The “Walk the Mile” session discussed how project descriptions and outreach information can increase bias toward increased capacity and auto-centric construction in the name of safety.

During the Equity in Transportation Session, panelists discussed equity in relation to many components of transportation planning and design including a goal from Portland, WA, USA to “Keep Everyone Free From Harm.” This goal addresses the psychological harm of walkers and bikers when subjected to verbal abuse.

But perhaps most poignantly, U.S. Secretary of Transportation Pete Buttigieg offered the following wisdom during the opening plenary: “Since we know better, we need to do better,” he said. We need to “take care to assess and examine the moral challenges that sit along [side] the technical challenges.”

That is what we are working on today and into the future of ITE.



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

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

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The Virtual ITE Annual Meeting 2.0

I vividly remember my first ITE Annual Meeting after becoming Executive Director. I had experienced many as a member, but never had to deliver one. It was an intense week to say the least.

Having just completed our second virtual ITE Annual Meeting, I safely can say the staff is longing for the simplicity of an in-person Annual Meeting. While virtual may seem like it should be easier, the level of behind-the-scenes preparation and the length of time involved—a month from the start of our Board Meetings to

the last Committee session concludes—make it a marathon versus the in-person sprint.

All in all, we were very pleased with how this virtual ITE Annual Meeting went. With more than 1,400 participants, we reached a large and diverse audience with very strong public sector participation. The technology worked almost flawlessly. While we were happy with our delivery in 2020, we significantly enhanced our offerings in several areas. Using Zoom for our poster presentations provided a better platform for the presenters and easier access for participants. Participation in these sessions was very strong with up to 30 or 40 participants engaging with a single poster presenter at one time. We also added Hallway Chat using the Wonder tool. This provided a place for attendees to catch up with speakers after a session, and members to connect with one another in the virtual hallway. We see opportunities to use both of these tools in virtual events in the future.

I want to thank all of those who contributed to the success of this year's Annual Meeting. Obviously, the staff plays a big role in the meeting and deserves much credit, but I also want to recognize the many volunteers who served as session and workshop organizers, Council and Committee chairs, moderators, speakers, poster presenters, social event hosts, etc. And a special thank you to our sponsors. We could not do it without all of your support!

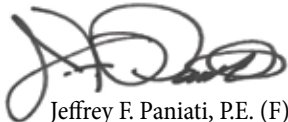
As part of the Opening Plenary Session, I had the opportunity to share my annual State of ITE report. It has been a challenging 18 months for all of us as we have dealt with the impacts of COVID-19 on our families, communities, and workplaces. I am happy to report that ITE has not only survived this challenging time, but thrived.

So far in 2021 we have held a virtual Student Leadership Summit with participation from more than 75 universities, delivered a very successful virtual Technical Conference to more than 1,200 participants, announced our first class of Young Leaders to Follow, graduated our first all-virtual *Leadership* ITE Class, held virtual Section 101 sessions with our 16 new Sections, delivered our second virtual Annual Meeting, and much, much more.

Later this year we will debut our new Designing Signalized Intersection certificate program (which is already sold out), deliver the 11th Edition of our signature product—the *Trip Generation Manual*—hold Strategic Visioning Sessions with two of our Districts, and bring forward a number of new technical products and programs.

While we are beginning to transition back to in-person events, we expect to continue to use the lessons learned during COVID-19 to better serve our members. We recognize that not all of our members can travel to in-person events, and we envision continuing to experiment with hybrid approaches at the International, District and Section levels. I look forward to seeing you in person or virtually at an ITE event sometime soon.

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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Miss #ITE2021?

Check Out the Recap on Page 23 to See the Highlights

Session recordings are available
through October 17.

<https://bit.ly/ITE2021Recap>

Save the Date for #ITENOLA2022!

July 31-August 3, 2022

New Orleans, LA, USA

The Call for Abstracts will be released this Fall!



2021 Annual Meeting

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Member Updates



Wulf Grote, P.E. (F) recently joined HDR as a senior transit engineering advisor. Grote will assist HDR's transit clients nationwide with expert insight into developing public transportation systems, working with the Federal Transit Administration, and developing major capital expansion programs.

At HDR, Grote is looking forward to supporting public transportation clients in overcoming post-COVID challenges, partnering with them to pursue major funding opportunities through the FTA, and implementing new service offerings.

"HDR has had the good fortune to collaborate with Wulf for over 25 years as he led planning, engineering, and construction of a major transit system expansion for the Phoenix Metropolitan area, first with the City of Phoenix and later with Valley Metro," said HDR Global Transit Director Tom Waldron. "Now that he has closed the chapter on an exemplary public sector career, we are thrilled that he has joined HDR to benefit our clients across North America with his extensive knowledge of delivering transit programs."



Ty Parham (M) recently accepted the position of Transportation Engineer, E.I., in the Transportation Engineering Department at J.M. Teague Engineering & Planning (JMTE). Ty passed the P.E. exam and will be eligible to apply for licensure in December 2022.

Ty is responsible for preparing complex traffic engineering studies using the principles of civil engineering, traffic impact analysis, data collection, and pavement condition survey techniques.

Ty graduated from UNC Charlotte with a B.S. degree in civil engineering with a transportation concentration and statistics minor. While at UNC Charlotte, Ty was the President of the UNC Charlotte Student Chapter of ITE.



Wes Guckert, PTP (F), President and CEO of The Traffic Group, recently received the 2021 Influential Marylander award.

Fifty-one Influential Marylanders were selected by the editors of *The Daily Record* for their significant contributions to their respective fields, and for their leadership in Maryland in the following areas: civic leadership, communications, education, finance, general business, health care, law, philanthropy, real estate, and technology.

In addition to his traffic engineering and transportation planning work, *The Daily Record* noted that Guckert also earned the honor through his work in the community. He started a scholarship for area college students, co-founded a non-profit dedicated to helping veterans returning from war to assimilate back into the community, and has spent nearly a decade and a half as a board member with the Carson's Scholars Foundation.

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.

Donald O. Robbins, P.E., of San Diego, CA, USA, passed away on July 26. He was a Life and Fellow member of ITE and served as President of the Western District in 1981. [itej](#)

ITE Talks Transportation Podcast



Moving a Public Agency into the Future of Active Transportation

Toks Omishakin, Director of the California Department of Transportation

Director of the California Department of Transportation, Toks Omishakin, discusses how the agency dealt with the challenges of the pandemic as well as the strategies it is employing to create safer, more livable, and more equitable communities.



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

New Members

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

Canadian

Faisal Ahmed
Sarah J. Grady
Nouran Habib, E.I.T.
Josh Self
Anna Simone
Corey Watterson
Janice Zhang

John Moschovich, P.E., PTOE
Stephanie Santana
Scott Schlect
Kevin Slovarp
Veronica Son, P.E.

Northeastern

Steven J. Babalis
Nick Merrifield
Alexa Wetmore
Stephan Zaets

Global

Rahul Sudarsan
Lucky Ami Worchie

Great Lakes

Mahjoub Abdalla
Mazen Ibrahim
Jacob Kleinhenz
Krista May
Alfredo Rodriguez

Southern

James Henry Graham, Jr.
Lauren Mayes
Raul King Viera
Chad Zellner

Texas

Siyuan Cao
Linda Chau
Rakshith Erra
Solome Musasizi Nakaweesa
Darren Ujano, P.E.

Mid-Colonial

Anthony Grescavage
Anahita Mazidi

Missouri Valley

Joseph Osgood
Levenson Girton
Michael Harrington

Western

David Campos
Natalie Chyba
Barbara Kimberly Duran
Steve Frank
Randell Gene Hahn
Stephen McWilliams, P.E.
Jason Nguyen
Eve Nilenders
Zachary William Popp
Sara Sadeghi
Rochelle Wise

Mountain

Alex Brucki
Adam David Carreon, P.E.
Trent Fallica
Colby GeDeros, P.E.
Eric Hernandez
Isaiah P. Landavaso
Sal Licari
Aryana Meyer

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.

LeadershipITE 2022 Hybrid Program

LeadershipITE is combining the past and the present by offering a hybrid program. As we begin to emerge from the COVID-19 pandemic, LeadershipITE is proud to announce that in 2022, LeadershipITE will consist of two in-person sessions and nine virtual sessions.

Application deadline for the class of 2022 is September 15, 2021.

This hybrid approach will allow you to connect with your peers in person to kick off the year, support and balance your professional and personal lifestyle through virtual workshops throughout the year, and end with an in-person graduation and celebration.

This approach combines the best attributes of years past into a comprehensive, inclusive program that will enable you to evolve your leadership skills for the future. The virtual workshops will be supplemented by professional and social events that provide participants not only the same content that this program is built on, but also enhancements to provide additional ways to engage with classmates, alumni, and the greater ITE community.

The virtual workshops will not be your average webinars. The curriculum is built around engagement, and each of the nine, four-hour virtual workshops beginning in January will include interactive and experiential elements. These workshops are led by **Shelley Row, P.E., CSP (F)**, a professional leadership consultant who is also a registered professional engineer with a strong background in transportation. You are in great hands and will undoubtedly benefit from her expertise.

Additionally, small team projects will be conducted addressing real-world issues facing the transportation profession and/or ITE and its members.

Throughout the year, you will have many opportunities to meet new people and grow your networks with intimate social events, sessions, and assignments with LeadershipITE alumni and ITE leadership.

If you've been interested in LeadershipITE, and the travel schedule and costs have held you back, 2022 is your opportunity to experience this hybrid interactive and engaging program while minimizing time away from your family and work responsibilities.

To stay up-to-date on the latest LeadershipITE activities, send a note to leadership@ite.org.

For more information and to apply to LeadershipITE, visit www.ite.org/LITE.



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.

ITE Member Wins Big on 'Jeopardy!'

Joshua Saak, P.E., PTOE (M) recently lived out a dream by participating in the game show "Jeopardy!" where he won \$68,000 for three consecutive winning appearances.

Saak is a traffic engineer with the Ada County Highway District in Boise, ID, USA, and is the Local Arrangement Committee Chair for the Mountain District's first in-person Annual Meeting next summer in Boise. [itej](http://itej.org)



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www.ite.org/jobs

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- Certification
- Mentoring
- Webinars, videos, and podcasts
- Advice and tips on resume writing, networking, interviewing, and maximizing your presence on social media

2021 EVENTS

TRANSPO (ITE AND ITS FLORIDA EVENT)
September 27–29 | Bonita Springs, FL, USA

NY UPSTATE SECTION 2021 ANNUAL MEETING
September 16–17 | Binghamton, NY, USA

ITS NJ 2020 ANNUAL MEETING /
COLLABORATION WITH ITE MET SECTION
October 22 | Location TBD

MET SECTION: 28TH ANNUAL MEETING
AND TECHNOLOGY EXHIBITION
October 28–29 | Location TBD

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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Go to www.ite.org to join.

Getting to Know ITE's 2021 Diversity Scholars

Because of generous contributions from Transoft Solutions, Econolite, and the ITE Industry and Consultants Council, ITE is able to award three Diversity Scholarships this year. We are excited to support these young people as they begin their undergraduate educations.



Gianluca Villegas

Transoft Solutions Diversity Scholar

School:

New York University

Major:

Civil Engineering



ITEJ: Tell us about yourself, your family, hobbies, and/or interests.

GIANLUCA VILLEGAS: My name is Gianluca Villegas, I'm 17 years old, and I'm from Houston, TX, USA. My family consists of my mom, Lucy; my dad, Pablo; and my younger brothers, Pavel and Allan. My parents are from Mexico, but they came to the United States searching for a better life for us. As a result, they left all of their family behind and came here relying on one another. My hobbies consist of playing my saxophone, video games, listening to music, gardening, learning Japanese, and running in my spare time.

ITEJ: How did you become interested in engineering?

VILLEGAS: I became interested in the field as I expanded my knowledge on different areas such as planting and global warming because of their impacts on the planet. I also had a strong admiration for mathematics and science, finding the application of hands-on learning being the most fascinating. As a result, I began to investigate ways to combat global warming. My focus came to civil engineering, focusing on the negative impact on the environment provoked by the misuse of urban and structural development. I then thought of looking more into renewable materials, such as carbon fiber, and how that could be implemented to help with civil engineering and other areas that could benefit from its superior utilization compared to nonrenewable materials.

ITEJ: What are you looking most forward to about going to college?

VILLEGAS: The most significant thing is to have an environment where I can learn more about engineering and its components and have the opportunity to build connections with other engineers, potentially finding internships that could provide me with experience in the field. I hope college also can help support my research with renewable materials and implement these resources to a city landscape such as the highly urban New York City.

ITEJ: How do you think the ITE Diversity Scholars Program will support you?

VILLEGAS: I will be going to my dream university with the financial support my family cannot provide, but I know that I can always rely on fellow scholars to help me out whenever I need support. Not only that, but working with individuals with similar backgrounds and ideals will prove beneficial and grow my knowledge of the engineering field.

ITEJ: How do you think being a part of ITE can help you?



VILLEGAS: Overall, the community of transportation engineers can help me brainstorm and focus on furthering my education and allow me not to find myself being alone whenever I need help with engineering. More importantly, transportation is also an avenue that would benefit significantly from renewable resources, and carbon fiber could be one of those ideas that could be implemented. It excites me to be selected as a scholarship recipient and get to involve myself in many different environments such as ITE to continue diversifying my interests.

ITE JOURNAL: Tell us about yourself, your family, hobbies, and/or interests.

XAVIER PHILLIPS: I am 18 years old, and the only child of Michael Phillips (Columbia, SC, USA) and Nicole Phillips (Washington, DC, USA). I graduated from McKinley Technology High School in Washington, DC, USA, with honors from the National Academy Foundation Engineering Academy.

Several extracurricular activities kept me busy throughout school, such as the National Honor Society, FIRST Robotics Competition Team, Architecture Construction, Engineering Mentor Program (ACE), Future Business Leaders of America, Art Club, Manga Club, LifeSmarts Team, YMCA Youth and Government, Video Game Club, Jazz Band (I play the alto saxophone), Archery Club, and the National Society of High School Scholars.

My Architecture, Construction, and Engineering (ACE) Mentor Program team was first runner-up in the Construction Industry Round Table (CIRT) National Design and Construction Competition for 2021 in the Manufacturing Center/Zone Challenge. The Boy Scouts of America also has kept me active, and I served in several leadership positions such as Senior Patrol Leader, earned the rank of Eagle Scout, and was inducted in the Order of the Arrow (The National Honor Society of the BSA). My Eagle Scout project consisted of leading a group of volunteers that included scouts, students, and adults in building wooden planter boxes to beautify my high school in time for the return of students for in-person learning.

I also was awarded the Citizenship Award for the Class of 2021 from McKinley Technology High School for service to the school and construction of the planter boxes during the pandemic.

In my free time, I enjoy playing video games, card games like Yu-Gi-Oh!, and reading books. I will attend North Carolina Agricultural and Technical State University in the fall as a student in the Honors Program and the College of Engineering where I will study civil engineering.

ITEJ: How did you become interested in engineering?

PHILLIPS: I first became interested in engineering from playing with Legos and other types of build blocks as a child. Participating in extracurricular activities such as First Lego League, FIRST Robotics Competition Team, and ACE Mentor Program have exposed me to different types of engineering as well as taught me problem-solving skills. Additionally, video games like Minecraft have helped me explore some of the creative aspects of design and engineering.

ITEJ: What are you looking most forward to about going to college?

PHILLIPS: I am most looking forward to all of the experiences and opportunities that going to college will provide me. I can't wait to meet new people and learn new and exciting things.

ITEJ: How do you think the ITE Diversity Scholars Program will support you?

PHILLIPS: The ITE Diversity Scholars Program will support me by allowing me to attend college and alleviate some of the financial burdens of rising tuition costs. The ITE Diversity Scholars Program will also provide me the opportunity to explore the field of transportation engineering through networking and internships.

ITEJ: How do you think being a part of ITE can help you?

PHILLIPS: I believe being a part of ITE will allow me to network with students, professional mentors, and companies. I also believe being a part of ITE will help me grow as a leader and an innovator to become a successful engineer. I hope that being a part of ITE will help me make the place where I live better by finding creative ways to improve upon engineering.



Xavier Phillips

Econolite Diversity Scholar

School:

North Carolina Agricultural and Technical State University

Major:

Civil Engineering





Aaron Sesay

ITE Consultants and Industry
Council Diversity Scholar

School:

University of Minnesota
–Twin Cities

Major:

Engineering

ITEJ: Tell us about yourself, your family, hobbies, and/or interests.

AARON SESAY: I recently graduated from Apple Valley High School in Apple Valley, MN, USA, where I prioritized my academics and graduated with honors, but I also was involved in a lot of school activities. In general, my activities fell under three categories: service, music, and STEM. My service activities included the Interact Club, National Honor Society, and Student Council. I liked these clubs because I love to volunteer and help others. I was even recognized with a National Community Service Awards Ambassador Award during my senior year for completing over 100 volunteer/service hours.

One of the reasons I'm passionate about helping others and solving real-world problems is because of my dad. My dad is the founder and CEO of a new nonprofit organization called FASE (Foundation for African Social Entrepreneurship). It emphasizes socially innovative solutions for sustainable development.

I developed a partnership with FASE and my Interact Club. One of the projects I started through this partnership was an annual school supply drive for Sierra Leone. With the first school supply drive, we collected enough school supplies for about 400 students in Sierra Leone. It feels great to make an impact, and that is one of the main reasons I want to study engineering.

Although I've gotten lots of fulfillment from the activities I've participated in, my family is more important, and they have been the foundation for my education as well as my spiritual and moral development. My family consists of my mom, dad, older brother, and younger sister. My older brother has autism, and he is mostly nonverbal and faces extreme behavioral challenges. This has brought challenges to my family, but we all love and support him, and he has helped us all be more patient and thoughtful people.

ITEJ: How did you become interested in engineering?

SESAY: I have been interested in activities related to STEM from a young age. I have always been fascinated with building things and playing with technology. Legos were my favorite type of toy growing up. I would have fun spending countless hours making Lego airplanes, cars, and houses. Spending time building these structures was exciting to me and gave me a sense of achievement.

Although I love STEM concepts in engineering, the aspect of engineering that is the most captivating to me is the opportunity to help others. My mom and dad were born in Ghana and Sierra Leone, respectively. I feel very connected to the culture of these countries and have always been interested in solving the problems in the impoverished areas of these countries such as food insecurity, polluted water, unequal access to education, and more using a STEM approach.

For example, in 9th grade I researched the 2017 mudslide in Sierra Leone for a school project. Over 1,000 people were killed and thousands were left homeless. I believe the effects could have been less drastic if there were more sustainable and innovative solutions/regulations put into



place by engineers in advance. The fact that engineers can solve huge real-world problems like this is intriguing to me.

ITEJ: What are you looking most forward to about going to college?

SESAY: I am looking forward to the amazing educational opportunities in college. I will get more exposure and go deeper into engineering studies because of the variety of hands-on activities I will be able to do in the advanced learning facilities. I am also looking forward to strengthening my responsibility and independence skills, as this will be my first time living away from my house for such a long time.

ITEJ: How do you think the ITE Diversity Scholars Program will support you?

SESAY: I am beyond grateful for the ITE Diversity Scholarship. I've always known that I want to go to college, but I haven't always been sure how I'd pay for it. The ITE diversity scholarship will allow me to further my studies without worries about my financial situation.

ITEJ: How do you think being a part of ITE can help you?

SESAY: Being a part of ITE will give me easy access to opportunities that I didn't know would be this accessible in college, such as internship and mentoring opportunities. As an incoming freshman pursuing a career in engineering, these sound like wonderful opportunities, and I am looking forward to being involved in them. [itej](#)

ITE's 2021 Diversity Scholars Program

The purpose of this program is to increase underrepresented populations' participation in the transportation profession by supporting increased diversity at the undergraduate level. This program is open to any U.S. high school student of African-American, Native American, Alaskan, Hawaiian, or Hispanic/Latino heritage with an interest in a career in transportation and seeking to study transportation engineering, planning, or in a related field at a school with an established ITE Student Chapter. Financing is provided through the ITE Legacy Fund.

ITE Will Begin Accepting 2022 Diversity Scholar Applications Soon

Visit the Diversity Scholars Program page at <https://www.ite.org/membership/diversity-scholars-program> to find out how eligible students can apply for the scholarships. Scholars will receive a total of up to \$20,000 in scholarship support (up to \$4,000 annually per student for up to five years of undergraduate enrollment).

Support the ITE Diversity Scholars Program

The program provides tuition assistance, mentoring, internship opportunities, and support through ITE Student Chapters for young people of African-American, Native American, Alaskan, Hawaiian, or Hispanic/Latino heritage with an interest in transportation.

For more information about our Diversity Scholars Program, please go to: <https://www.ite.org/membership/diversity-scholars-program>

100%
of your donation
will go to support
these young people.



Donate here: <https://bit.ly/DonateforDiversity>

Vision Zero Sandbox Design Competition Presents Innovative Solutions

Participating Teams

Student Competition

AggieVision
 Florida International University (FIU)
 Tennessee Cherries
 University of Florida
 UW-Madison
 ZeroCrash

Professional Competition

AECOM Atlanta
 Arcadis
 Fehr & Peers
 RK&K Safety
 STV, Inc.
 The Proactive Badgers
 UFTI

Earlier this year, the ITE Consultants Council sponsored the Vision Zero Sandbox Design Competition, and winners were selected after finalist presentations during the 2021 ITE Annual Meeting.

The ITE Consultants Council encouraged teams to think beyond traditional ways of assessing crash data based on historic information and move toward a more proactive approach by leveraging new near-miss data analytics and technology. Teams were challenged to demonstrate how automated conflict data being collected through innovative technologies in Bellevue, WA, USA, can be used to gain new insights into safety problems and the selection of low-cost countermeasures at six different intersections. ITE thanks Transoft Solutions and the City of Bellevue for their assistance and participation.

Submissions were judged on their creativity and innovation in working with conflict data, the soundness of their technical approach, and the transferability of the methodology to other jurisdictions—not just on developing specific countermeasures. The selection process was difficult, as each team presented informative and thought-provoking solutions. Summaries of the winning presentations follow, and accompanying graphics are provided courtesy of respective teams. To read the final papers or watch the video presentations, please go to: <https://bit.ly/3xJCoUI>.

Student Competition Winner

Texas A&M

Team Members: Xiaoyu “Sky” Guo (S), Sruthi Ashraf (S), Zihao Li, Chaolun Ma, Xiao Xiao (S), Cheng Zhang (M)

Key information from the winning submission

A newly proposed approach was utilized, based on conflict-level data and intersection-level data to conventional approaches. The effectiveness of proposed solutions based on both approaches was evaluated, as well as the constructability and transferability of countermeasure selections.

VISSIM was utilized to create a simulated intersection to better analyze information.

This project successfully introduced and presented the new approach pertaining to the first three steps of safety management process: Network Screening, Diagnosis, and Countermeasure Selection. This new approach provides safety improvement and traffic improvement based on several indicators that have good transferability and adaptability for new sites.

What the judges said

I liked how this proposal described the conventional approach and their new proactive approach. This made it easier to understand the strengths of their proposed new approach.



Example of Conflict in Simulation, using VISSIM software.

Professional Competition Winner

The Proactive Badgers from Traffic Analysis and Design Inc. (TADI), Wisconsin DOT, and the City of Janesville, WI, USA

Team Members: John Campbell, IV, P.E., RSP2I (M) (TADI); Christian Stemke, P.E., RSPI (TADI); Kevin Scopoline, P.E. (Wisconsin Department of Transportation); Ahnaray Bizjak, P.E. (M) (City of Janesville)

Key information from the winning submission

The group introduced the Multimodal Intersection Severity Score (MiSS) method, which is a point scoring system that summarizes observed near-miss events. The goal of this technique is to put safety first by estimating crashes that have not yet occurred and finding targeted solutions.

Grant or federal aid money, if it became available on a widespread basis for this type of work, would make collecting and analyzing near-miss data substantially more feasible for many jurisdictions.

Pedestrian and bicyclists can specifically be accounted for in the MiSS method, and the crash type categories presented enabled targeted solutions. Given the transferability of MiSS to virtually any intersection with near-miss data, MiSS can identify cost-effective improvement options at top-ranking intersections, but also for targeted solutions for specific crash types at lower-ranking intersections.

What the judges said

The approach could be used for both screening/prioritization, analysis of potential crash types, and cost-benefit calculations, so it was very versatile.

Student Competition Honorable Mention

University of Wisconsin-Madison

Team Members: Erynn Schroeder (S), Hesham Alyamani, Kentin Brummett (S), Ian Hargrove (S)

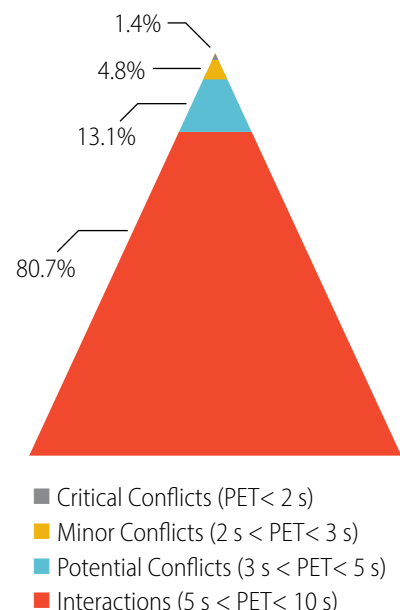
Key information from the submission

Proposed a methodology that focused on a process to select low-cost countermeasures and evaluate the effectiveness of countermeasures after implementation using Extreme Value Theory (EVT).

The approach integrated traditional and alternative data keeping so application could be transferable and adaptable to other communities. Data analysis facilitated the process to identify safety targets and evaluate potential safety improvements by type of collision, crash severity, location, and users involved. CMFs and cost of implementation for several proven low-cost countermeasures in the literature were considered.

What the judges said

Innovative approach using Extreme Value Theory to assess the effectiveness of countermeasures after implementation.



Selection Conflict Types	Sketch	Possible Crash Types	Road Users and Movements
Car-Car-Thru-Left		Approach Turn	Through car vs. left-turn car
Car-Car-Thru-Thru		Right Angle (T-bone)	Through car vs. through car
Car-Peds-Right-Cross		Pedestrian	Right-turn car vs. crossing peds (same or the other leg)
Car-Peds-Thru-Cross		Pedestrian	Through car vs. crossing peds
Car-Peds-Left-Cross		Pedestrian	Left-turn car vs. crossing peds (same or the other leg)
Car-Bicycle-Left-Thru		Bicycle	Left-turn car vs. through bicycle

UFTI's List of Common Conflict Types

Professional Competition Honorable Mention

University of Florida Transportation Institute (UFTI)

Team Members: Sivaramakrishnan Srinivasan (M), Karla Cristina Rodrigues Silva (M), Gustavo Riente de Andrade (M), Rui Guo

Key information from the submission

Utilized a four-step approach to identify and evaluate low-cost countermeasures using traditional and new data. Step 1: Serious Conflict Identification; Step 2: Screening & Prioritization of Intersections; Step 3: Analysis of Conflict Types; and Step 4: Countermeasures & Evaluations.

Emphasis was placed on engineering solutions involving changes to signal phasing and timing. The evaluation of the tradeoff between safety and operational performance measures was performed using the HCS software developed by the University of Florida Transportation Institute McTrans Center, which incorporated a novel model for crash prediction in addition to implementing the HCM methods for capacity determination.

What the judges said

Thoughtfully documented literature review; relevant research including Bellevue reports.



Behind the Scenes

Amir Rizavi, P.E., ENV, SP (F), Chair of the Consultants Council and the judging panel for the Vision Zero Sandbox Design Competition, shares insight on the value of the competition to ITE and the transportation industry.

ITE Journal: How did ITE determine the topic of Vision Zero for this year's design competition?

RIZAVI: The success of the 2020 Micromobility Sandbox Design Competition was a tough act to follow, and we needed a topic that would be relevant, impactful, and timely. A few of us had exchanged thoughts on potential topics like effective curbside management, unique data collection techniques, shared parking, use of technology in transportation, and safety. We had barely started this conversation when a parallel conversation with the City of Bellevue, WA, USA ensued where the city had recently utilized innovative near-miss technology to perform safety studies and graciously agreed to share the data with ITE.

This brought together the elements of safety and innovative technology, and commemorated the United Nations General Assembly's proclamation of 2021-2030 as the Decade of Action for Road Safety. We felt that Vision Zero was the thread that tied all these aspects together, and it felt appropriate to have it as the theme of our design competition in 2021.

ITEJ: Can you explain the process involved in developing the competition parameters and criteria?

RIZAVI: Once we had identified the topic as Vision Zero, our immediate next step was to develop the competition parameters and criteria along with subject matter experts. For this, we collaborated with ITE's Safety Council and worked with three safety experts—**Cynthia Redinger, P.E., RSP1, PTOE (M)** (City of Ann Arbor, MI, USA), **Eric Tang, P.E., RSP2B (M)**

(VHB), and **Nithin Agarwal, RSP1 (M)** (University of Florida) to review and understand the data provided by the City of Bellevue, WA, USA, and Transoft Solutions. Based on the data review, a select number of intersections were identified for the competition. Once this was complete, the competition parameters and the scoring criteria were established. Transoft Solutions then prepared a video explaining the data provided. All of this was uploaded to ITE's website for use in the competition.

ITEJ: What was the process of selecting judges?

RIZAVI: We were looking to identify experienced leaders in the transportation industry who would bring multiple perspectives to the judging table. These individuals were knowledgeable either in the field of safety, or in implementing aspects of safety, or in developing/ implementing technology. We were successful in bringing together an outstanding mix of individuals representing the public and private sectors, non-profit and research institutions, and ITE leaders. We were fortunate that we were able to find such a terrific group of individuals, which speaks to the depth of knowledge and diversity available within ITE.

ITEJ: What innovative ideas did the judging committee see from participants?

RIZAVI: The submissions were impressive across the board, and it is difficult to list them all. One idea that jumps out was the application of applied machine learning (XG Boost) with machine vision to automate the munching of data toward performance metrics that could be utilized for safety and conflict analysis. This elevates the potential to make the vast array of video available for more detailed safety analysis.

Pairing tools like this with other visualization tools (such as Microsoft Power BI) has the potential to provide outcome-oriented solutions to complex analyses, sort of like what smartphones have done to telephones in communication.

ITEJ: Why is this competition so important to the Consultants Council?

RIZAVI: In 2020, the Consultants Council, along with the Industry and Public Agency Councils, sponsored the Micromobility Sandbox Design Competition as part of the Annual Meeting. We felt this event saw a terrific response with great ideas, and it was important for us and ITE to continue an event like this. After discussions with ITE, we felt the Consultants Council could take ownership and sponsorship of the Sandbox Design Competition moving forward.

We worked with ITE leadership to identify the topic for 2021 on Vision Zero, collaborated with the Safety Council to get subject matter experts and with public and private entities to obtain the data required to get the competition afoot. We were involved with judging the competition and rewarding the winners with the registration costs for the Annual Meeting along with some well-deserved recognition. The Consultants Council feels that encouraging and promoting activities such as these is extremely important to our industry, and it aligns well with our guiding principle of communicating and sharing ideas and trends with our membership. **itej**

Judges

Amir Rizavi, P.E., ENV, SP (F)

Chair of the Consultants Council, VHB

Hardik Shah, P.E., PTOE (M)

Vice Chair of the Consultants Council, Structurepoint

Robert Wunderlich, P.E. (F)

Texas A&M Transportation Institute

Darcy Akers, P.E. (M)

City of Bellevue, WA, USA

Noah Budnick

Together for Safer Roads

Franz Lowenherz

City of Bellevue, WA, USA

Randy McCourt, P.E., PTOE (F)

Immediate Past President of ITE

A Strong ITE Connection



Although there is a vast distance between Washington, DC, USA, and Australia/New Zealand, the ITE-ANZ Section stays involved in several different areas to remain well-connected to the ITE broader community.

The main avenue for the Section to keep in touch with ITE North America is through the ITE e-Community, which allows ITE-ANZ to stay abreast of global issues and collaborate with other members. Additionally, ITE-ANZ board members keep in contact with ITE headquarters through work on various committees. President **Sarah Zhang (M)** sits on the OneITE Committee; **Kate McDonald (M)** sits on the D&I Committee; **Matt Bennett (M)** sits on the Younger Member Committee; and **David Mitchell (M)** sits on the Traffic Engineering Council. The Section also receives monthly updates on International Board of Direction activities through its Global District Director, **Daniel Przychodzki (M)**.

Prior to COVID-19, ITE Annual Meetings presented a great opportunity for the Section's members to meet with other members from around the globe, and two young members were slated to attend the Annual Meeting in Portland in 2020, but those plans were put on hold. Prior to the pandemic, ITE-ANZ member **Andy O'Brien, P.E. (H)** attended a number of Annual Meetings, and from time to time other members also enjoyed the opportunity to attend and meet with other members. A special program called "Worldwide Learning Opportunities," sponsored by Austraffic, helped fund travel for successful applicants, and the Section hopes that program can pick up again for 2022.

The Section's quarterly newsletter keeps members abreast of all ITE activities, as well as a news report from New Zealand and the main Australian states. *ITE Journal's* "Where in the World" photo quiz has been adopted for the newsletter, and is popular with members.

Several key initiatives keep the ITE-ANZ Section at the forefront of issues impacting industry today. For instance, in 2015, ITE-ANZ ran a forum on gender in the profession, and that broadened to diversity and inclusion in more recent years, including a commitment to Women in Engineering Day. An additional diversity and inclusion effort the Section honors is Australian National Reconciliation Week. According to the Reconciliation Australia website, National Reconciliation Week, "is a time for all Australians to learn about our shared histories, cultures, and achievements, and to explore how each of us can contribute to achieving reconciliation in Australia." In 2020, the Section ran an informative webinar on Inclusive and Equitable Transport.

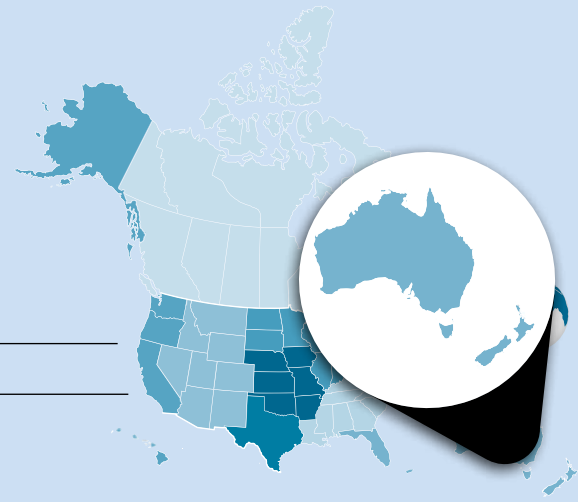
Plans are currently underway to hold a webinar on how indigenous issues affect the transport sector, but it has been difficult for the Section to find speakers on the topic. One

specific area of interest (which is now subject to a legal case) is a controversial dispute between the state road agency and indigenous communities where sacred trees were removed for a road duplication project.

Advocacy also is a focus for ITE-ANZ and its board. The Section recognizes that other professional organizations can be reluctant to take part in advocacy efforts, as some of the agencies addressed are corporate members of those same professional organizations. However, ITE-ANZ considers itself independent, and lobbies for reforms that concern its members. In some cases,



Board members at the ITE ANZ 2021 Annual General Meeting.



ITE Australia New Zealand

Global District

Members

330

Email Subscribers: 1,500+

LinkedIn Followers: 760+

Board Executives

President – **Sarah Zhang (M)**

Co-Vice Presidents – **Matthew Bennett (M), Danielle Rebbechi (M)**

Secretary – **David Nash (F)**

Treasurer – **Eric Ye (M)**

Immediate Past President – **Nick Szwed (M)**

Global District Director, Panel Chair – Contribution to Profession Award – **Daniel Przychodzki (M)**

Additional Board Members

Assistant Secretary: **Daniel Gaschk (M)**; Panel Chair – Sustainability Award: **David Mitchell (M)**;

Lead – Diversity & Inclusion: **Kate McDonald**; Newsletter Editor: **Marianne Richards (M)**; Panel Chair

– Emerging Professional Award: **Matt Harridge (M)**; Panel Chair – Postgraduate and Student Awards:

Richard Tay (M); Lead – Strategic Planning: **Ruw Palapathwala (S)**; **Angela Mejia-Hernandez (S)**;

Ashim Debnath (M); **Ben Thomson (M)**; **Jey Parthiban (S)**; **John Smelt (R)**; **Ken Hall (M)**; **Kenn**

Beer (M); **Lindsay Oxlad (M)**; **Michael Plant (M)**; **Sara Moridpour (M)**

The YITE Annual General Meeting was held on June 30, 2021, where the following committee was elected:

YITE Committee Executives

President – **Matthew Bennett (M)**

Vice President – **Nikhil Maharaj (S)**

Secretary – **Joshua Jang (S)**

Treasurer – **Abbass Kak (S)**

Other YITE Committee Members

Media and Communications – **Cassandra Min**

(M); Student Chapter Support – **Yvonne Chen (S)**;

Partnerships – **Hesara Weliwitiya (S)**; **Cristian**

Infante (S); **Danielle Rebecchi (M)**

Notable Members

The Section boasts three Honorary ITE members: **Ted Barton, P.E. (H)**, **Andrew O'Brien (H)**, and **Peter McCombs, HonMITE, DistFEngNZ (H)**. All three have made incredible contributions to the traffic/transport engineering profession during the course of their their careers. Ted was the ITE-ANZ President from 1982–1985, and Andrew held this role in 1987–1988. Peter served as Global District Director for two terms, contributed to a number of ITE Councils and Committees, and helped make the Global District what it is today.

Awards

The Section presents six awards each year, with some awards named after the sponsoring company.

- Austraffic Worldwide Learning Opportunities Award
- Contribution to the Transport Profession Award
- Outstanding Service to the ITE Award
- Sustainable Transport Award
- Emerging Professional Award
- SIDRA SOLUTIONS Postgraduate Award
- Trafficworks Student Award

Awards also are given to past presidents, and occasionally a President's Excellence Award is given.

This year, YITE created a Road to Recovery award to a young professional or student who demonstrated a contribution to the recovery from the COVID-19 pandemic.



Nick Szwed (Immediate Past President); Daniel Gaschk (Emerging Professional Award winner); and Emmanuel Natalizio (Trafficworks sponsor) at the 2020 President's Dinner.

however, individual members cannot lobby their own political matters for reforms that are needed.

One of the advocacy stances the Section has taken impacts CO2 vehicle emission standards. Australia is one of the few countries that has not adopted standards, and therefore the automotive industry is reluctant to sell low-emission in vehicles in Australia. That makes for a much slower adoption of electric and hybrid vehicles in the country.

The Motor Vehicle Safety Act presents another important advocacy push for the Section, and submissions have been contributed for its review to include better bicycle facilities on one of the large freeway projects in Melbourne. Submissions regarding access to crash records, window tinting, how to work toward the “uncrashable” car, and an Austroads report on transport modeling capabilities also have been made by the Section.

As these various issues are addressed, the Section knows the importance of education and mentorship to hand the leadership baton to its next wave of members.

ite section profile

Two student chapters—Monash University (Melbourne, Australia) and University of Canterbury (Christchurch, New Zealand)—are very active. Students at University of Melbourne and Deakin University also have expressed interest in creating a formal chapter, but until the COVID-19 crisis is over, those discussions cannot be solidified.

Both chapters organize seminars for their membership, typically presentations about careers in the transportation field or about technical issues. The Monash University Chapter runs a formal mentoring program, and ITE-ANZ supports this endeavor by encouraging professionals to become mentors. A current board member is part of that organizing committee, but students are the primary drivers.

The Section's Young Members of ITE Committee (YITE) is very active. YITE has been very successful at forming a network of young members from a range of employers in the public sector, private sector, and academia. Most are in the workforce, but some are doing postgraduate studies at the universities.

YITE aims to build and foster a community of young professionals in the transport industry through providing technical and professional development events as well as social and networking events. The YITE Committee meets once a month and is responsible for organizing and hosting events targeted at young professionals and students interested in the transport sector. Committee members also contribute to the wider ITE-ANZ community through helping organize and host ITE-ANZ events.

One of the larger events that YITE has hosted in the past year has been a student design competition. Teams of students were presented with a section of road that has many conflicting priorities and were asked to design a solution to improve the street. The designs were then sent to the local government agency that is responsible for the road for judging. [itej](#)



Members of the Young ITE Committee.



Members of the Monash University Student Chapter.



Future-Thinking Education and Insight

Highlight ITE 2021 Annual Conference

Another year of collaboration and virtual communication made for a successful ITE 2021 Annual Meeting (#ITE2021) from July 20–29. Although continued COVID-19 and international travel concerns prevented the meeting from being held in Portland, OR, USA, as hoped, there were many highlights and learning opportunities for members to follow the conference theme and “Navigate a New Future.”

Day one kicked off with a State of the Institute report from ITE Executive Director and CEO **Jeff Paniati, P.E. (F)** where he talked about challenges of the past year and a half. He discussed lessons learned from the pandemic, including the necessary but impersonal nature of video meetings, as well as relying on families, mentors, ITE, and others to keep things moving in a positive direction.

“Success is not possible without support,” Paniati said.

Paniati also noted that many accomplishments resulted from the pandemic. He said initially the ITE team was concerned about finances, staff wellness, the best way to serve members, and how to adjust to a world without in-person events. How would the organization use new tools and learn new approaches to help members through a difficult period?



Resources

Attendees can access ITE Annual Meeting sessions until October 17 through the ITE Annual Meeting page on the ITE Learning Hub: www.pathlms.com/ite/courses/32872.

To register for the event and view online now, please go to: www.ite.org/events-meetings/ite2021-registration-page

*Beverly Kuhn, Ph.D., P.E. (F), Division Head and Regents Fellow at Texas A&M Transportation Institute (TTI) in College Station, Texas, USA and ITE Vice President 2021 moderated a discussion on trends, forecasts, and perspectives about post-COVID-19 society through a transportation lens. Panelists included **Steven E. Polzin (M)**, Transportation Consultant; **Freddie Fuller**, Vice President, Jacobs; **Dr. Jeff Michael**, Distinguished Scholar, Johns Hopkins Bloomberg School of Public Health; and **Noreen McDonald**, Department Chair, City and Regional Planning, University of North Carolina.*

“For 2020, we not only survived the COVID-19 experience, but we thrived during this period,” Paniati said. “It forced us to get out of our comfort zone a little bit.” He mentioned new benefits ITE shared with members, such as virtual drop-ins that provide members a chance to engage and learn from each other, and more online education opportunities that provide flexibility to busy members.

One of the Annual Meeting highlights was the opening keynote, with ITE President **Alyssa Rodriguez, P.E., PTOE (F)** interviewing U.S. Secretary of Transportation Pete Buttigieg. He spoke about the Biden Administration’s proposal for the American Jobs Plan, ongoing efforts to advance reauthorization of the surface transportation program, and the Administration’s vision for the nation’s transportation system. He broke that vision into five key areas:

- **Safety.** Buttigieg said safety is “the Department’s reason for existing.”
- **Equity.** “I think sometimes equity has been a little bit beneath the surface of transportation policy discussions, but it is always there and deserves to be surfaced now because so much is at stake,” he said.
- **Climate.** “The fact that transportation represents the single biggest sector in our economy emitting greenhouse gases means we have the potential to be the biggest part of the solution if we have the right policies,” he said.
- **Economics.** Buttigieg added that the country’s “economic strength depends on transportation policy in the work we are going to do.”



ITE President Alyssa Rodriguez, P.E., PTOE (F) interviews U.S. Secretary of Transportation Pete Buttigieg, who spoke about the Biden administration’s vision for the nation’s transportation system.



John Hansen (R), Subject Matter Expert – Transportation, Olsson; Jaime Sullivan, P.E., Director, National Center for Rural Road Safety; and Steve Latoski, P.E., PTOE (M), Public Works Director, Mohave County, AZ, USA, discussed emerging issues in rural intelligent transportation systems.

- **The Future.** He said that some of the historic modes of transportation such as walking are being thought of in new ways, adding, “I think we will look back at the 2020s as one of the most transformative chapters in the life of U.S. transportation with all of the technologies that are coming our way.”

Another highlight to opening day was formal announcement of esteemed award winners. **Allen Swanson, P.Eng. (H)**, was awarded the Theodore M. Matson Memorial Award, and **Peter J. Yauch, P.E., RSP2I, PTOE (F)** accepted the Burton W. Marsh Distinguished Service Award. Both men appeared with their awards and thanked the ITE community and others for making an impact on their storied careers. Please see pages 34 and 37, respectively, to read more about those award winners.

During an ITE Town Hall, President **Alyssa Rodriguez, P.E., PTOE (F)**, Vice President **Beverly Kuhn, Ph.D., P.E. (F)**, Past President **Randy McCourt, P.E., PTOE (F)**, and Executive Director and CEO **Jeff Paniati, P.E. (F)** discussed the importance of equity in transportation.

ITE previously held Equity in Transportation Listening Sessions, and of the 350 participants in the sessions, 92 percent felt equity in transportation should be a priority for ITE.

“We’re not here to lay blame and rehash the past, but what can we do to fix the problems that we recognize?” Kuhn said. “We know what we need to do. There is a lot of intellectual capital around our organization and our communities, and we need to work together.”

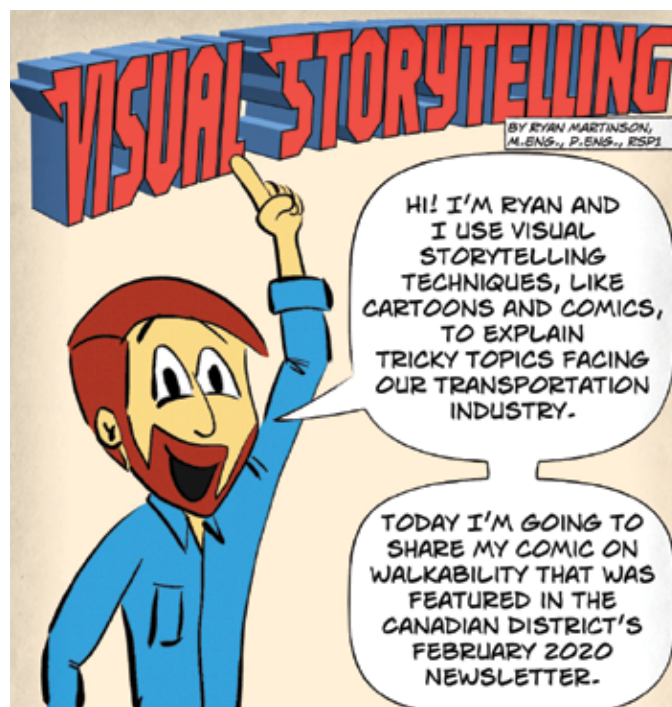
The Traffic Bowl Watch Party on the evening of Day 2 was a well-attended and fun event. The Oregon State University ITE Student Chapter won the 2021 tournament and will have their name added to the Voigt/Davis Cup, the trophy for the Traffic Bowl Grand Championship.

Throughout the remainder of the Annual Meeting, attendees had several concurrent technical session opportunities, including presentations on everything from “Signs and Markings: Innovations That Work” to “Big Data and Cloud-Based Solutions for Improved TMSO.”

Social events provided an opportunity for attendees to meet virtually and wind down after a long day of education. Sections enjoyed social events that included games and costumes, and the ITE Younger Member Committee hosted a speed mentoring social.



A session on 2021 proposed revisions to the Manual on Uniform Traffic Control Devices (MUTCD) provided attendees insight on the need for a new approach to its scope, content, and structure. **Randy McCourt, P.E., PTOE (F)** moderated an insightful presentation with **Gene Hawkins, P.E., Ph.D. (F)**, Professor, Texas A&M University, College Station, TX, USA; **Steve Jewell, P.E., PTOE (F)**, Consultant, New Albany, OH, USA; **Jeff Lindley, P.E. (F)**, Deputy Executive Director/Chief Technical Officer, ITE; and **Dongho Chang, P.E., PTOE (F)**, City Traffic Engineer, City of Seattle, WA, USA.



Poster presentations were a popular feature of the Annual Meeting, with an array of great ideas and forward-thinking visual representations of the transportation industry. **Ryan Martinson, M.Eng., P.Eng., RSP1 (M)** presented his engaging visual storytelling cartoons.

The Annual Meeting closed with a TED Talk-like presentation with Toks Omishakin, Director of the California Department of Transportation. He discussed his role in leading a public agency into the future in today’s world.

More than 1,400 attendees participated in this year’s Annual Meeting, followed by Council and Committee meetings from August 3–5. Those meetings help guide ITE and the future of the transportation industry. We are incredibly grateful for everyone who participated, and for the investment sponsors made to bring everything to life.

We look forward to another great year of camaraderie and education in New Orleans for #ITENOLA2022. [itej](https://www.ite.org)

See You in
New Orleans!

2022 ITE Annual
Meeting and Exhibition
July 31–August 1





2021 ITE Excellence in Transportation Awards

Some of the industry's best educators, students, young leaders, and practitioners were honored during the virtual ITE 2021 Annual Meeting for their contributions to the transportation industry and the communities they serve. The virtual environment led to great interaction and presentations that gave attendees great insight into the processes taken by many of these talented award winners.



Theodore M. Matson Memorial Award



Theodore M. Matson contributed greatly to the traveling public through the advancement of traffic engineering and the training of professionals. Mr. Matson was the Director of the Bureau of Highway Traffic at Yale University and also was the Vice President of ITE at the time of his death in December 1954. Mr. Matson was one of ITE's founders. The Theodore M. Matson Memorial Award honors outstanding contributions in the field of traffic engineering, including practical application of traffic engineering techniques or principles, valuable contributions through research, successful adaptation of research findings to a practical traffic situation, and the advancement of the profession through training or administration. The award has been given annually since 1957.

H. Allen Swanson, P. Eng. (H)

President

Swanson Transportation Consultants

H. Allen Swanson, P.Eng. (H), lives in Calgary, Alberta, Canada. He served as ITE International President in 1988, and is an Honorary Member of ITE as well as a recipient of the Burton W. Marsh Award in 2007. Allen was a member of the Board of the Calgary Parking Authority for 26 years. He was instrumental in the creation of the ITE Parking Council. He was also the founding Vice President of the Canadian Parking Association. He has bachelor of science degrees in forestry and civil engineering and a master's degree in civil engineering.

Some of Allen's other awards and interesting projects are:

- The first recipient of the ITE Canadian District H. Robert Burton Award in 1993.
- Recipient of the Ted Seeberg Award in 2005 by the Canadian Parking Association for his outstanding service to the parking industry in Canada.
- Responsible for rewriting the traffic signals section of the Canadian MUTCD.
- Co-developer of the Canadian warrant for traffic signalization based on the Cumulative Factors Equation.
- Principal researcher for a research assignment from the U.S. Federal Highway Administration on symbol sign design for older drivers.

[SEE AWARD PAPER ON PAGE 34](#)

Burton W. Marsh Award for Distinguished Service to the Institute of Transportation Engineers



The Burton W. Marsh Distinguished Service Award recognizes an individual who has contributed to the advancement of the Institute of Transportation over a period of years in an outstanding fashion. Burton W. Marsh was "Mr. ITE." He was a Founder, Past President, and former Executive Secretary of ITE. He was a pioneer in urban traffic engineering and recognized early on the importance of traffic safety programs that incorporated the driver, the vehicle, and the roadway elements.

Peter J. Yauch, P.E., PTOE, RSP21 (F)

Associate Vice President and TSM&O Practice Leader

Iteris, Inc.

Peter J. (Pete) Yauch, P.E., PTOE, RSP21 (F) works in the Tampa, FL, USA office of Iteris, Inc., and he is a native of St. Petersburg, FL, USA. He and his family returned to the Tampa Bay area in 1988 after spending 15 years in the Atlanta area. Pete joined ITE as a student member at the Georgia Institute of Technology in 1975, and he served as the Student Chapter President in 1977. He has twice served as President of the Florida Puerto Rico District; represented the District as a member of the International Board of Direction; and is currently in his fifth year as the District Administrator. Prior to joining Iteris' predecessor firm, Albeck Gerken, Inc., in 2012, he was the Director of Public Works and Transportation and Assistant County Administrator for Pinellas County, FL, USA. Prior to that, he worked in both the public and private sectors, including serving as the City Traffic Engineer for the City of Clearwater, FL, USA, and the District Signal Systems and Safety Engineer for the Tampa Bay Area District of the Florida Department of Transportation.

Previous awards include the John R. Freeman FLPRITE District Transportation Professional of the Year (2001), Nathan H. "Nat" Rambo FLPRITE District Fellowship Award (2012), and Sherwood H. "Woody" Hiller FLPRITE District Distinguished Service Award (2013).

[SEE AWARD PAPER ON PAGE 37](#)

Wilbur S. Smith Distinguished Transportation Educator Award



Dr. David Hurwitz (F)
Professor, Oregon State University

Young Member of the Year Award



**Yung Koprowski, P.E., PTOE,
RSP1, M.ASCE (M)**
Principal, Y2K Engineering, LLC

LeadershipITE Class of 2021

The 2021 *LeadershipITE* class ended its program with a virtual graduation and group Shark Tank project presentations. Because the program was virtual again this year, employers, the ITE Board of Direction, Coordinating Council Leadership, and *LeadershipITE* alumni were invited to attend.

David K. Addison, P.E. (M)
Harpreet Bedi, P.E., PTOE, PTP (M)
Rachel Bolton, P.E., PTOE (M)
Robert E. Brydia (M)
John R. Campbell IV, P.E., RSP21 (M)
Ethan Coxsey (M)
Tanya M. Davis, P.Eng., PTOE (M)
Christina L. Doughney, P.E., PTOE (M)
Ryan T. Eckenrode, P.E., PTOE, RSP1 (M)
Justin R. Effinger, P.E. (M)
Derrick J. Estell, E.I.T. (M)
Terrance Q. Hill, P.E. (M)
Lili Liang, P.E., PTOE, PTP (M)
Alexandra Lopez, P.E., PTOE (M)
Shruti Malik (M)
Anthony D. Mariani, P.E., PTOE, RSP1 (M)
Erica E. Myers, P.E., PTOE (M)
Erik A. Nevland, E.I.T. (M)
Benjamin Palevsky (M)
Michael L. Paylor, P.E., PTOE (M)
Karyn Robles (M)
Natalie J. Sager, P.E. (M)
Joshua D. Smith, P.E., PTOE (M)
Jonathon Staats, P.E. (M)
Anamaria Torres, P.E., PTOE (M)
Govind Vadakpat, Ph.D., P.E., PTOE (M)
Joyce Louis Yassin, P.E., PTOE (M)
Seth M. Zubatkin, P.E. (M)

ITE'S 2021 District Rising Stars

Northeastern — **Farukh Ijaz (M)**
Mid-Colonial — **Adam Greenstein, P.E., PTOE (M)**
Great Lakes — **Tyler Krage, P.E., PTOE (M)**
Southern — **Kate Shearin, P.E., PTOE (M)**
Western — **Daniel Lai, P.E. (M)**
Mountain — **Victoria Edington (M)**
Canadian — **Frederico Puscar, M.ASc, P.Eng., PTOE (M)**
Texas — **Lasaro Picasso, P.E. (M)**
Florida-PR — **Jodi Godfrey (M)**
Missouri Valley — **Kelly Schaefer, P.E., PTOE (M)**

HSIS Research Paper Competition

**Henrick J. Haule (S), MD Sultan Ali,
and Angela E. Kitali, Ph.D. (S)**

For the paper "Factors Influencing the Severity of Crashes Near Exit Ramps in North Carolina" (Please see page 41).





Complete Streets



The City of Nanaimo and ISL Engineering & Land Services

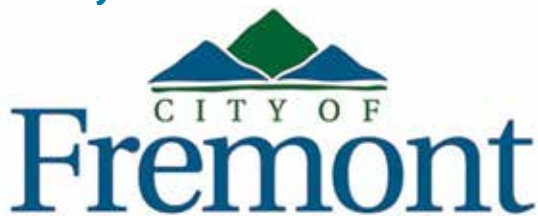
“Raised Local Intersections: The City of Nanaimo’s New Engineering Standard”

Transportation Systems Management & Operations (TSMO)



Florida Turnpike Enterprise
SunTrax Facility

Safety



City of Fremont, CA, USA
Fremont Vision Zero Program

Planning



Hillsborough Metropolitan Organization
Speed Management Action Plan

Traffic Engineering



City of Prior Lake
CSAH 21 Downtown Prior Lake Improvement Project



community.ite.org



ITE Headquarters



@ITEHQ



Institute of Transportation Engineers

DISTRICT AWARDS

District Innovation Award



Western District of ITE

Outstanding Section/Chapter Award



A collage of activities from the Section.

Metropolitan Section of New York & New Jersey

Section/Chapter Momentum Award



National Capital Section of CITE

Student Chapter Award



Oregon State University ITE Student Chapter

The ITE Excellence in Transportation Awards program honors outstanding achievements in transportation and distinguished service to ITE.



Student Chapter Momentum Award



University of California, Los Angeles, ITE Student Chapter

Daniel B. Fambro Student Paper Award



Mingjian Wu (S) (University of Alberta)
“A Citywide Location-Allocation Framework for Driver Feedback Signs Optimizing Safety and Coverage of Vulnerable Road Users”

COUNCIL AWARDS

Coordinating Council Outstanding Volunteer Award



Chuck Huffine (TEC), P.E., AICP, PTOE (F)

Consultants Council Distinguished Consultant Award



Dr. Kenneth Ackeret, P.E., PTOE (F)

Coordinating Council Best Project Award

2021 ITE Technical Conference—Innovative Intersections and Streets



Complete Streets Council—
Alex Rixey, AICP, RSP1, Chair (M)



Safety Council—Meghan
Mitman, AICP, RSP1, Chair (M)



Planning Council—Aaron
Zimmerman, PTP, Chair (M)



Traffic Engineering Council—
Gordon Meth, P.E., PP,
PTP, PTOE, RSP2I, Chair (F)

COUNCIL AWARDS

Traffic Engineering Council Troy A. Peoples Awards



Kevin Lacy, P.E. (M) (right) with Chris Peoples.

Kevin Lacy, P.E. (M)
North Carolina (USA) Department of Transportation

Public Agency Council Achievement Award



The City of Calgary
Mobility Trends During COVID-19

Transportation Systems Management & Operations Council Individual Award



Robert Rausch, P.E. (M)

Transportation Systems Management & Operations Council Organization Award



CITY OF
MADISON

City of Madison Local TSMO Program



Safety Council Edmund R. Ricker Award–Individual



Karen Dixon, P.E., RSP1 (M)
Senior Research Engineer, TTI

Pedestrian and Bicycle Standing Committee John LaPlante Award



Jesse Skulmoski

**British Columbia Active
Transportation Design Guide**

Safety Council Edmund R. Ricker Award–Organization



The Transoft Bellevue Team

Transoft Solutions Inc: Video-based Network-wide Conflict and Speed Analysis to Support Vision Zero in Bellevue, WA

Transportation Education Council Innovation in Education Award



University of Washington Online Master of Supply Chain Transportation & Logistics

Anne Goodchild **itej**



The Beat Goes On

BY ALLEN SWANSON, P.ENG. (H)

When I received the phone call from ITE Executive Director Jeffrey Paniati, P.E. (F) advising me that I was recipient of the 2021 Matson Memorial Award, I was speechless. I have been honored to receive other major ITE awards, but I was certainly not expecting to receive this award. I am humbled, and I want to thank the six organizations and their representatives who voted for me, believing that I was deserving of this award.

Life is interesting, and during this journey, one experiences many twists and turns as if subjected to gale-force winds. Upon completion of high school, I had set my course on a career in forestry. My first bachelor's degree is in forestry, but someone had other plans for me. Certainly, my wife Valerie was not looking forward to living in the middle of a forest. My career in forestry came to a swift closure, and I then set a course to achieve a degree in civil engineering.

When we returned to Seattle, WA, USA, so I could complete my studies in civil engineering at the University of Washington, I searched for summer employment and found a trainee position with the City of Seattle, Traffic Engineering Division. Growing up in a rural area in Washington, I had never even heard of traffic engineers—what breed of cat were they? It was interesting that the traffic engineer at the time also had a degree in forestry. Maybe he saw in me an opportunity to create another traffic engineer who could see that there were more aspects to a forest than just trees.

That moment of serendipity, when I got full-time summer work and part-time work during the scholastic year, turned out to be the “bright star” that I have followed in my life. It was at the University of Washington where I was introduced to Theodore Matson through purchasing the textbook “Traffic Engineering” written by Matson, Smith and Hurd. One of my early university mentors was Professor Roy Sawhill, with whom I studied undergraduate and graduate courses in transportation engineering. It was Professor Sawhill who encouraged me to become a student member of ITE and get involved with the local student chapter.

The year 1966 brought a major change in our lives. Coincidentally, it was the year that Sonny and Cher recorded their hit song, “The Beat Goes On.” Following a brief career as a Junior Traffic Engineer with the City of Seattle, my wife and I moved to Calgary, Canada (her home city) where I started a 10-year career in transportation planning and traffic engineering with the City of Calgary

Engineering Department (and subsequently the Transportation Department). It was in the early 1970s that I began to research and write technical articles including the development of an on-street sign inventory procedure, control of motor vehicle noise in urban areas, and recognition and comprehension of traffic sign symbols.

It was also during this period that I served as host to ITE International President Ross Shoaf when he stopped in Calgary to visit with local ITE members as part of his 1972 Grass Roots Tour. His demonstration of commitment to the Institute impressed me and likely served as an example for my future years of involvement in ITE. I was a member of the ITE committee that published a report in 1975 on “Airport User Traffic Characteristics for Ground Transportation Planning,” which won the 1976 Technical Council Award.

And the beat goes on.

In my career in transportation engineering, one of my major interests has been in traffic signing. One of my most interesting projects occurred in 1993 when my transportation engineering consulting firm was awarded a research assignment from the U.S. Federal Highway Administration on “Symbol Sign Design for Older Drivers.” The multi-discipline team involved a group of human factors and vision specialists from Canada and the United States, a graphic designer, and a traffic engineer from Boise, ID, USA (my friend **Jim Pline, P.E. (H)**, Past ITE International President and 2004 Matson Award recipient).

The purpose of the study was to undertake a systematic research program on the traffic sign symbols in the 1988 edition of the U.S. MUTCD. The testing program included sign comprehension, daytime and nighttime legibility distances (including the influence by a peripheral glare source), glance legibility, and reaction time and conspicuity. The research program resulted in some symbol



CALGARY HERALD

Allen working at the Stampede Parade.

sign design guidelines and the creation of several new and novel traffic sign symbols. Looking back at this research project, and looking ahead to the advent of autonomous vehicles, are we approaching the age when traffic signs will become redundant, replaced by roadside devices that will communicate with the control systems of these new motor vehicles?

And the beat goes on.

Parking has also been one of my interest areas. My initial involvement was in on-street parking management during my years of employment with the City of Calgary. I also spent 26 years on the Board of Directors of the Calgary Parking Authority, including over 13 years as Chairman. This experience in parking led me to believe that ITE should have a broader involvement in parking, and I was instrumental in the formation of the ITE Parking Council and served as the first Chair of the Council. In 2005, I was awarded The Ted Seeberg Award by the Canadian Parking Association for outstanding service to the parking industry in Canada. The last technical paper I had published in the *ITE Journal* was in 2017, and the subject was criteria for the implementation of pay-parking for curbside spaces.

And the beat goes on.

Traffic signalization has been another of my areas of interest. Besides being responsible for the traffic signal system in Calgary, as a consultant I have been involved in the design of several signalized intersections in Western Canada. One interesting project was rewriting the traffic signal section of the Canadian MUTCD. I was also the co-developer of the new Canadian traffic signal warrant procedure that was based on the Cumulative Factors Equation. This project was done in conjunction with Past ITE International President **Alf Guebert, P.Eng., PTOE (F)**. Other signal-related projects that we have jointly completed were on signal control strategies for dual left-turn lanes, and a warrant procedure for the



Allen, wife Valerie, and daughter Kerensa share a happy moment.

use of pedestrian signal heads at intersections. We are currently developing a traffic signal warrant procedure for intersections near railway crossings.

And the beat goes on.

In addition to my years of involvement with ITE and the Canadian Parking Association, I spent about 30 years of service on the Canadian National Committee on Uniform Traffic Control Devices, retiring from that committee about 20 years ago. My community service in Calgary includes being a volunteer and a shareholder for the Calgary Exhibition and Stampede where I have served on the Parade Committee for over 40 years. My other interests include travel, cooking, supporting several live theatre companies, and the Calgary Philharmonic Orchestra. I have also been involved with two men's barbershop choruses for about 50 years.

It must be recognized that what I have accomplished in my professional career could not have been possible without the support and cooperation of my mentors and other work colleagues. More importantly, I must recognize the constant support from my wife Valerie, and our daughter Kerensa, another transportation engineering professional.

One might ask, what did I receive from my many years of involvement with ITE and other organizations? To answer that, I would say a network of colleagues that I can contact to discuss matters of mutual interest at any time. As a result, I have developed many lifelong friends scattered across Canada, the US, and as far away as Australia, New Zealand, and Sweden. I urge all of you to volunteer to support the activities of the Institute and your community, to make this world a better and safer place for future generations.

And the beat goes on. [itej](#)



Allen and wife Valerie get ready for the Calgary Stampede.

See full bio on page 27.



Dedication to a Worthwhile Endeavor

BY PETER J. YAUCH,
P.E., RSP2I, PTOE (F)

Last year, ITE celebrated its 90th anniversary. Over those 90 years, we have seen the transportation profession grow and evolve. At its founding, ITE was the Institute of Traffic Engineers; in the mid-1970s, a name change to the Institute of Transportation Engineers reflected some of that evolution. Most recently, we have been describing ourselves as a community of transportation professionals, noting that we include engineers, planners, educators, technologists, and researchers, all with the common goal of serving the transportation needs of our communities.

One of the founders of ITE was Burton W. Marsh. Burt Marsh was the first full-time city traffic engineer in the United States, working for the City of Pittsburgh, PA, USA, from 1924 to 1930, and then moving on to the City of Philadelphia, PA, USA, from 1930 to 1933. In 1933, he became the Director of Traffic Engineering and Safety for the American Automobile Association, a role he held for 31 years. In 1964, he became the Executive Director of the AAA Foundation for Traffic Safety, and from 1967 until his retirement in 1970, he was the Executive Director of ITE.

Burt was on the initial Board of Direction of the Institute and became the second President of the Institute in 1932. Over the years, he became known as “Mr. ITE.” At the 1970 Annual Meeting of ITE, the Burton W. Marsh Award for Distinguished Service was established in his honor, reflecting his lifetime of contributions to the profession and the Institute.

I never had the opportunity to meet Burt Marsh, but I was definitely familiar with his name, his accomplishments, and his service to the profession. And, as you look at the list of the 50 past

recipients of the Burton W. Marsh Award, every name stands out as an acknowledged leader of the Institute and the profession.

Therefore, I was surprised and truly honored when I received a call from **Jeff Paniati, P.E. (F)**, ITE's Executive Director, that I had been selected as this year's Burton W. Marsh Award recipient.

I would characterize myself as a lifelong traffic nerd. My wife recently found a drawing I made when I was 3 that showed an intersection with a diagonal span wire installation for a four-way signal; the controller cabinet is clearly visible on one of the poles. A coworker of my father begged for a stop sign from the city's sign shop for a Christmas present for me when I was 6. A schoolteacher aunt sent me a copy of the 1961 MUTCD when I was 11. My eighth-grade science project compared the visibility of the signals at a nearby intersection with the minimums shown in the MUTCD. And on and on.

When it came time for college, I was fortunate to be accepted to Georgia Tech. While there, I was even more fortunate to get to know Dr. Peter S. Parsonson, a transportation professor in the civil engineering department. Dr. P's specialty was traffic signalization. He had a large traffic signal lab and was known throughout the Southeast for his annual signal control workshops held through the continuing education department at Tech. I worked for him as a student assistant while an undergrad, and I'm sure he helped get me accepted into the master's program by convincing the powers that be that my niche was traffic, and not the other sections of civil engineering as reflected by my less-than-stellar grades in those areas.

I first joined ITE in 1975 as a student member at Tech. I still have my acceptance letter signed by Executive Director Ken Layer,

shortly before he passed away. We had a very small chapter; there were about six members, so most of the members were officers. Our treasurer had never had a checking account. But, we had fun and got a lot out of the experience.

While at Tech, I did a lot with the folks at the City of Atlanta Traffic Engineering Department, and it was assumed by all that upon graduation I would join the city to operate their recently implemented computerized traffic signal system. However, as graduation day loomed, the city entered an extended hiring freeze. Dr. P suggested I talk with Tom Stout with the local office of JHK & Associates about an opening they had. I wore my stop-sign-patterned tie to the interview, but Tom hired me anyway.

JHK at that time was at the forefront of computerized traffic signal control system design, and concurrently, the Federal Highway Administration was sponsoring several demonstration projects of the Urban Traffic Control System (UTCS) control software. We worked on the design of projects in Evansville, IN, USA; Sioux City, IA, USA; Grand Rapids, MI, USA; and Tampa, FL, USA. As a native of the Tampa Bay area, this gave me a chance to visit family, though it often seemed like the work on the northern systems always seemed to be mid-winter, and the time in Tampa was mid-summer.

While at JHK, I was fortunate to work on the development of an FHWA training course on traffic signal design with JHK himself, Jim Kell, and his co-author of ITE's *Traffic Signal Design Handbook*, Iris Fullerton. Jim and I continued further with the development and presentation of two additional courses on controller equipment.

In the late 1980s, our family moved from Atlanta back to the Tampa Bay area. I became the District Signal Systems Engineer for a



Leading a tour of the Iteris signal lab for University of South Florida ITE Student Chapter members.



Pete, wife Linda, and grandchildren Hayley and Sheldon.

newly formed district of the Florida Department of Transportation. Within a year, I also assumed the role of District Safety Engineer—my first venture into the field of traffic safety. Shortly thereafter, I was invited to a meeting with a local organization of trauma surgeons, during which they referred to one of our interstates as “Chopper Alley” for all the crashes requiring air transports. Further investigation showed that the 35-mile corridor was experiencing an average of 20 fatal crashes a year just from cross-the-median head-on crashes. Armed with that information, we were able to get a median guardrail project into the work program.

A couple of years later, Keith Crawford, City Traffic Engineer for Clearwater, FL, USA, and past member of ITE’s International Board of Direction, retired. I left FDOT to take his position, and Keith, looking for a post-retirement career, ended up taking my vacant position at FDOT. Our interaction during that time led to my becoming much more involved in ITE District 10 and the Florida Section.

As professionals, we cannot be successful working in a vacuum. Collaboration, the sharing of (and often debating) ideas and concepts, and building upon past accomplishments all lead to advancing our profession.

A year or so later, Keith forwarded me a clipping from the paper across the bay from me. The article included a photo of a semi that had run into the brand-new median guardrail on “Chopper Alley.” The headline was “Guardrail Saves First Life.” I was hooked.

In the past 25 years, I’ve had three primary engagements—leading the traffic engineering and ITS practice at a Florida-based consulting firm, TEI; then Director of Transportation for Pinellas County; and eight years ago I joined Albeck-Gerken, Inc., a Florida-based consulting firm that specialized in traffic signal

operations. Two years ago, Albeck-Gerken was acquired by Iteris, Inc., which expanded our coverage and our capabilities. All three employers were very supportive of my involvement in ITE, and for that I am most appreciative.

In 2002, I was elected to the ITE District 10 (now the Florida Puerto Rico District) Board, becoming President in 2006. In 2009, I was selected to represent District 10 on the International Board of Direction for a three-year term. I filled in as President in 2013 again when the incoming President-elect made a career change, and I became the District Administrator in 2016.

So, enough about me. The theme I want to advance is one that I’ve heard repeated multiple times over the years: “The more you put into an organization, the more you get out of it.”

As professionals, we cannot be successful working in a vacuum. Collaboration, the sharing of (and often debating) ideas and concepts, and building upon past accomplishments all lead to advancing our profession.

Consider ITE’s Mission Statement: *To provide the global community of transportation professionals with the knowledge, practices, skills, and connections to serve the needs of their communities and help shape the future of the profession and transportation in the societal context.* As members, the Institute’s mission is based on our (as members) efforts to share our knowledge, practices, and skills with our connections. How can we do that?

One of the most effective means is networking. With ITE’s more than 16,000 members (and what a great number that has become



At the 2013 ITE Annual meeting in Boston.

over the past several years), there are plenty of opportunities to identify and network with members with common interests:

- Councils and Committees—Membership and participation on technical councils, employer councils, and multiple Institute committees is a great way to become involved and advance our mission. Keep in mind the opportunities to get involved on committees with the districts, sections, and chapters.
- Meetings—Conferences, meetings, and workshops at all levels of the Institute are great venues for learning and sharing. During the pandemic, the Institute has done a great job of keeping everyone connected virtually; with the recovery underway, we look forward to the return of in-person gatherings as well as the convenience of online interfaces.
- ITE's eCommunity—This discussion application is ideal for sharing information and requesting the experiences of others. If you're not on there already, you should be.
- Technical Publications—There are often opportunities to contribute your knowledge in the development of a technical report or publication.

- Mentoring—Mentoring provides a great opportunity for younger engineers to learn from the more experienced ones. I would consider everyone I've named so far in this paper to have been one of my mentors, and to them I am grateful.

The recent OneITE initiative has enhanced the Institute as a whole; one key element has been to improve the opportunities for volunteer and leadership roles. OneITE helps to distinguish us from competing associations and provides many more involvement opportunities at the local level and to younger members.

Your participation also helps guide the future direction of the Institute. As I mentioned earlier, the Institute continues to evolve. This coming year, the three members of the International Board's Executive Committee will be, for the first time, all females. I look forward to the leadership of Alyssa, Beverly, and Rosana as we continue our evolution.

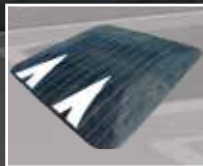
My thanks to the membership of this fine organization for this honor. [itej](#)

See full bio on page 27.

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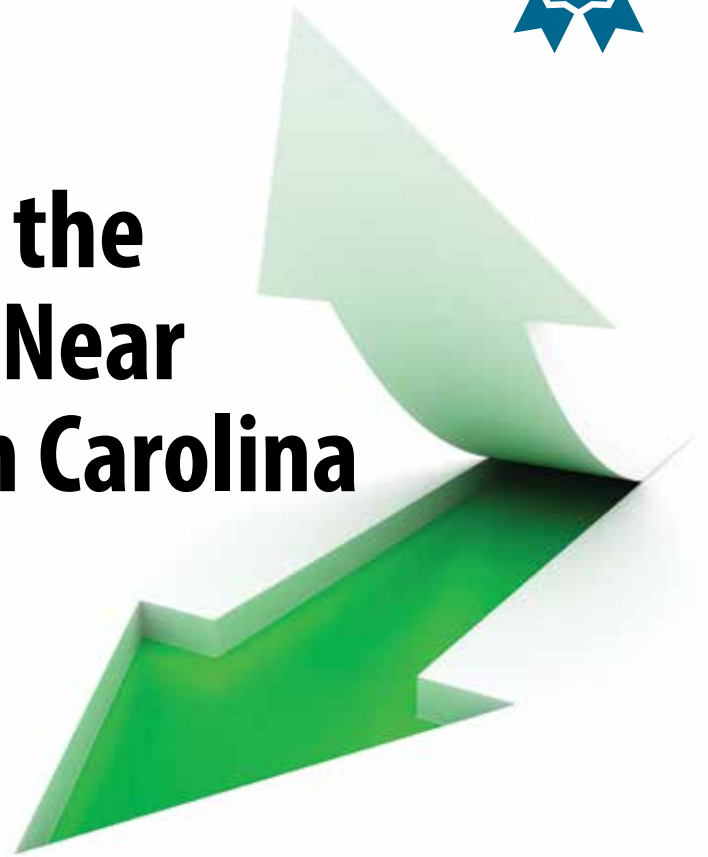
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Factors Influencing the Severity of Crashes Near Exit Ramps in North Carolina

BY HENRICK HAULE, (S) MD SULTAN ALI,
AND ANGELA E. KITALI, PH.D. (S)



Exit ramps play an essential role in diverting traffic from a non-interrupted traffic flow facility to another non-interrupted or interrupted traffic flow facility. To access exit ramps, motorists need to perform maneuvers such as lane change, lane merge, and/or lane diverge at lower speeds. The extent and frequency of these maneuvers vary by ramp configuration, traffic composition, horizontal alignment, crossroad ramp terminal control, and the design speed differential of the two connecting facilities.¹ Therefore, traversing

HSIS First Place Safety Data Award

This is the first place winning paper of the Federal Highway Administration's (FHWA) 2020 Excellence in Highway Safety Data Award, which is designed to encourage university students to use Highway Safety Information System (HSIS) data to investigate a topic that advances highway safety and to develop a paper to document the original research. The HSIS Highway Safety Data Awards Program is jointly administered by FHWA and ITE.

through a ramp presents a driver with complex conditions and multiple decision points. Besides, these maneuvers create a speed differential as diverging traffic moves at a relatively slower speed than the mainline traffic. This situation may increase the probability of crash occurrence and even exacerbate crash injury severity.^{2, 3}

A substantial proportion of total freeway crashes occur on and near ramps.⁴ For instance, about a fifth of all interstate crashes occur at interchanges, although such locations constitute less than 5 percent of total freeway mileage.^{3,4} McCartt et al.³ suggested that about half of all ramp-related crashes occurred when at-fault drivers were in the process of exiting interstates. Compared to entrance ramps, exit ramps were found to experience more severe crashes.^{3,5} Therefore, crashes on exit ramps have been a significant freeway safety issue.²

Several studies analyzed the likelihood, types, and severity of crashes near exit ramps.³⁻¹⁰ Qu et al.⁷ found frequent lane-changing maneuvers and merging activities as the main reason for the differences in crash risk across the different lane types near exit ramps. Among the crashes that occur at freeway diverge areas, rear-end and angle crashes were more likely to result in severe outcomes than sideswipe crashes.¹⁰ Lee and Abdel-Aty⁴ suggested using advisory speed signs as a countermeasure to potentially reduce the likelihood of crashes on exit ramps.

Most of the existing studies evaluated the safety of freeway exit ramps by considering crash frequency, crash type, and crash severity. However, these studies did not consider the effect of heterogeneity in crashes while identifying factors influencing the severity of crashes near exit ramps. Moreover, previous studies on the severity of crashes near exit ramps assumed that the effect of factors on different severity levels does not vary. This study, therefore, evaluated the severity of crashes near freeway exits using latent class clustering analysis (LCCA) and partial proportional odds (PPO) model in an effort to account for the limitations of previous studies on the severity of crashes near exit ramps.

Study Area and Data

This study focused on crashes that occurred near freeway exit ramps in North Carolina from 2013 to 2017. The crash data were requested from the Highway Safety Information System (HSIS). One piece of information essential for this study was the crash location in relation to the exit ramps categorized as the entry of the exit ramps, the ramp terminal with the crossroad, and the ramp proper. This study focused on crashes that occurred at the entry of exit ramps only. About 4,157 crashes that occurred at the entry of exit ramps were retrieved and processed for analysis. After removing crashes with missing information in the target variables, 3,541 crashes were available for analysis. In summary, out of 3,541 crashes, about 1 percent resulted in fatalities (K crashes) and incapacitating injuries (A crashes). About 5 percent of the crashes led to non-incapacitating injuries (B crashes), nearly 20 percent of crashes caused possible injuries (C crashes), and approximately 75 percent of the crashes were property damage only (PDO).

Data Variables

The variables included in the analysis were selected based on existing literature.¹⁻¹² Table 1 shows the variables included in this study and their corresponding categories. All categories of the variables are self-explanatory except for crash severity, alcohol use, older drivers, crash type, and time of day. Although crash severity had five levels, the study recategorized crash severity into three groups: KAB crashes (i.e., fatal, incapacitating, and non-incapacitating crashes), C crashes (possible injury crashes), and PDO. Older drivers included those aged 65 years and above. The alcohol use variable was categorized into a group that at least one driver involved in a crash had the blood alcohol concentration (BAC) > 0 percent (i.e., *Yes*) and a group that no driver in the crash had the BAC > 0 percent (i.e., *No*). The crash type variable included single-vehicle, rear-end, sideswipe, and angle crashes. Head-on crashes were removed from the analysis since their crash mechanisms are significantly different from other crash types. The time of day was categorized into morning peak hours (6 a.m.–10 a.m.), evening peak hours (3 p.m.–7 p.m.), and off-peak hours (10 a.m.–3 p.m. and 7 p.m.–6 a.m.).

Descriptive Statistics

Table 1 shows the frequency distribution of crashes according to the severity of crashes and explanatory variables. The distribution shows that more KAB and C crashes involved intoxicated drivers. The percentage of KAB crashes was higher when older drivers were involved. Crashes involving trucks had a higher percentage of KAB and C crashes. Single-vehicle crashes involved more KAB crashes than all other crash types. Conversely, angle crashes had the highest percentage of C crashes than other crash types.

Nighttime was associated with more KAB and C crashes than daylight. More KAB crashes occurred during adverse weather conditions. Morning peak hours had a lower percentage of C crashes than off-peak and evening peak hours. Weekends experienced more C and KAB crashes than weekdays. The proportion of KAB and C crashes in urban areas was higher than in rural areas. Mountainous terrain had a higher percentage of KAB and C crashes than rolling and flat terrain. Freeway segments with AADT < 50,000 vehicles per day (vpd) had a higher proportion of C crashes than segments with AADT ≥ 50,000 vpd.

Methodology

A two-step approach was used to evaluate factors that influence the severity of crashes near exit ramps. First, crashes were grouped into clusters using LCCA to reduce heterogeneity in the data. Therefore, crash clusters were defined as groups of crashes with similar characteristics. Second, the PPO model was fit to each cluster. The PPO model accounts for the natural ranking between severity categories: KAB, C, and PDO. Also, the PPO model relaxes the proportional odds (PO) assumption that the effect of variables is the same across severity

Table 1. Descriptive Statistics of the Crashes Near Exit Ramps

Variable	Levels	PDO crashes		C crashes		KAB crashes		Total
		Count	%	Count	%	Count	%	
Alcohol	No	2,469	72	642	19	342	10	3,453
	Yes	61	69	20	23	7	8	88
Older driver involved	No	1,480	72	387	19	176	9	2,043
	Yes	1,050	70	275	18	173	12	1,498
Teen driver involved	No	1,974	71	529	19	258	9	2,761
	Yes	556	71	133	17	91	12	780
Truck involved	No	2,360	72	611	19	319	10	3,290
	Yes	170	68	51	20	30	12	251
Crash type	Single-vehicle	704	68	203	20	127	12	1,034
	Angle	144	66	54	25	20	9	218
	Rear-end	1,189	70	343	20	173	10	1,705
	Sideswipe	493	84	62	11	29	5	584
Light condition	Daylight	1,975	73	493	18	248	9	2,716
	Nighttime	555	67	169	20	101	12	825
Weather	Clear	2,137	71	570	19	285	10	2,992
	Adverse	393	72	92	17	64	12	549
Time of day	Off-peak hours	1,721	72	473	20	197	8	2,391
	Morning peak hours	341	73	69	15	59	13	469
	Evening peak hours	468	69	120	18	93	14	681
Day	Weekday	1,978	72	512	19	262	10	2,752
	Weekend	552	70	150	19	87	11	789
Area type	Rural	110	77	21	15	12	8	143
	Urban	2,420	71	641	19	337	10	3,398
Horizontal alignment	Straight	1,887	72	470	18	271	10	2,628
	Curve	643	70	192	21	78	9	913
Terrain	Flat	181	74	48	20	16	7	245
	Rolling	2,220	72	569	18	308	10	3,097
	Mountainous	129	65	45	23	25	13	199
Speed limit (mph)	< 55	1,091	70	315	20	156	10	1,562
	≥ 55	1,439	73	347	18	193	10	1,979
Shoulder width (ft)	< 4	376	70	115	22	43	8	534
	4 – 10	1,332	72	339	18	191	10	1,862
	>10	822	72	208	18	115	10	1,145
AADT (vpd)	< 50,000	949	72	255	19	118	9	1,322
	≥ 50,000	1,581	71	407	18	231	10	2,219

levels.¹³ The PPO model assumes that only a subset of variables in the model violates the PO assumption. Given the imbalanced distribution of KAB, C, and PDO crashes within the dataset, the PPO model was fit using the bootstrap resampling method.

Latent Class Clustering Analysis

LCCA assumes that data originates from a model of mixed probability distributions, and there is a latent variable separating the data into homogeneous and mutually exclusive subgroups.¹⁴ In general, LCCA estimates an observation's probability to be allocated to a homogeneous group.¹⁵ The Bayes rule was applied to calculate the probability of crash belonging to latent class k (posterior membership probability):

$$P_{x_k|y_l} = \frac{P_{x_k} P_{y_l|x_k}}{P_{y_l}} \quad (1)$$

where

Y_l is one of the L ($1 \leq l \leq L$) observed variables,

X is a latent variable,

k ($k = 1, 2, \dots, K$) is a latent class,

P_{y_l} is the probability of obtaining response variable Y_l ,

P_{x_k} is the prior probability of being in cluster k ,

$P_{y_l|x_k}$ is the conditional probability that a crash has response pattern Y_l (y_1, \dots, y_l), given it is in the k class of latent variable X .

The optimum number of clusters in LCCA was selected using measures indicating the accuracy improvements in the model for assigning crashes to clusters.¹⁶ The accuracy measures used include Bayesian Information Criteria (BIC), Akaike Information Criterion (AIC), Consistent Akaike Information Criterion (CAIC), and entropy-based measures. The number of clusters associated with low AIC, BIC, CAIC, and the entropy criterion value greater than 0.9 was considered to have the most relevant results.¹⁷

Partial Proportional Odds Model

The PPO model was derived by defining an unobserved latent variable U as a linear function for each crash such that:

$$U = \beta X + \varepsilon \quad (2)$$

where X is a vector of independent variables determining a discrete ordering for each crash, β is a vector of estimable parameters, and ε is the random disturbance term. Using Equation 3, the observed severity level y for each observation was defined as:

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$$\begin{aligned}
 y_1 &= 1 \text{ (PDO)} && \text{if } U \leq \mu_1 \\
 y_2 &= 2 \text{ (C)} && \text{if } \mu_1 < U \leq \mu_2 \\
 y_3 &= 3 \text{ (KAB)} && \text{if } \mu_2 < U
 \end{aligned} \tag{3}$$

where $\mu_1, \mu_2,$ and μ_3 are estimable thresholds that define $y_1, y_2,$ and y_3 . The probability of a crash severity level in the PPO model was calculated as:

$$P(y_i > j) = \frac{\exp(X_{pi}\beta_p + X_{qi}\beta_q - \mu_j)}{1 + \exp(X_{pi}\beta_p + X_{qi}\beta_q - \mu_j)} \quad j=1,.., J-1 \tag{4}$$

where

β_p is a vector of parameter estimates that do not violate the PO assumption,

β_q is a vector of parameter estimates that violate the PO assumption,

X_{pi} and X_{qi} are vectors of independent variables that violate and do not violate the PO assumption, respectively. Other variables were defined in Equation 2 for the i th crash with severity j from J severity levels.

A graphical test proposed by Harrel was used to identify variables violating proportional assumption (if any).¹⁸ Results of the PPO model were interpreted using the odds ratio (OR), calculated as the exponential of the estimated mean β . An OR of 1.0 indicates that the variable has no effect on crash severity. An OR > 1.0 and OR < 1.0 indicates a 100(OR - 1) percent increase and a 100(OR - 1) percent decrease in the odds of severe outcomes, respectively.

Bootstrap Resampling

The bootstrap resampling method was applied to resolve the imbalance problem caused by a higher percentage of PDO crashes than C and KAB crashes. The bootstrap method estimates the coefficients and standard errors by repeatedly and randomly sampling subsets of data from the original dataset to reduce bias that can be caused by imbalanced data in parameter and standard errors of the model's estimates.¹⁹ Although the conventional bootstrapping approach involves drawing a sample randomly and evenly with replacement, this study divided the sample into three datasets (KAB, C, and PDO crashes) and applied the method on each subset. Then, n samples (where n is the number of PDO crashes) were randomly drawn from all groups in each bootstrap replication. The samples were then joined into a single dataset with a balanced number of crash severity levels. The procedure of drawing samples of n was repeated 1000 times, and the estimates of variables in each repetition were recorded. The number of repetitions (i.e., 1,000) was arbitrarily selected as the optimum number to enable measuring of the model performance while balancing the computation time.

Results

Crash Clusters

Crashes near exit ramps were clustered using variables listed in Table 1. The maximum number of possible clusters investigated was seven, assuming that the sample size (3,541 crashes) was not expected to have more than seven clusters. As shown in Figure 1, the performance measures (BIC, AIC, and CAIC) were slightly decreasing from three clusters to seven clusters indicating the insignificant change in the information criteria when more than two clusters were considered. The entropy was highest (0.94) when data were subdivided into two clusters. Therefore, crashes near exit ramps were divided into two clusters.

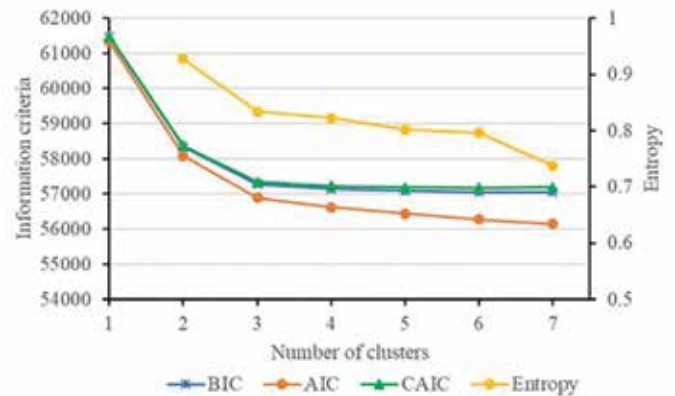


Figure 1. Determination of the Optimum Number of Crash Clusters

Figure 2 illustrates the distribution of variables in the two clusters. *Cluster A* was defined as “single-vehicle crashes or crashes involving older drivers” because approximately 95 percent and 99 percent of the crashes in this cluster involved a single vehicle and older drivers, respectively. *Cluster B* was defined as “multi-vehicle crashes” as about 99 percent of the crashes in this cluster involved at least two vehicles.

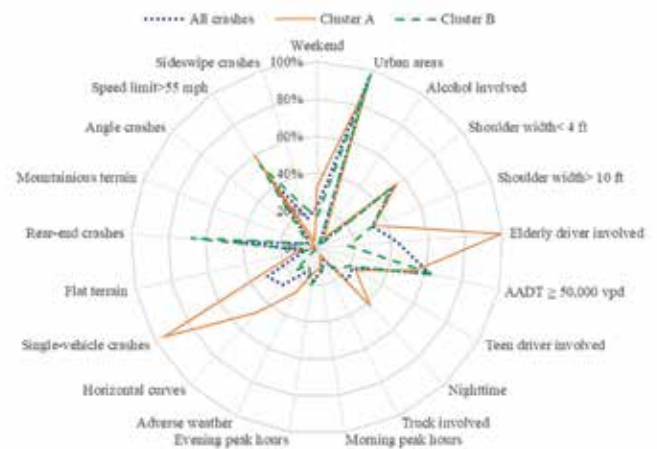


Figure 2. Distribution of the Variables in All Crashes and Cluster A and B

Factors Associated with Severity of Crashes

Table 2 presents the results of the PPO model fitted to *all crashes*, *Clusters A* and *B*. The table shows the estimates of the PPO model variables when comparing C crashes with PDO crashes (Threshold 1) and when comparing KAB crashes with C crashes (Threshold 2). The estimates of variables that violated the PO assumption were different for Threshold 1 and Threshold 2. This indicated that a variable had a different effect on the risk of crash severity levels. Variables that followed the PO assumption had the same effect between different levels of crash severity. Figure 3 shows the ORs of significant variables of the PPO models.

All Crashes

The following variables were significant at the 95 percent CI in the model fitted to all crashes: truck involvement, light condition, weather condition, time of day, day of the week, area type, horizontal alignment, terrain, shoulder width, and AADT. Crashes involving trucks had a 37 percent higher risk of C crashes than crashes not involving trucks. Adverse weather was associated with a 59 percent and 125 percent increased risk of C crashes and KAB crashes, respectively. Urban areas had a 54 percent and 26 percent higher risk of C crashes and KAB crashes, respectively. Mountainous terrain had a 39 percent higher risk of C and KAB

Table 2. Results of the PPO models

Var.	Levels	All crashes						Cluster A						Cluster B					
		Threshold 1 Est.			Threshold 2 Est.			Threshold 1 Est.			Threshold 2 Est.			Threshold 1 Est.			Threshold 2 Est.		
		Mn	95% CI		Mn	95% CI		Mn	95% CI		Mn	95% CI		Mn	95% CI		Mn	95% CI	
			2.5	97.5		2.5	97.5		2.5	97.5		2.5	97.5		2.5	97.5		2.5	97.5
Alcohol ^b	No*																		
	Yes	0.21	-0.15	0.57	0.21	-0.15	0.57	0.52	0.10	0.95	0.73	0.27	1.18	1.32	0.63	2.01	1.32	0.63	2.01
Teen driver inv. ^b	No*																		
	Yes	0.04	-0.11	0.20	0.04	-0.11	0.20	0.00	-0.19	0.19	0.00	-0.19	0.19	-0.12	-0.31	0.07	-0.12	-0.31	0.07
Truck inv. ^c	No*																		
	Yes	0.31	0.06	0.57	0.31	0.06	0.57	-0.18	-0.59	0.24	-0.18	-0.59	0.24	-0.73	-0.97	-0.49	-1.11	-1.42	-0.80
Light cond. ^a	Daylight*																		
	Nighttime	-0.34	-0.51	-0.18	-0.65	-0.85	-0.45	0.41	0.23	0.60	0.41	0.23	0.60	-0.06	-0.31	0.18	-0.06	-0.31	0.18
Weath. ^{a,b}	Clear*																		
	Adverse	0.46	0.24	0.69	0.81	0.49	1.13	0.70	0.48	0.93	1.23	0.94	1.53	0.27	-0.02	0.55	0.75	0.21	1.29
Time of day	Off-PH*																		
	Morn. PH	0.54	0.35	0.72	0.54	0.35	0.72	0.28	-0.04	0.60	-0.32	-0.68	0.03	0.38	0.17	0.59	0.38	0.17	0.59
	Even. PH	0.45	0.27	0.62	0.45	0.27	0.62	0.11	-0.20	0.42	0.01	-0.31	0.33	0.55	0.38	0.72	0.55	0.38	0.72
Day of the week	Weekday*																		
	Weekend	0.17	0.02	0.32	0.17	0.02	0.32	-0.05	-0.24	0.14	-0.05	-0.24	0.14	-0.03	-0.24	0.18	-0.03	-0.24	0.18
Area type ^a	Rural*																		
	Urban	0.43	0.13	0.73	0.23	-0.09	0.56	0.44	0.12	0.76	0.44	0.12	0.76	0.32	-0.17	0.81	0.32	-0.17	0.81
HZ align.	Straight*																		
	Curve	0.31	0.16	0.46	0.31	0.16	0.46	-0.16	-0.34	0.01	-0.16	-0.34	0.01	0.12	-0.07	0.31	0.12	-0.07	0.31
Terrain ^b	Rolling*																		
	Flat	-0.19	-0.47	0.08	-0.19	-0.47	0.08	0.44	0.11	0.77	0.62	0.24	1.01	-0.08	-0.46	0.31	-0.28	-0.71	0.16
	Mount.	0.33	0.07	0.59	0.33	0.07	0.59	-0.08	-0.53	0.36	-0.52	-0.91	-0.13	-0.15	-0.48	0.18	0.41	-0.17	0.99
Speed limit (mph)	< 55*																		
	≥ 55	0.08	-0.07	0.23	0.08	-0.07	0.23	-0.03	-0.21	0.15	-0.03	-0.21	0.15	-0.09	-0.27	0.10	-0.09	-0.27	0.10
Shoulder width (ft)	4 – 10*																		
	< 4	-0.33	-0.54	-0.11	-0.33	-0.54	-0.11	0.05	-0.28	0.39	0.42	0.09	0.75	0.02	-0.20	0.25	0.02	-0.20	0.25
	> 10	-0.13	-0.29	0.02	-0.13	-0.29	0.02	0.00	-0.22	0.21	0.16	-0.06	0.38	-0.08	-0.27	0.11	-0.08	-0.27	0.11
AADT	< 50,000*																		
	≥ 50,000	-0.37	-0.54	-0.21	-0.37	-0.54	-0.21	-0.14	-0.33	0.05	-0.14	-0.33	0.05	-0.05	-0.24	0.14	0.38	0.11	0.64
Constant		0.27	-0.07	0.60	1.47	1.13	1.81	-0.58	-0.95	-0.21	0.77	0.40	1.14	1.06	0.54	1.58	2.29	1.77	2.82

Note: a, b, c variables that violated proportional odds assumption in all crashes, cluster A, cluster B, respectively; * base category, Mn means mean, CI means confidence interval, inv. means involved, HZ means horizontal, PH means peak hours, cond. means condition, align. means alignment, Morn. means morning, Even. means evening, weath. means weather, Bold numbers show significant values at the 95% CI.

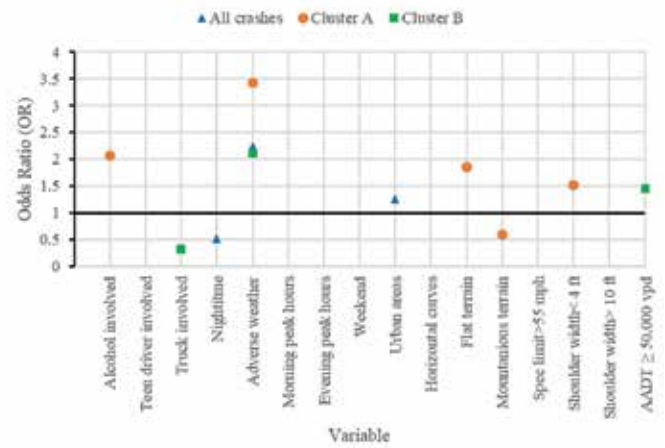
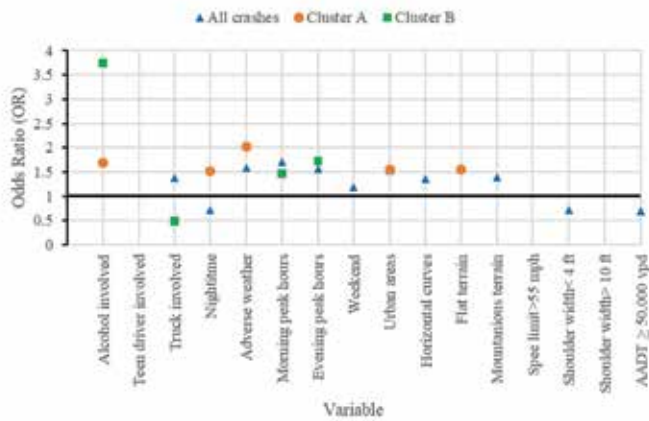


Figure 3: Odds Ratios of the Significant Variables in (a) Threshold 1 and (b) Threshold 2 of the PPO models

crashes than rolling terrain. The results could be related to Wang et al.² findings that up- and down-grades increase the risk of severe crashes near diverge areas. Results indicated that nighttime, shoulder width < 4 ft, and AADT ≥ 50,000 vpd were associated with the decreased risk of C and KAB crashes. Nighttime was associated with the decreased risk of C crashes and KAB crashes by 29 percent and 48 percent, respectively. Mainline segments near exit ramps with AADT ≥ 50,000 had a 31 percent lower risk of C and KAB crashes than segments with AADT < 50,000 vpd.

Cluster A: Crashes Involving Single Vehicles or Older Drivers

Variables significant at the 95 percent CI in the model fitted to Cluster A include alcohol use, light condition, weather conditions, area type, terrain, and shoulder width. The effect of alcohol on the crash severity varied across severity levels. The risk of C and KAB crashes was 69 percent and 107 percent higher when an intoxicated driver was involved, respectively. Nighttime was associated with a 51 percent higher risk of C and KAB crashes than daylight. The risk of C crashes was 102 percent higher during adverse weather conditions than during clear weather conditions. Similarly, the risk of KAB crashes was 243 percent higher during adverse weather conditions.

Urban areas were associated with a 55 percent higher risk of C and KAB crashes than rural areas. Compared to crashes that occurred on a rolling terrain, crashes on flat terrain had a 55 percent and 86 percent higher likelihood of being C and KAB crashes, respectively. Mountainous terrain showed a 41 percent lower risk of KAB crashes than rolling terrain. The high risk of C and KAB crashes on flat terrain could be associated with higher driving speeds on flat terrains. Since the roadway grade in mountainous terrain is steeper than that of rolling terrain, reduced vehicle speed could serve as a reason for the lower risk of KAB crashes on mountainous terrain. Segments with shoulder width less than 4 ft had a 52 percent higher likelihood of KAB crashes than segments with 4-10-foot shoulders.

Cluster B: Multi-vehicle Crashes

Variables significant at the 95 percent CI in the model fitted to Cluster B include alcohol use, truck involvement, weather condition, time of day, and AADT. Results indicated that the risk of C and KAB crashes was 274 percent higher when the crash involved an intoxicated driver. The effect of truck involvement varied across the severity levels. The risk of C and KAB crashes was 52 percent and 67 percent lower when a truck was involved in a crash. Similar counterintuitive results were observed in the study on crash severity near diverge areas in Florida.² The risk of KAB crashes was 111 percent higher during adverse weather. Morning peak hours had a 46 percent higher risk of C crashes than off-peak hours. Similarly, evening peak hours had a 73 percent higher risk of C crashes than off-peak hours. Segments with AADT ≥ 50,000 vpd had a 46 percent higher risk of KAB crashes than segments with AADT < 50,000 vpd.

Comparison of Results Across All Crashes, Clusters A and B

The following significant variables had different coefficient signs across the three crash datasets: truck involvement, lighting condition, terrain, shoulder width, and AADT. The risk of C and KAB crashes when a truck was involved was higher for all crashes and lower for Cluster B. Overall, crashes involving trucks are expected to be severe, considering their size. The reason for crashes in Cluster B involving trucks to be less severe is not apparent and seeks an in-depth investigation.

When considering all crashes, nighttime was associated with a lower likelihood of C and KAB crashes. Conversely, nighttime crashes in Cluster A were more likely to be C or KAB crashes. The lower severity of nighttime crashes in all crashes dataset may be due to drivers' cautiousness during nighttime. However, as expected, nighttime crashes in Cluster A were severe, possibly due to diminished vision of older drivers. The provision of lighting near exit ramps may improve safety, particularly for older drivers.

Compared to rolling terrain, mountainous terrain significantly influenced the likelihood of C and KAB crashes in *all crashes* and PDO crashes in *Cluster A* crashes. Compared to mountainous terrain, rolling terrain provides a good preview of the roadway to make last-minute maneuvers, if necessary, and avoid imminent collisions. Nevertheless, crashes in *Cluster A* occurring in mountainous terrain may be less likely to be severe considering the defensive nature of older drivers.

Narrow shoulders were associated with a lower likelihood of C and KAB crashes in the *all crash* dataset and a higher likelihood of KAB crashes in the *Cluster A* crashes. Wider shoulders provide more clearance for drivers to take corrective actions after making an errant maneuver and avoid running off the roadway and encountering a harmful roadside object or embankment. Thus, it is expected that crashes in *Cluster A* at locations with narrower shoulders to be severe. The opposite observation made in *all crashes* indicates that crashes in *Cluster B* might neutralize the effect of shoulder width on crashes in *Cluster A* when analyzing the entire dataset. While higher AADT was associated with a reduced likelihood of C and KAB crashes in *all crashes*, it was associated with an increased risk of KAB crashes in *Cluster B*. The aggressive driving behavior of other (not older) drivers may explain the high severity of crashes at locations with high traffic volumes.

For all the three datasets used in the study, crashes under inclement weather conditions were more likely to be severe. The impact of inclement weather was at the highest in *Cluster A*. Adverse weather conditions are associated with reduced sight distance and friction between the tire and the roadway surface. Considering this situation and older drivers having a longer reaction time, the likelihood of severe crashes in *Cluster A* may increase. A majority of significant variables influenced crash severity in the *all crashes* and either of the clusters except for alcohol involvement. Results indicated that the risk of C and KAB crashes was 274 percent higher when the crash involved an intoxicated driver.

Conclusions

Freeway exit ramps have been long considered crash-prone locations. The objective of this study was to investigate factors influencing the severity of crashes near exit ramps. Also, the study aimed to show factors that affect specific crash categories near exit ramps that cannot be identified by analyzing all crashes in one model.

Resources

Please go to <https://bit.ly/3lmaDyC> to watch a video and learn more about HSIS, HSIS data, and the Excellence in Highway Safety Data Award.

The analysis was based on crashes that occurred near exit ramps in North Carolina from 2013 to 2017. The crash analysis was performed using LCCA and PPO model. The LCCA divided crashes into homogeneous subgroups, and the PPO model identified variables with significant influence on crash severity. Also, a bootstrap resampling approach was used when fitting the PPO model to account for the imbalance of data in different crash severity levels.

The study identified two crash clusters: single-vehicle crashes or those involving older drivers (*Cluster A*) and multi-vehicle crashes (*Cluster B*). The variables with significant influence on all crashes near exit ramps include: truck involvement, light condition, weather condition, time of day, day of the week, area type, horizontal alignment, terrain, shoulder width, and AADT. The variables that significantly affected the severity of crashes in *Cluster A* include alcohol use, light condition, weather conditions, area type, terrain, and shoulder width. The variables that significantly influenced the severity of crashes in *Cluster B* include alcohol, truck involvement, weather condition, time of day, and AADT.

In addition to identifying factors influencing the severity of crashes near exit ramps, the results showed that categorizing the crashes near exit ramps into homogenous groups helps identify patterns that would not have been identified by only analyzing the entire dataset. With specific attributes leading to different crash severities, homogenous groups enhance the process of identifying measures for mitigating severe crashes near exit ramps by focusing on specific contributing variables in crash clusters. The study results and methodology could potentially be used by agencies when devising methods and policies to reduce the severity of crashes near exit ramps. Some of the potential countermeasures may include provision of sufficient lighting, advance warning messages to drivers during inclement weather conditions, and adequate shoulder width to the extent possible. [itej](#)

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Answer to "Where in the World?" on page 11: The Dom Luis I Bridge in Porto, Portugal. Photo submitted by Paula Flores (F).

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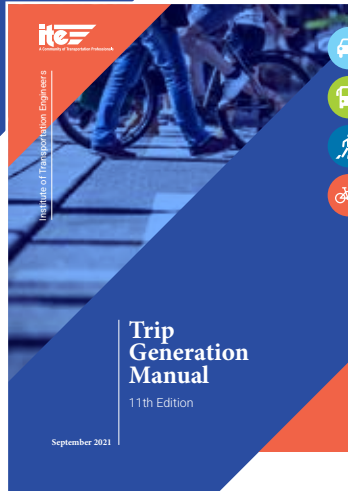
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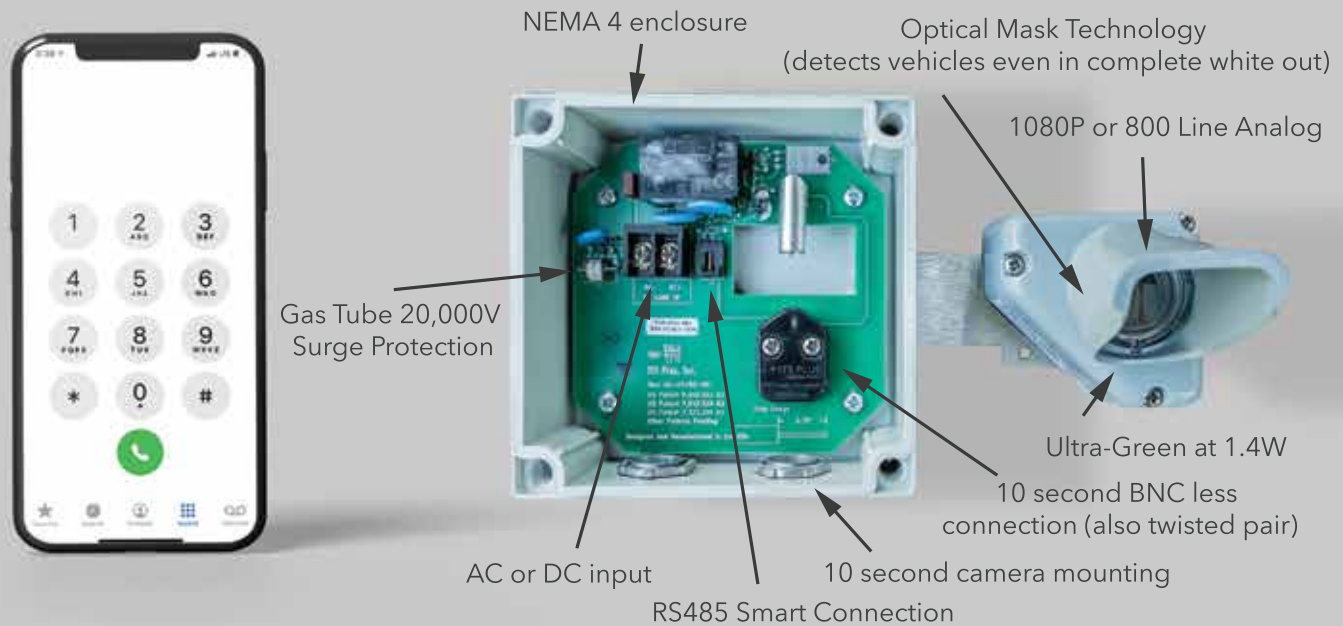
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