



2025 Safe Mobility Conference Proceedings

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Title

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Foreword

The 2025 Safe Mobility Conference, a collaboration between the AAA Foundation for Traffic Safety and the University of Wisconsin-Madison, was held from April 7 to April 9. The second edition of this event attracted more than 220 transportation professionals from academia, government, industry, and non-profit organizations to Madison, Wisconsin to discuss transportation issues and traffic safety challenges, but more importantly, share ideas and solutions to achieve the *Safe Mobility* vision.

Theme for the 2025 Safe Mobility Conference was *Delivering Safe and Reliable Transportation Systems* and many experts and stakeholders contributed to the richness of the conference content. Plenary sessions featured leaders from both public and private sectors sharing their perspectives on the meaning of safe mobility, why safe mobility is important, and how to achieve safe mobility for everyone. Transportation researchers and practitioners presented their work in multiple technical sessions, on topics that range from road user attitudes and behaviors and safe system approaches to vehicle technology and speed management.

The proceedings from the 2025 Safe Mobility Conference included summaries of plenary sessions as well as abstracts prepared by presenters of technical sessions. This document can serve as a platform to continue exchanging insightful information and practical solutions to shape our transportation systems so every user can travel from one place to another safely and efficiently.

Let's turn the *Safe Mobility* vision into reality.

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Table of Contents

Table of Abbreviations	vi
Introduction	viii
Plenary Sessions.....	1
Plenary Session 1: What is Safe Mobility to You?	1
Plenary Session 2: Why is Safe Mobility Important?.....	5
Summary Discussion Featuring Remarks from Satya Rhodes-Conway, Kristina Boardman, and Luca Pascotto	5
Q&A Session.....	7
Plenary Session 3: Safe Mobility: How to Achieve Safe Mobility for Everyone? .	10
Summary Discussion Featuring Remarks from Patricia Hu, Victoria Sheehan, Joe Zietsman, and Steve Kuciemba	10
Q&A Session.....	12
Technical Sessions	16
Technical Session 1: Micromobility: Attitudes, Adoption, and Safety.....	16
Exploring the Impact of Driver Attitudes and Roadway Infrastructure on E-scooter and Bicycle Safety	16
Identifying Factors Affecting the Uptake of Private and Shared E-scooters.....	17
Data-Driven Equity-Focused Analysis of Bicycle Crashes in NYC.....	19
Technical Session 2: Assessing and Addressing Knowledge Gaps Related to Vehicle Technology	21
Characterizing Clusters of Road Users Based on Quality of and Confidence in Mental Models of Adaptive Cruise Control and Lane Keeping Assist.....	21
An Investigation of Differences in Driver Opinions and Motivation for Training Engagement with L2 Systems Using the ARCS Methodology	22
Training the Next Generation of Drivers on ADAS	23
Technical Session 3: Addressing Work Zone and Incident Safety.....	25
Evaluating the Accuracy of Work Zone Data in Crash Reports Using Lane Closure Records	25
Traffic Incident Management (TIM) Planning for Major Construction Projects	26
Optimizing Alert Systems for Traveler Information Apps: A Study on Alert Impact on Driver Response to Road Incidents.....	26
Technical Session 4: Emerging Countermeasures and Strategies to Address Impaired Driving	29

Correcting Misperceptions about Cannabis Use and Driving.....	29
Incorporating Emerging Technology to Detect Impaired Driving	30
Technical Session 5: Understanding Risk Factors: Driving Styles, Aging, and New Approaches.....	31
The End of the Beginning for Telematics Data: Pioneering the Next Revolution in Road Safety Insights.....	31
Understanding Driving Styles: Differences in Personal Characteristics, Cultural Attitudes, and Beliefs.....	32
Health and Demographic Predictors of Driving Avoidance in Older Adults.....	34
Technical Session 6: Towards the Modernization of State DOTs' Crash Data Systems	36
Modernize Crash Narratives	37
Wisconsin Crash Data Systems Modernization.....	38
Technical Session 7: Safety and Automation: Hazard Response at Different Levels of Automation	39
Technical Session 8: Safeguarding First Responders in the Era of Emerging Mobility Technologies—Panel Discussion	41
Protecting Those Who Protect Us on Roadways Responder Safety Research by NextGen Transportation Lab/ATI.....	41
Remarks from Guest Panelists.....	42
Technical Session 9: Effectiveness of Behavioral Interventions and Programs..	43
Traffic Safety Impacts of Positive Youth Development.....	43
Safeguarding Children in Vehicles: Evaluating Countermeasures for Pediatric Vehicular Heatstroke.....	44
Nudging Safe Driving: Assessing the Effects of a Minimal Behavioral Science Intervention on Madison Public Works Drivers' Safety	45
Technical Session 10: Examples and Strategies for Safe System Implementation.....	47
TARGET Setting for High Severity Collisions: Tolerance-based Assessment of Risk for Generalized Event Thresholds.....	47
Safe Systems in Action: Multi-Agency Collaboration to Achieve Vision Zero on Highway 1	48
Supporting the Safe System Approach Decision-Making Through Crash Sequence Analysis	50
Technical Session 11: The Role of Vehicle Automation to Achieve Safe Mobility	51
Evaluating the Impact of Distraction Mitigation Strategies on Teenage Drivers Using Level 3 Automation.....	51

Navigating Mixed Traffic: The Behavioral Impact of Increasing Autonomous Vehicle Penetration	52
Safety Aware Neural Network for Integrated Connected and Automated Vehicle Prediction and Planning	54
Technical Session 12: Improving Vulnerable Road User Safety via Mixed Methods Research.....	55
Evaluating the Context of VRUs within Crash Reporting and General Laws by State across the U.S.	55
Sensor Networks to Increase Safety for Vulnerable Road Users.....	56
A Naturalistic Study of Driver Attention and Response to Vulnerable Road Users.....	56
Technical Session 13: Complete Streets Handbook and Design Leads to Safer Mobility in Milwaukee.....	57
Overview of Presentations from Invited Speakers: Jennifer Pangborn (WSP), David Tapia (City of Milwaukee), and Kevin Muhs (City of Milwaukee).....	57
Technical Session 14: The Trend of Motorcycle Crashes and Fatalities in the U.S.....	59
Trends in Motorcycle Fatalities in the U.S.	60
Motorcycling in a Safe System and Broader Traffic Safety Goals	60
Technical Session 15: From Data to Safety Solutions	61
Investigating Pedestrian Crashes on High-Speed Roads and Identifying Effective Countermeasures: A Focus on Urban and Suburban Corridors in Michigan.....	61
An Analysis of Pedestrian Safety at Bus Stops Using FARS Data	62
Examining the Effects of Spillover Effects of Crashes: Prioritizing Safe Speeds in Communities Near Interstates.....	63
Technical Session 16: Safety Initiatives from Local Transportation Agencies	65
Safety First Initiative.....	65
New York City Intelligent Speed Assistance Pilot Evaluation.....	66
Enhancing Vulnerable Road User Safety Analysis through Improved Crash Data Collection in Wisconsin.....	67
Technical Session 17: Paving the Way to a Future Free of Impairment—Panel Discussion.....	68
Remarks.....	68
Technical Session 18: Enabling Safe Mobility through Research & Development & Deployment	71
Technical Session 19: Innovative Approaches for Safe Mobility.....	74

Development of Effective Communications Infographics to Mobilize Community Members and Decision-Makers to Implement Evidence-Based Cross-Sector Safe Systems Interventions	74
A Digital Twin Framework for Physical-Virtual Integration in V2X-Enabled Connected Vehicle Corridors	74
Wisconsin Tribal Crash Mapping Improvements.....	75
Technical Session 20: Special Risk Factors: The Big, the Small, and the Sleepy ..	76
Identifying Massive Hazards: Compiling the Research on How Light Truck Design Impacts Road Safety	76
Examining Motorcycle Visibility for Left Turn Across Path Vehicles.....	77
Insights on Drowsy Driving and Break Taking Propensity	78
Technical Session 21: Emerging Technology and Commercial Motor Vehicle Safety: Two Naturalistic Studies	80
Technical Session 22: Automated Vehicle Safety: The Past, Present, Future.....	83
Retrospective Safety Impact for Autonomous Vehicles: Best Practices and Results	83
How Do Driver Assistance Technologies Affect Transportation Safety?	84
Quantitative Risk Assessment of Autonomous Vehicle Behavior Utilizing On-Road Driving Data: A SOTIF-based Approach.....	86
APPENDIX A: 2025 Safe Mobility Conference Organizing Team.....	88
APPENDIX B: 2025 Safe Mobility Conference Program	89
APPENDIX C: List of Organizations that Participated in the 2025 Safe Mobility Conference.....	102

Table of Abbreviations

ACC	Adaptive Cruise Control
ADAS	Advanced Driver Assistance Systems
ADS	Automated Driving System
ATI	Alabama Transportation Institute
ACIS	Arizona's Crash Information System
AI	Artificial Intelligence
AEB	Automatic Emergency Braking
AV	Autonomous Vehicle
BIL	Bipartisan Infrastructure Law
BAC	Blood Alcohol Concentration
C-V2X	Cellular Vehicle-to-Everything
CAG	Community Action Group
CAV	Connected Automated Vehicle
CHMI	Contextual Human-Machine Interface
CMV	Commercial Motor Vehicle
DMV	Department Of Motor Vehicles
DOT	Department Of Transportation
DSM	Driver State Monitoring
DRA	Driving-Related Areas
EV	Electric Vehicles
GIS	Geographic Information System
IMTF	Incident Management Task Force
ISO	International Standards Organization
ITE	Institute for Transportation Engineers
IIHS	Insurance Institute for Highway Safety
ISA	Intelligent Speed Assistance
LKA	Lane Keeping Assistance
LLM	Large Language Model
MTC	Metropolitan Transportation Commission
MMUCC	Model Minimum Uniform Crash Criteria
MADD	Mothers Against Drunk Driving
NHTSA	National Highway Traffic Safety Administration
NEUTC	New England University Transportation Center
NDRT	Non-Driving-Related Task
OMS	Occupant Monitoring Systems

PVH	Pediatric Vehicular Heatstroke
RO	Rider-Only
RTZ	Road To Zero Coalition
SANN	Safety-Aware Neural Network
SAE	Society of Automotive Engineers International
SOTIF	Safety of Intended Functionality
TOR	Takeover Request
TDS	Teens in the Driver Seat
TTI	Texas A&M Transportation Institute
TARGET	Tolerance-Based Assessment of Risk For Generalized Event Thresholds
TIM	Traffic Incident Management
TSCI	Traffic Safety Culture Index
T-CPS	Transportation Cyber-Physical Systems
TRB	Transportation Research Board
USDOT	U.S. Department of Transportation
VRU	Vulnerable Road User
WisDOT	Wisconsin Department of Transportation
WisLCS	Wisconsin Lane Closure System
ZIHOP	Zero-Inflated Hierarchical Ordered Probit

Introduction

The 2025 Safe Mobility Conference was held in Madison, Wisconsin, on April 7–9, in partnership with the University of Wisconsin–Madison. The conference aimed to foster partnerships and collaborations among a diverse group of transportation stakeholders, including industry experts, academic researchers, and representatives from governmental agencies.

The 2025 Safe Mobility Conference Proceedings include abstracts and summaries from the three plenary sessions as well as 12 technical sessions based on submitted abstracts and 10 technical sessions with invited speakers. Content highlights the multifaceted nature of transportation challenges and the innovative approaches being developed and deployed to achieve safe mobility.

Speakers for the three plenary sessions discussed what safe mobility means to them, why safe mobility is important, and how to achieve safe mobility. They also discussed barriers to achieving safe mobility, as well as practical suggestions for overcoming them based on their respective experiences in state and local government, industry, academia, and advocacy. Technical sessions delved into many various aspects of safe mobility, with topics including perennial barriers to safe mobility such as speeding and impaired driving, safety in emerging forms of mobility, and the critical importance of data to measuring and achieving safe mobility.

Plenary Sessions

Plenary Session 1: What is Safe Mobility to You?

John Lee (University of Wisconsin–Madison)



Dr. John Lee began by defining his perspective on safety as “no falls, no deaths.” He outlined four main areas to focus on in the pursuit of safe mobility: attentive technology, forgiving infrastructure, coordinated interdependence, and graceful interaction. Dr. Lee recounted his own experience of being struck by a large pickup truck during his bicycle commute, which demonstrated to him the need for accuracy in detection technologies, such as smartwatches that identify a fall and issue emergency notification options accordingly. To the point of forgiving infrastructure, he spoke to the danger of “stroads” (segments with features of both streets and roadways) that are essentially “built to kill pedestrians.” In addition to infrastructure, he highlighted the danger posed by large, unforgiving vehicles, which are very crashworthy for occupants, but hazardous to pedestrians. He raised the need for coordinated interdependence by relating the “three body problem” of physics to the context of roadway interaction. What each road user does influences what the surrounding traffic does, and vice versa; there is real-time, back-and-forth negotiation of actions. This kind of negotiation is governed by

proxemics (proximity of other actors) and kinesics (movement or expectations of trajectories), and this signaling is used to communicate intent across different types of road users. He noted that as vehicles on the road begin incorporating higher levels of automation, consideration should be paid to how these interactions may be impacted. His final point of focus was graceful interaction. Both the users and the technologies that make up these transportation patterns should aim to reframe these exchanges in a more pro-social way. On a societal level, we should seek to shift mindsets away from viewing other cars and traffic as an annoyance, but rather as a community of people.

Roger Millar (Washington State Department of Transportation (former))



Roger Millar began his remarks by making a case for the inclusion of “safer land use” as a sixth segment of the Safe System approach. In addition to contributing to safer mobility, he argued that land-use considerations can help combat congestion and provide economic vitality opportunities. He posited that highway capacity is not necessarily required for economic development and population growth, and provided the State of Washington as an example. In the past 25 years, Washington’s economy has grown by almost 40% (over twice that of the national economy), but only saw a 2.5% increase in lane-miles of pavement. He argued that businesses and workers do not really prioritize capacity in transportation, but instead prioritize reliability. He stated that there is a desire for reliable and resilient transportation systems that can prepare, adapt,

respond, and rapidly recover from whatever challenges may arise. Mr. Millar advocated for an overall shift in how we view the hierarchy of importance for transportation needs and how that translates to design and land-use decisions. He recommended putting how people live (or want to live) their lives first, then creating appropriate public spaces, and then investing in buildings and infrastructure. That shift would entail giving first priority to movement on foot, followed by bicycles, then transit, and then moving freight, with the movement of personal vehicles being a lower priority. He stated that the one element common to all crashes is cars. From a public health perspective, when there is a threat to human life, the first step is to separate people from the threat and eliminate the possibility of interaction. He argued that if this convention was practiced in the context of transportation, it would target a reduction in the number of vehicle miles traveled. It would mean aiming to use cars only when their utility is necessary or preferred, rather than as the default means of transportation. He also raised the point that a considerable portion of the population does not or cannot drive, but they are still transportation industry customers and deserve travel options as safe, convenient, and reliable as the automobile. He acknowledged that Americans live in an auto-centric country, but there are opportunities to save lives and discover economic opportunities by doing more with what we have, enhancing the reliability of all our modes of transport, and linking land use and transportation policy.

Jessica Cicchino (Insurance Institute for Highway Safety)



Dr. Jessica Cicchino defined safe mobility as “getting to the places that are important to you without it ruining your day or worse.” She began by recounting a personal story of a time she ran off the road at an exit with a sharp curve while driving in the rain several years ago. She used this incident to speak to how the wider spread incorporation of electronic stability control has been effective in reducing crashes of this nature since becoming required in vehicles in 2012. She went on to discuss how the road safety crisis has not been impacting all road users equally, particularly vulnerable road users. Vehicles themselves have continued to get progressively safer with improved technologies, but the fatality numbers are not reflecting that. The Insurance Institute for Highway Safety (IIHS) has set a goal of “30x30,” to achieve a 30% reduction in traffic fatalities by 2030, as a stepping stone on the way to zero fatalities. Dr. Cicchino outlined the three emphasis areas that are part of their strategic plan: reducing risky behavior (such as impaired driving or lack of seatbelt use), extending safety to everyone (including vulnerable road users), and accelerating commercial vehicle safety. She spoke to the availability of promising vehicle safety technologies, but cautioned that vehicle changes take time to trickle down through the overall vehicle population. The average car in the U.S. is 12 years old. As an example, she cited that in 2023, about 75% of all new vehicle models have automated emergency braking as a standard feature, but estimates that it will only be present in one-fifth of vehicles on the road. She added that it is likely that it will take until 2045 for this technology to be in 95% of vehicles. She asserted that we need to be implementing other solutions that will have an impact sooner than advancing vehicle technologies can hope to. She advocated that infrastructure that makes more places for pedestrians to cross safely, such as improved lighting, rectangular red flashing beacons, pedestrians refuge islands, and traffic calming treatments, can have more immediate effects on vulnerable road user safety. She stated that lowering speeds is another area that can provide expeditious results. Strategies like lowering speed limits, improved enforcement of speed limits, and road features like speed humps that bring down vehicle speed can make a substantial impact on pedestrian survivability.

Plenary Session 2: Why is Safe Mobility Important?

Summary Discussion Featuring Remarks from Satya Rhodes-Conway, Kristina Boardman, and Luca Pascotto



Mayor Satya Rhodes-Conway (City of Madison, Wisconsin)

Mayor Satya Rhodes-Conway opened by discussing the Vision Zero work that the City of Madison has done, and highlighted the work that the city staff did in leading the charge. Though, having lost two of her own family members in a crash, her support for this initiative is also very personal. She stated, “I know first-hand the pain and suffering that families go through when a loved one dies in a traffic fatality. I don’t want any family to have to experience what my family experienced, and if we can do anything at the city level to help make that true, it will have been worth it.” She made the point that when the streets are made safer for the most vulnerable of road users, it increases safety for everyone. When the perspective and needs of those who have the most difficulty getting around are considered, the built environment is improved for all of us. She punctuated this point with the example of curb ramps, which are primarily built for wheelchairs, but also benefit kids on bikes and parents with strollers. She stressed the need for executive and legislative forces to work together, stating that Madison has seen a substantial reduction in both fatalities and serious injuries, but is not at zero yet. She

advised that it is very important to stay the course, which often requires bravery; the public may not always understand traffic safety, but it is important to persevere with evidence-based strategies, even if they are not popular.

Kristina Boardman (Wisconsin Department of Transportation)

Secretary Kristina Boardman characterized Wisconsin's infrastructure as a shared resource that all in the state pay into, and because of that, citizens should have some basic assumptions about it, including safe mobility. That expectation of safe mobility requires a lot of trust: citizens must trust that others on the road are making smart choices, that they have been educated on the ways to operate their vehicle, and that their vehicles are operating in a safe manner. She asserted that the government has a role to lower risk where they can. It has a duty to step in, do the research, and implement changes that will reduce risk, particularly for the most vulnerable of road users. She said Wisconsin has a role with education (through the Department of Motor Vehicles [DMV]), enforcement (Division of State Patrol), and infrastructure (multi-modal engineering services). She warned that there is a significant portion of the population that does not take driver's education. In proctoring knowledge and skill tests, the DMV is the first interaction with the public. She stated that it is an opportunity to connect with people about what a serious responsibility driving is and stress that it is a privilege. The DMV is also responsible for keeping records of each driver so they can stay up to date in order to implement whatever controls may be needed for an individual driver. The State Patrol is in charge of enforcement as well as vehicle compliance inspections. They ensure that commercial and heavy vehicles on the road are in compliance with weight regulations. The Division of Transportation Systems is in charge of project selection, project oversight, management of project construction, bridge inspections, and staying up to date on research. She stated that passenger rail, harbors, airports, and bike and pedestrian systems are all part of their unified system that people can depend on for safe mobility. Wisconsin is striving for safer people, safer vehicles, safer speeds, and safer roads. She stated that post-crash care is an element they are looking forward to delving into more, but it is not currently under the purview of the Wisconsin Department of Transportation (WisDOT). She closed by saying, "I get an email every day showing how many people died the day prior, where we stand for the year, and how we compare to this point last year, and we are currently 20 fatalities ahead of where we were last year."

Luca Pascotto (Fédération Internationale de l'Automobile)

Mr. Luca Pascotto began by saying that safe mobility is important because "it is life." He stated a primary problem in automobile transportation is not applying the same standards for predictable or acceptable risk to traffic safety that are applied in other transportation modes such as aviation or rail. He argued that we could learn from these sectors in putting users as the paramount element of safety. He highlighted one of the points that arose in the Safe System workshop he attended at the conference—that it is difficult to change the passive cultural dimension we currently have. He asked, "Why do

we still tolerate unsafe road elements?” He went on to say he was very encouraged by the efforts he saw implemented in Madison on the workshop tour, feeling it helped demonstrate that it is possible to change. He stated he is proud of the work that the Fédération Internationale de l’Automobile (FIA) has done over the last decades to drastically improve safety in motorsport and use it as a laboratory for safety. He emphasized that road safety is now part of global development plans, and that it should be characterized as a public health issue.

Q&A Session

1. What are the DMV opportunities for elevating safe education?

Ms. Boardman explained that the DMV is an important touch point. She noted that driver’s education has not been maintained as part of the public-school curriculum, so if people want to get their license before age 18, they need to take driver education from a private provider. In her observations, people who have done this and are under 18 are passing at a much higher rate than those who wait until 18 and just take the DMV test. She further noted that Graduated Driver’s Licensing has also been beneficial. In the DMV’s last budget, they included \$6 million for a grant program that allowed low-income residents to enroll in private lessons, and it was very successful—they used all of the funds within 3 months. She emphasized that as larger numbers of residents wait until age 18 to take the test with no supervised learning, it is important for to find ways to connect with these people to ensure that they are learning fundamental safe driving skills.

2. What are you doing in your fleets to make people safer during travel that relates to work, and what are you doing around school areas regarding infrastructure to lower speeds or introduce “school streets” or walking/biking buses?

Mayor Rhodes-Conway replied that the City of Madison is striving for safe vehicles. To illustrate, she noted that the majority of city fleet vehicles have GPS tracking on them to monitor for unsafe behavior. She further noted that the city participated in a Bloomberg-Harvard city leadership group experiment looking at driver behavior when vehicles had bumper stickers, such as “How’s my driving?” as an example of efforts to use behavioral science to nudge human behavior. She noted that the city has also right-sized vehicles based on the job and avoid using unnecessarily large ones when they are not needed, and discourages single occupancy vehicle use among city employees, offering free transit options while parking must be paid for. The city has a Safe Routes to School program, and some neighborhoods do have walking and bike bus programs. She also discussed how Madison has changed the way it prioritizes projects, basing priorities on a scoring process informed by their High Injury Network rather than prioritizing projects based on citizen requests and complaints, as reacting to complaints tended to

prioritize areas with residents who are more connected/engaged with government rather than the greatest objective safety needs.

Ms. Boardman added that fleets are a big emphasis for WisDOT. She noted that WisDOT is working to develop safety champions at the local level and there are lots of work zone safety education efforts. They have also installed flashing beacons and pedestrian refuges in school zones, to slow down traffic and create safer paths.

Mr. Pascotto added that there is such a high portion of fleet vehicles associated with private sector activities, it offers an opportunity to work with them to work towards fleetwide rules.

3. Traffic cases make up a large amount of state and local court dockets, and traffic enforcement disproportionately affects the most vulnerable communities. How have you worked to balance some of those inequities and work with the judiciary as a stakeholder to mitigate downstream impacts of high-visibility traffic enforcement?

Ms. Boardman noted that the state has seen a lot of extremely high speeding (100 mph+) since 2020. She noted that in her personal opinion, speaking as a citizen and not as a public official, automated methods like cameras can help mitigate biases. She explained that in her view, they provide a neutral format. She noted that automated speed enforcement is not currently legal in the State of Wisconsin, however, and suggested that school zones might provide an opportunity to introduce them and build public acceptance.

Mayor Rhodes-Conway commented that in addition to having a lack of cameras, DUI laws in Wisconsin are very lax, and suggested that cameras would be more equitable. She explained that high-speed pursuits are not conducted in the City of Madison, but neighboring communities do conduct them, and stated that she would like to hear about what alternative law enforcement approaches other communities have tried, and would like to see the Safe System approach elements take the burden off of enforcement as much as possible.

Mr. Pascotto added that public support for enforcement may be improved if funds are re-invested in safety efforts, and that is publicized.

4. What is the effectiveness of education efforts, like in Scandinavian countries, that start in preschool and extend into high school? Would such an approach be feasible in the United States?

Mr. Pascotto noted that not all European countries have a uniform approach. He explained that some countries have introduced mandatory advanced driver training after one first receives a license, as the first year after is risky in terms of lack of

experience. Scandinavian societies accepted this cultural change back in the 1980s, so they have had time for this to really take hold.

Ms. Boardman commented that the earlier we can start to normalize education, the better, so that it becomes more natural for people to learn about safe road-user behavior, and view themselves as active and safe participants in this shared system.

Mayor Rhodes-Conway agreed that more should be done to introduce traffic safety education at earlier ages, but noted that it would require more funding of the education system. She explained that K-12 schools would not be able to take on additional activities such as this without additional funding. She noted that the city does have staff that work with elementary and middle schools for walking school buses, bike safety, and safe routes to school, and that it is important to have strong partnerships with local organizations, citing bicyclist organizations as an example. She commented that exposure beginning at early ages, as different kinds of road users, will better prepare young people to become safe drivers, and that road user education should be a lifetime endeavor extending well beyond initial licensure. She suggested that children may be able to help change the culture through their parents, as was done for recycling initiatives. She concluded that no one institution alone can change cultures and communities, so our challenge is to find the pieces as a city government to collectively contribute to that education and cultural shift.

5. What plays into the growing disparity between the U.S. experience and the international experience in the last five years or so?

Mr. Pascotto suggested that differences in automated enforcement may be a factor. But while this is useful for actual enforcement, he questions its usefulness for education. He explained that in Europe, a driver may receive a notice of an infraction in the mail several months after they committed the infraction, and that it can be seen as punitive. There has also been a shift to focusing efforts on slowing down the most extreme speeders rather than on reducing average speeds.

Mayor Rhodes-Conway added that the City of Madison has started looking at both peak and average speeds along its high injury networks, and noted that the biggest impacts of the city's interventions have been on peak speeds.

Plenary Session 3: Safe Mobility: How to Achieve Safe Mobility for Everyone?

Summary Discussion Featuring Remarks from Patricia Hu, Victoria Sheehan, Joe Zietsman, and Steve Kuciemba



Patricia Hu (Bureau of Transportation Statistics (former))

Ms. Pat Hu began her remarks by noting that early estimates suggest, encouragingly, that traffic fatalities appear to be trending downward in 2024. However, she noted, pedestrian deaths are the highest they have been since 1980, and motorcyclist deaths are the highest since 1975. She stated there are three big contributing factors: speed, impaired driving, and not using a seatbelt. She stressed that we need specific strategies to tackle high-risk drivers. Three out of seven drivers involved in a fatal crash exhibited at least one of these three risky driving behaviors. Though, she noted they were not mutually exclusive and were often interactive. She then presented the safety triangle to frame the escalation of risk starting with an unsafe act, then moving to a near-miss, a minor injury, lost-time or a major injury, and ending with a fatality. She put forth four recommendations. First, it is necessary to improve our understanding of the link between fatalities and minor injuries, all the way through the pyramid to near-misses and unsafe acts. She stressed that we have not mined the data enough to fully understand the relationship between all of these tiers yet. Second, she recommended

targeting research barriers to Safe System approach implementation, stating that we need to understand what stops us from getting where we need to go. Third, she stated a need to reframe the conversation about data gaps; there is a need to pivot focus and talk about the problems that cannot be solved because of data that is missing or that is not even being collected. And finally, she recommended addressing safety concerns over reduced and unmet mobility needs, particularly for vulnerable populations.

Victoria Sheehan (Transportation Research Board)

Ms. Victoria Sheehan began by providing background on the Transportation Research Board (TRB) and its duties. She put particular emphasis on presenting work to practitioners to ensure that the research is put into practice. She highlighted a recent study focused on saving lives through research and action, which asked how to accelerate the pace of change and ensure that the products of research get into the hands of practitioners. In this study, they were charged with recommending improvements to the process of conducting road safety research, and more importantly, how it translates into practice ([National Academies of Sciences, Engineering, and Medicine, 2024](#)). She stated that the U.S. is behind in traffic safety—that the country is failing while others are making progress. A lot of very good work has been done, but is not yet translating into better safety outcomes. She argued that the research and the work is being siloed, and that measurements of the effectiveness of these solutions are not being measured at a prescribed frequency, which makes it difficult to get data that enables a compelling case for investment. She stressed that there is a need for researchers to strengthen their relationships with traffic safety practitioners. She suggested emulating the medical field's approach to updating practitioners, who are provided with accessible information about the most recent guidance on given treatment protocols. She advocates this field should similarly aim to curate all research content and deliver it in a way that makes it transferable and usable by practitioners. She also commented on how disjointed funding, which is allocated to individual projects, can make it harder to synthesize results on effectiveness. In summary, barriers to progress include multiple parallel, siloed, duplicative programs; a lack of an integrated data-driven strategy; and a lack of structured processes to translate research into practice. Her recommendations included a Safe System approach with a comprehensive research strategy; ongoing evaluation of countermeasures; harmonizing guidance, education, and training; and national implementation.

Joe Zietsman (Texas A&M Transportation Institute)

Dr. Joe Zietsman began by speaking to the need for greater understanding of the safety implications of electric vehicles (EV) in crashes given their increasing numbers on the roads. He pointed out that EVs are much heavier than their conventional internal combustion engine counterparts, and that their center of gravity is very low. He warned that investigations at the Texas A&M Transportation Institute have demonstrated that EVs may pose underappreciated challenges for existing transportation infrastructure.

For example, he noted that in guardrail crash testing, these larger heavier EVs “crashed through the guardrail like a hot knife through butter.” He also spoke about the merits of using interdisciplinary teams in conjunction with law enforcement during crash investigations, as is done in Germany. He explained that an advantage of this approach is providing a much more holistic understanding of what has occurred. He closed his remarks by emphasizing that an innovative approach is needed for an initiative like Vision Zero to be successful. He stated that it will need to be an approach that includes varied stakeholders, collects and employs data that are focused on specific questions, garners public support by changing the culture, and applies a holistic “system of systems” lens to problem solving.

Steve Kuciemba (Institute of Transportation Engineers)

Mr. Steve Kuciemba began by highlighting the need for a national cultural shift that prioritizes safety. He presented the Institute for Transportation Engineers’ (ITE) transportation safety action plan from 2025 to 2027. The action plan includes five primary pillars: student engagement, professional development, ITE initiatives, technical resources, and partnerships. First, he believes it is important to better integrate road safety culture into curriculums, from K-12 programs to college engineering programs and student chapters. Second, he encourages this perspective in professional development resources, like the Safe Systems approach certificate program. He added that, encouragingly, the Road Safety Professional certification is currently one of the fastest growing. Third, he stated that ITE has a duty of care—that it is the obligation of every transportation professional to take safety seriously and elevate it to the top of the priority list. Fourth, he aims to keep increasing technical resources by continuing to issue recommended practices and guidelines. He stated that issues like near-misses are a very high priority for ITE, and that there is an ability to do so much more with the data we have or have the ability to collect. Finally, he spoke about how critical partnerships are to this kind of large-scale effort.

Q&A Session

1. How do you define or characterize a near-miss, and what can we do about them?

Ms. Hu explained that near-misses can be grouped into two “buckets”: (a) incidents that meet certain reporting requirements, which are reported to agencies and collected by the U.S. DOT, and (b) incidents below reporting requirements, which are the “boots-on-the-ground” sources, for example from a bus driver who experiences or witnesses a near-miss.

Ms. Sheehan added that TRB informs a lot of design standards. She stated that we need to do a better job articulating what the true needs are. She explained that, for

example, the fact that a location does not have a history of crashes does not necessarily mean that it is safe, as there could be countless near-misses, and a future incident could result in a fatality. We want 50 to 100 years of value from infrastructure, and we need to start thinking about how to future-proof those investments.

Mr. Kuciemba added that small municipalities do not have the resources to handle everything; thus if we could create tools that help guide them and encourage coalitions of multiple agencies to get together, it could help.

2. How is near-miss “boots-on-the-ground” data collected and stored? Is passive data collection, like mounted video cameras, an option?

Ms. Hu explained that in the example of the bus driver that she cited in response to the previous question, there is a need for cooperation from the labor unions, which was not easy to achieve. Additionally, it is very important to protect their data. As a federal statistical agency, the Bureau of Transportation Statistics had the legal authority to protect their identity, thus their data could not be subpoenaed or requested through FOIA, increasing people’s confidence that the data would be kept confidential. This is important because members are often fearful of retribution from reporting.

Mr. Kuciemba added that there are lots of technology- and infrastructure-based options. Agencies are sometimes afraid of collecting data like video due to concerns about liability and about being sued. There are still policy issues that need to be worked through.

3. How is Germany is going about collecting crash site data differently?

Dr. Zietsman explained that in Germany, crash investigations are more multidisciplinary. For example, investigation teams include health experts, those who understand the infrastructure, those who understand the weather, etc. They collect over 2,000 pieces of data. The key thing is bringing all that data to a centralized location for analysis.

4. For the IIHS goal of “30 by 30,” what is one important thing that needs to happen to actually reach that goal?

Mr. Kuciemba stated that the first pillar of ITE’s plan is focusing on the youth. For example, he noted that within his lifetime we did not have seatbelts and airbags in cars and people did not wear helmets when riding bicycles, but there has been a cultural shift.

Dr. Zietsman added that there are a lot of opportunities for technology to save lives. While a technology could have an impact fairly quickly, the challenge is getting it to

market. We need to get resources to these partners with ideas. We need to get them through the “valley of death” so their technologies can get to market, get to scale, and save lives.

Ms. Sheehan emphasized the need to strengthen collaborations and partnerships. If the practitioners cannot figure out a way to accelerate the pace of change, then we are failing as an industry. We should be proud of the work that has been done and the solutions that have been discovered, but we need to figure out a way to effectively get them into the hands of practitioners. If these valuable resources are not reaching them for implementation, then they are not being used to combat these issues. It leads to “silos of success.”

Ms. Hu noted that funding remains an issue. Communities with lower resources cannot take on some technical options because of the on-going costs required for upkeep. We need to provide information so policymakers and those making funding decisions understand the expected return on investment. It is not about costs, it is about how these tools can help you operate the system to save more lives. A 30% reduction in five years is a tough challenge. She suggested that cultural transformation is really going to be key in change. Like with recycling—kids are the ones convincing their parents to do it.

5. There are tradeoffs between safety and convenience. For example, we know there are benefits to lowering the blood alcohol concentration (BAC) limit from 0.08 to 0.05, but there is pushback from the restaurant industry because they believe it would hurt their bottom line. How do we find balance that allows efforts to be actionable?

Mr. Kuciemba noted that Mothers Against Drunk Driving (MADD) has been advocating for BAC reforms and in-vehicle technologies, but they get a lot of push back from automakers. It comes back to the larger cultural issue of finding “X number of lives lost in this fashion” to be acceptable. Context matters; certain solutions can be done in certain contexts. Not all of them lend themselves to national implementation. States and localities have to tailor that balance for their own circumstances.

Dr. Zietsman added that people do not want their privacy impinged upon. We have to get the community behind these initiatives and larger movement. There is a lot of numbness. Right now, we accept a certain level of deaths on our roads that are really unnecessary.

Ms. Sheehan added that the average person is desensitized to traffic fatalities, but most people do not know the root causes of these crashes. People are often horrified when they actually hear the statistics about impairment. It particularly worries them when they are thinking about their children getting out on the road. She expressed hope that people, as constituents, can demand more from their representatives. We have to show them that there is technology and solutions out there to combat these problems.

We can do something if we have the will. The privacy element is difficult to contend with. There is a need to bring a larger diversity of partners to the table.

6. Given EVs are such a small portion of vehicles on the road, if we are worried about the hazards that come from their heavier weight, shouldn't we be more worried about heavy vehicles like pick-up trucks? Are people looking into interactions of EVs with vulnerable road users?

Dr. Zietsman stated that we need holistic solutions that address the particular hazards posed by a variety of specific vehicle types. He noted that current infrastructure does not do a good job of protecting motorcyclists, either, for example. With EV ownership increasing, however, they should be considered in reference to current safety infrastructure as well. He added that both the heavier weight and quieter operation of EVs pose dangers to vulnerable road users, and that in addition to this, research is being conducted into other safety aspects of EVs (e.g., how to mitigate battery fires) as well.

Technical Sessions

Technical Session 1: Micromobility: Attitudes, Adoption, and Safety

[Session Based on Submitted Abstracts]

Exploring the Impact of Driver Attitudes and Roadway Infrastructure on E-scooter and Bicycle Safety

Eleni Christofa (University of Massachusetts–Amherst)

E-scooters are becoming increasingly popular in U.S. cities. While the frequency of crashes involving e-scooters has risen, crash or near-miss data involving e-scooter riders are scarce, limiting exploration of factors contributing to e-scooter crashes. While e-scooters share operational similarities with bicycles, which can help identify safety issues, the lack of research into the impact of infrastructure and driver attitudes on e-scooter safety highlights a significant gap. This study examines how driver behavior is impacted by attitudes toward e-scooters and bicycles, as well as the role of roadway infrastructure.

Existing research suggests e-scooter riders prefer smooth pavements, local roads, and bike lanes for longer trips. Sidewalk use often results in pedestrian conflicts and e-scooter rider injuries, while travel lanes see more severe injuries. Negative driver attitudes toward bicyclists are linked to aggressive driving, whereas higher cycling rates improve interactions. Wide and separated bike lanes enhance safety but are impacted by traffic volume, vehicle types, and road conditions. However, no studies have analyzed how riding surfaces and bike infrastructure affect driver behavior toward e-scooters compared to bicycles. This study aims to address this gap by evaluating how attitudes and infrastructure design influence driving behavior around micromobility users.

The study utilized a Realtime Technologies driving simulator to observe driver behavior across seven scenarios in two environments: one with bike lanes and one without. In the former environment, scenarios included an e-scooter or a bicyclist riding in the bike lane, and a control scenario with no micromobility present. In the latter environment, scenarios included an e-scooter or a bicyclist on the rightmost side of the travel lane, an e-scooter on the sidewalk, and a control scenario with no micromobility. Driver behavior was assessed by recording average speeds and the maximum lateral distance as the driver approached the micromobility in a 100-meter (328-foot) observation zone.

The study also included pre-study and post-study surveys. The pre-study survey assessed participants' familiarity with e-scooters and bicycles, while the post-study survey captured their attitudes toward e-scooters and bicycles. In all, 42 participants

aged 18 to 50, with a valid U.S. driver's license for at least one year and no history of motion sickness, were recruited. Statistical analyses, including two-sample t-tests and two-proportion z-tests, were conducted with a 95% confidence interval.

The survey showed participants were less familiar with e-scooters than bicycles. Less than half of the participants had experience riding e-scooters, while all 42 participants had experience biking. Participants preferred e-scooters on sidewalks for greater separation from motor vehicles, whereas bicycles were preferred in bike lanes. Both riders and drivers perceived the same preference for e-scooters and bicycles, highlighting the importance of greater separation from traffic to ensure safety.

The driving simulator findings showed that drivers exhibited more caution around e-scooters than bicycles. Participants drove slower and maintained larger lateral distances when interacting with e-scooters, particularly when they were on sidewalks or travel lanes. E-scooters in travel lanes also elicited slower speeds and wider lateral distances compared to bicycles. However, no significant differences in speed or lateral distance were observed when e-scooters and bicycles were in bike lanes.

The integration of survey and simulation findings revealed that attitudes toward e-scooters played a greater role in affecting driving behavior than participants' prior experience with e-scooters or bicycles. Participants who believed e-scooter riders should pass an operating test maintained larger lateral distances when interacting with e-scooters during the experiment, indicating heightened caution. However, there was no significant difference in average speed and lateral distance based on participants' familiarity with e-scooters or bicycles.

The study highlights that drivers exhibit greater caution around e-scooters than bicycles, as reflected in slower driving speeds and wider lateral distances. This cautious behavior is likely due to the novelty of e-scooters and their perceived vulnerability compared to bicycles. These findings underscore the importance of designing infrastructure that accommodates e-scooters and promotes safe interactions between all road users. Additionally, educating drivers about e-scooter behavior and vulnerabilities could further enhance safety. Future studies should expand the sample size to enable more robust and comprehensive statistical analyses, providing a deeper understanding of behavioral differences and their underlying causes.

Identifying Factors Affecting the Uptake of Private and Shared E-scooters

Christopher Cherry (University of Tennessee-Knoxville)

Our knowledge of e-scooter use and safety is largely based on research using data from shared e-scooter companies. However, the popularity of private e-scooters is growing in many cities and riders may use private e-scooters or ride both shared and private e-scooters. To date, little is known about the extent to which this occurs or how

shared and private e-scooter riders and riding patterns differ. This knowledge could potentially have implications for policies seeking to improve safety and sustainability for this transportation and leisure mode.

This research seeks to quantify and characterize the three potential types of e-scooter riders: those who only use shared e-scooters (SH), those who only use private e-scooters (PR), and those who use both (PS) according to the characteristics of riders, their use of different modes of transportation, e-scooter riding patterns, and total amount of riding. The paper also seeks to identify the key variables associated with e-scooter uptake among these three groups.

An online survey completed in July 2023 and December to June 2024 provided valid data for 732 adult riders of shared and private e-scooters across Australia. Riders were classified into three groups based on their reported number of previous trips on shared and private e-scooters. Descriptive analyses were undertaken to gain insights into the characteristics of these three groups. Decision tree analysis using the Exhaustive Chi-Squared Automatic Interaction Detector algorithm was used to identify the most significant variables associated with e-scooter uptake across the three rider groups.

Results: SH (56.7%) was the largest group followed by PS (22.8%) and PR (20.5%). There were more female and younger riders in the SH group than the PR group, while the PS group fell somewhere in between. PR had a lower level of education and SH were more likely to be students. PR riders were more likely to hold a motorbike license (38.7%) than SH riders (10.6%). PS and SH riders used a similar mix of transportation modes, with walking and driving a car the two most common choices.

More PS riders reported that their previous e-scooter trip was for commuting than PR riders (32.5% versus 26%). Conversely, more PR riders used private e-scooters for leisure and sightseeing (41.4%) than did PS riders (35.1%). About two-thirds of shared e-scooter trips by SH and PS riders replaced walking (67.5% and 64.1%). Private e-scooter trips by PR and PS riders replaced driving at the same rate (50%).

The rate of helmet use (mandatory in Australia) by PS riders when riding shared e-scooters was similar to SH riders (81.1% versus 81.0%). When using private e-scooters, helmet use by PS riders closely matched that of PR riders (90.4% versus 94.0%). PR and PS riders had longer total riding times (trip frequency times duration) than SH riders. PS riders reported using shared e-scooters as frequently as SH riders.

The decision tree analysis showed that age was the most significant predictor of group membership. For riders aged under 29, frequencies of use of other modes of transport in the previous 12 months were second- and third-level predictors. For riders aged 29–49, education was the second-level predictor and distance to public transport and trip purpose were the third-level predictors.

The characteristics and usage patterns of SH and PR riders differ markedly. Almost a quarter of e-scooter riders use both private and shared e-scooters, suggesting that research based on data from shared e-scooter schemes and other studies solely of private e-scooter riders may be missing an important group whose characteristics do not fully align with those of either of the other two groups. The factors associated with the use of shared and private e-scooters, or both appear to differ by age group, with types of other modes used being important for younger riders and education, distance to public transport and trip purpose important for other riders. The type of e-scooter used on a particular trip, perhaps as an indicator of trip characteristics, appears to be a more important factor than rider characteristics in terms of its influence on trip purpose, mode replaced, and whether a helmet is worn.

Data-Driven Equity-Focused Analysis of Bicycle Crashes in NYC

Austin Angulo (University at Buffalo)

Bicycling has rapidly grown in New York City as a viable mode of transportation due to investments in bicycle infrastructure and shared platforms. However, inconsistencies in the systemic development of bicycle infrastructure, such as connectivity and safety features, can exacerbate safety risks. These inconsistencies oftentimes occur within and around marginalized and underserved communities, which generate inequitable disparities in bicyclist safety outcomes. This study investigates factors influencing injury severity in bicycle crashes, focusing on the interplay between behavioral, environmental, infrastructure, and socio-economic factors. Furthermore, this study highlights the methodological advantages of the Zero-Inflated Hierarchical Ordered Probit (ZIHOP) model with correlated disturbances in analyzing crash data, particularly in distinguishing between no injuries (structural zeros) and those with varying degrees of injury severity (one injury, more than one injury, and fatal). This research aims to investigate how bicyclist safety outcomes are distributed among varying communities and environmental factors to ultimately inform equitable safety interventions.

This study supplements the NYPD (2012–2024) dataset of bicycle crash reports with data from multiple sources including the NYC roadway infrastructure GIS database, Open-Meteo weather API, NYSDOT AADT datasets, and the U.S. Census Bureau Climate and Economic Justice dataset. The ZIHOP with Correlated Disturbances model was used to analyze the combined dataset for its capacity to address the overabundance of zero-injury outcomes by distinguishing no-injury crashes from low-risk events, leading to improved accuracy and insights into safety determinants. This model also provides flexibility in defining the thresholds of explanatory variables as compared to conventional ordered models. This approach improves the explanatory power of the final model by capturing unobserved heterogeneity and correlated disturbances influencing both zero-injury and injury-severity states. Finally, this model integrates two

core components: a binary probit framework that determines whether a crash belongs to the zero-injury state or the injury-severity state and an ordered probit framework that models the severity of injuries within the injury-severity state. The analysis considers a range of factors, including crash characteristics, environmental conditions, socio-economic indicators, and infrastructure availability.

The analysis identified the following equity-related factors impacting bicyclist safety:

- Disadvantaged communities: Crashes in disadvantaged communities are associated with higher injury severities. These areas lack critical safety infrastructure, such as protected bike lanes, increasing the likelihood of severe injuries and fatalities.
- Bicycle infrastructure: Areas with fewer protected bike lanes and suboptimal road conditions show reduced probabilities of zero-injury outcomes and increased probabilities of severe outcomes. This highlights the need for equitable infrastructure investments across boroughs.
- Spatial disparities: Crashes in Manhattan are more likely to result in lower injury severities, potentially due to better infrastructure and safer road conditions. In contrast, boroughs with fewer resources experience higher likelihood to result more severe injury outcomes.
- Environmental inequities: Poor lighting, pavement defects, and inadequate lane markings are disproportionately present in underserved areas, decreasing the likelihood of no-injury outcomes and increasing risks for bicyclists.

Other factors identified by the ZIHOP model include the following:

- Improper driving behaviors: A major contributor to severe and fatal injuries, particularly in areas with high commercial vehicle activity and violations of traffic rules by drivers.
- Temporal factors: Crashes occurring between 6:00am–12:00pm were likely to result in no injuries, suggesting lower exposure risks during these hours.
- Weather and road conditions: Adverse weather conditions increase crash severity, and roadways with higher speed limits will lower severity thresholds, making severe injuries more likely.

This study highlighted critical factors shaping bicyclist safety outcomes in NYC through advanced statistical modeling. Specifically, this study revealed inequities in infrastructure allocation and higher bicycle injury risks in marginalized communities. Additionally, other factors including improper driving behaviors and adverse weather also significantly influenced bicyclist injury severity. Findings from this study can be leveraged to address bicyclist safety outcomes by informing the development of equity-focused policies, identify crash and risk hotspots, and support data-driven safety interventions to promote safe mobility for all.

Technical Session 2: Assessing and Addressing Knowledge Gaps Related to Vehicle Technology

[Session Based on Submitted Abstracts]

Characterizing Clusters of Road Users Based on Quality of and Confidence in Mental Models of Adaptive Cruise Control and Lane Keeping Assist

Justin Mason (University of Iowa)

Advanced driver assistance systems (ADAS) refer to vehicle technologies that support the driving task by issuing warnings, intervening with temporary control, or automating part of the driving task. New vehicles are increasingly equipped with ADAS as standard features, and these technologies and their use stands to impact safe mobility for road users. The increasing prevalence of ADAS leads to changes in the knowledge, skills, and behaviors required by drivers to safely operate their vehicles. Drivers often learn about the ADAS on their vehicles over time, from educational material or training, and through trial and error. This study provides insights into consumer preferences shaped by different levels of understanding, confidence, attitudes, and perceptions of adaptive cruise control (ACC) and lane keeping assistance (LKA). This presentation summarized the findings from a national online survey that examined experiences with ADAS, learning preferences, and driving habits from 2,528 participants, representative of the U.S. population, based on age, race, and gender. Road users' understanding of ACC and LKA were evaluated using mental model assessments. Four distinct clusters (Weak Confident, Strong Confident, Weak Unconfident, Strong Unconfident) of road users emerged, based on road users' mental models as well as confidence in their mental models revealing some important patterns pertaining to their exposure to consumer education, consumer education preferences, use of ACC and LKA, and driving self-efficacy. Findings suggest that road users with a strong understanding of ADAS are younger and prefer relying on videos and internet to find educational material compared to learning about vehicle systems from the owner's manual or by trial and error. Road users in the confident groups (Weak Confident & Strong Confident) reported safer driving and had more positive attitudes toward technology. The confident groups also reported higher levels of familiarity, trust, and ownership of ACC and LKA systems compared to the unconfident groups (Weak Unconfident & Strong Unconfident). Of the road users in the Weak Confident group, 42% reported owning ACC and 30% reported owning LKA compared to 18% (ACC) and 8% (LKA) in the Strong Unconfident group ($p < 0.001$). The confident groups reported using ACC and LKA more often than the unconfident clusters ($p < 0.001$). Interestingly, the Weak Confident group reported using ACC and LKA more often than the other groups ($p < 0.001$). This study implies that while experience can aid drivers' understanding about the systems, it may not necessarily lead to a sufficient and accurate assessment on how the U.S. population is using ADAS and the

importance of targeted education about ADAS. Educating drivers about their roles and responsibilities while using ADAS may promote safe mobility for all road users.

An Investigation of Differences in Driver Opinions and Motivation for Training Engagement with L2 Systems Using the ARCS Methodology

Richard Greatbatch (Virginia Tech Transportation Institute)

The objective of the focus groups and subsequent qualitative analysis was to find guidance to refine the development of the L2 system training modalities and ascertain whether flip charts, in-vehicle demonstrations, in-vehicle videos, and interactive training should be further tested, combined, or removed from further research. The objectives were investigated using the following research prompt categories:

- Pre-training prompts: These questions assessed drivers' uses for ACC and learning strategies.
- Post-training prompts: These questions asked drivers' opinions of the four training modalities developed by the researchers.
- Final thoughts: This prompt was used as a final unstructured time to allow drivers to give their opinions and final thoughts outside of the structured research questions.

Participants who owned and drove vehicles equipped with L2 systems were recruited from the New River Valley and Northern Virginia areas for this study. The team conducted four focus groups comprising seven or eight participants with each focus group session lasting approximately 90 minutes. Focus groups were recorded for later transcription and coding. During each focus group, researchers used prompts to gain insight into participants' thoughts, opinions, and experiences of L2 systems and how they learned to use those systems. Researchers also showed examples of four types of training modalities: flip charts, in-vehicle demonstrations, in-vehicle videos, and interactive training. Participants then responded with their opinions on each training modality.

After the focus groups were completed, researchers transcribed and coded data into one of four components of the ARCS methodology. The ARCS methodology is an educational strategy that aims to improve the impact motivation on learning materials or experiences ([Keller, 1983](#)). There are four components of the ARCS Model—attention, relevance, confidence, and satisfaction. Participant responses were then further categorized themes of each ARCS component and assigned an attribute (i.e., was the response positive, negative, or neutral) based on the inflection given by the participant.

For the attention component, the most common themes identified indicated that participants would like training that is easy to use and convenient. Participants also identified that the in-vehicle video would capture their attention. The relevance

component indicated that the largest theme involved using trial and error to learn systems, both while driving and not driving. Participants also identified that they would like to learn at their own pace with training that is not complex. Responses categorized under the confidence component reflected participants desire for comfort and understanding of the vehicle as key themes in instilling their confidence, as well as understanding of system limitations and system sensitivity. The satisfaction component showed that participants had the highest number of themes and system satisfaction was imperative for system use.

The four focus groups provided valuable insights into how drivers learn about new technologies and what training modalities they thought would be most motivating. Overall, participants indicated that they want training that is easy to use, convenient for when and how they would like to learn, and gives them an understanding of how and in what scenarios the L2 system will operate. Participants also indicated that trial and error was a large facet of learning, which supports the need for training that aligns with driver needs to increase the chances of drivers engaging and completing training. Participants best liked the idea of an in-vehicle video or interactive training. They thought the flipbook would be good as a supplemental reference. They were not enthusiastic about having someone from a dealership train them in person.

Training the Next Generation of Drivers on ADAS

Justin Owens (University of North Carolina)

Novices are currently learning to drive during a transition from traditional manual vehicle control, in which drivers are responsible for modulating all aspects of longitudinal and lateral control, to driving using ADAS technology that is increasingly able to temporarily automate control of one or more driving control tasks such as throttle, braking, and/or steering. While such partial automation features may be stepping stones to full vehicle automation, at present they provide—at best—imperfect and unreliable driver assistance.

Partial automation systems can help reduce workload for experienced drivers in certain situations such as traffic jams and highway driving but are not replacements for driver engagement with the driving task and supervision of system performance. Drivers must maintain constant vigilance to detect errors and situations that exceed system limits, such as a system inability to detect a stopped vehicle in time to avoid collision, and must be capable of executing rapid, appropriate control maneuvers when exceedances or failures occur. Similarly, collision avoidance features such as blind spot alert, forward collision alert, and rear cross-traffic alert can help prevent or mitigate potentially serious mishaps but still require the driver to exercise appropriate caution and glance behavior.

Each aspect of these requirements may prove especially challenging for novice drivers for three reasons: first, because novices may not understand the proper use and

limitations of such systems, either in general or for the particular vehicle they are driving; second, because it is possible that over-reliance on such systems during driver training may result in insufficient vigilance and/or manual control skills; and third, because many vehicles currently on the road do not have such systems, potentially leading to misperceptions about the driver's role. For example, it is conceivable that a driver who has learned on a vehicle with a blind-spot alert system may not learn to properly adjust mirrors and conduct check glances, which could lead to a collision when driving a vehicle without such a system. Complicating matters further, adult drivers may have misperceptions of system capabilities (e.g., [Horrey et al., 2021](#); [DeGuzman & Donmez, 2021](#)) and these would likely transfer these to their teens during supervised practice driving.

There is no simple solution to the challenges associated with teaching novice drivers to appropriately utilize ADAS, especially given the rapid pace of technology change and the variance of system names and capabilities across vehicles. Teaching novices to drive using purely manual control may provide them the necessary skills to operate any vehicle, including when vehicles with partial automation fail, but does not support the appropriate use of ADAS; training new drivers in the general use of ADAS may support more generalized knowledge, but with a lack of understanding of the specific capabilities of their primary vehicle; and training the use of specific ADAS systems poses a scale challenge and reduces generalizability.

The presentation discussed the issues surrounding the training of novice drivers when using partial automation, including the following:

- Teaching novices the variety of ADAS types, controls, capabilities, limitations, and operational design domains, and how to identify these for an individual vehicle
- How to ensure sufficient training and experience with manual control tasks
- The importance of maintaining vigilance

The presentation also noted research needs including the following:

- The development of comprehensive training and outreach materials for novices and parents, including recommendations for integrating ADAS training into driver training curricula and parental training literature
- Evaluation of novice driver understanding of system capabilities and limitations
- Considerations for novice drivers with neurodivergence and disabilities

Beyond the formal presentation of these issues, the presentation engaged the audience in discussion to identify additional areas of research and practitioner need, and next steps to improve novice driver understanding of and safe driving with evolving ADAS.

Technical Session 3: Addressing Work Zone and Incident Safety

[Session Based on Submitted Abstracts]

Evaluating the Accuracy of Work Zone Data in Crash Reports Using Lane Closure Records

Yang Chen (University of Wisconsin–Madison)

Work zones play a vital role in maintaining and enhancing road infrastructure, ensuring the long-term functionality and safety of transportation networks. However, they often lead to significant traffic disruptions and heightened safety risks for both road users and workers. Recognizing these challenges, improving work zone safety has become a critical focus area in the strategic safety planning efforts of transportation agencies. Effective work zone safety analysis requires comprehensive data on crashes, work zones, and other factors. The Model Minimum Uniform Crash Criteria (MMUCC) standard defines work zone–related data elements for crash reports. However, the work zone data elements included in the MMUCC standard are limited in scope, restricting their ability to capture the full complexity of work zone environments and associated risk factors. Additionally, the accuracy of these data elements is often difficult to verify, leading to potential discrepancies and inconsistencies that can hinder effective safety analysis and planning. Addressing these limitations is essential for developing robust solutions to improve work zone safety and reduce crash risks.

Some states have built a work zone management system, which could be a valuable work zone data source if the work zone records can be linked to work zone crashes. In Wisconsin, a new generation of the Wisconsin Lane Closure System (WisLCS) was deployed in 2022, with an improved data model for work zone location, time, and lane configuration, along with other features. Leveraging the work zone records from WisLCS and the crash reports in the state crash database, we developed an algorithm to correlate crashes and work zones. As the first step, we used the correlation results to assess the accuracy of the work zone information in the crash reports in this study. Four categories of crashes are based on the correlation results:

1. Work zone crashes within work zones
2. Non-work zone crashes not in work zones
3. Work zone crashes not in work zones
4. Non-work zone crashes within work zones

The first two categories are cases when the two data sets (crash and work zone) are consistent, and the latter two are the discrepancies. The ratios of the four categories were similar to a previous study using Wisconsin data from a decade ago, and the discrepancies are not negligible. One hundred crashes were randomly picked from the

latter two categories and manually analyzed to investigate the underlying causes. The findings indicate that a considerable number of the discrepancies are due to misunderstandings about what work zone crashes are and what work zones are. For example, a car hitting a street swiper was considered a work zone crash, and a crash in a congested work zone was marked as caused by the congestion but not work zone related. Those results highlight the need to improve training materials to include more comprehensive examples to ensure accurate data entry.

Furthermore, the approach developed from this study has the potential to serve as a foundational framework for work zone safety tools. By integrating the algorithm and insights gained from the analysis, these tools could streamline the process of identifying and addressing data discrepancies, enhance the accuracy of crash reporting, and support real-time monitoring of work zone activities. This could ultimately improve decision-making and foster safer and more efficient work zones.

Traffic Incident Management (TIM) Planning for Major Construction Projects

Susie Paulus (Lakeside Engineers)

Work zones present distinct challenges for incident responders. These challenges include limited access, narrowed lanes, few refuge points, physical barriers, and reduced visibility. All these factors contribute to an elevated likelihood of incidents occurring within work zones and amplify the impact of even minor incidents on traffic operations in those areas. This session provided an overview of the incident management process, discussed the purpose and goals of an incident management plan, identified the special needs and concerns when managing traffic incidents within a work zone, and discussed the advantages associated with deploying effective incident management strategies within a work zone.

The on-going I-41 Appleton to De Pere expansion project was discussed including how TIM planning was conducted before construction began, how the execution of the plan worked in 2024, and updates that were completed after the first construction season.

Optimizing Alert Systems for Traveler Information Apps: A Study on Alert Impact on Driver Response to Road Incidents

Saquib Mohammed Haroon (University of Arizona)

Efficient incident management on roadways is vital to ensuring public safety and minimizing disruptions. Traveler information apps, designed to provide critical incident information to drivers, have the potential to improve safety by delivering alerts about crashes, work zones, and road closures. Traveler information apps have advantages over commercial navigation apps as they have accurate and efficient information reported by

public agencies over crowd-sourced information in other traditional apps. However, unlike traditional navigation apps, these apps do not provide turn-by-turn navigation, which presents unique challenges in designing an alert system that efficiently delivers vital information to drivers. This study aimed to identify the most effective alert types for use in traveler information apps to enhance driver responses to road incidents. The primary goals were to evaluate how different alert types and timing impact driver behavior, response times, and overall engagement while identifying user preferences for alert content and timing.

To address these objectives, we used a combination of a driving simulator, eye-tracking technology, and post-survey questionnaires to assess driver behavior and preferences. A diverse group of 40 participants, balanced by gender and representing various racial backgrounds, completed the IRB-approved study. This number was identified to ensure statistical significance with the number of variables studied. Participants were between 18 and 64 years old, ensuring a broad range of driver experiences. Each participant drove a simulated five-mile stretch of highway featuring a crash scene designed to replicate a realistic driving scenario where road incidents may occur.

The alert types tested in the study included four distinct categories:

1. Alerts providing only the incident type (e.g., crash, work zone, road closure)
2. Alerts providing the incident type along with the distance to the incident
3. Alerts including incident type, distance, and recommended driver action
4. Basic alert which contains the location of the crash.

The alerts were issued at two distances from the incident site: one mile and two miles. A balanced Latin square design was used to order the scenarios, ensuring participants' equal distribution of all alert types and distances. The alert content and the distance were within-subject design criteria, while the crash's left and right start and location (left or right) were between-subject design criteria.

The driving behavior data were collected using an RDS 100 driving simulator, capturing key metrics such as reaction time, reaction distance, speed, position, and acceleration. Eye-tracking data were gathered using Argus Eye tracking glasses to assess visual engagement with the alerts. Participants also completed a post-survey to provide feedback on their preferences regarding the alert types, clarity, helpfulness, and timing.

The study found that alerts providing detailed information, such as crash location, distance to the incident, and recommended actions, resulted in the fastest driver response times, significantly outperforming simpler alerts that only provided basic incident information. Eye-tracking data revealed that even basic alerts elicited strong visual responses, with more detailed alerts leading to higher dwell time and increased

revisit counts. Post-survey feedback showed a clear preference for detailed alerts, rated highest for helpfulness, clarity, and ease of understanding. Additionally, most participants preferred receiving alerts at least two miles before an incident, highlighting the value of early warnings to allow drivers sufficient time to adjust their response.

This study underscores the importance of providing detailed, clear, and timely alerts to drivers to improve their responses to road incidents. The key takeaway from the study is that alerts that convey essential information such as the crash location, distance, and recommended actions result in faster driver responses and are preferred by users for their clarity and usefulness. Additionally, the findings suggest that drivers are more likely to engage with alerts that offer comprehensive details, and they prefer to receive such alerts at least two miles before an incident.

These findings will be of interest to professionals involved in developing and managing traffic management systems, as well as those working on designing user interfaces for traveler information apps. The results of this study provide evidence-based recommendations that can be used to refine alert systems, making them more effective in promoting safe driving behavior and minimizing the impact of road incidents. By optimizing alert content and timing based on user preferences and behavior, transportation agencies can better support drivers in making informed decisions, improving road safety and incident management across various applications.

Technical Session 4: Emerging Countermeasures and Strategies to Address Impaired Driving

[Session with Invited Speakers]

Impaired driving is a continuing public health concern and methods for preventing driving under the influence of alcohol or other drugs have received increased focus, including methods incorporating emerging technology or addressing cannabis impairment. This session featured two presentations that provided attendees with an understanding of the state of research on and development of these two types of strategies to reduce impaired driving. In addition to addressing questions from the audience, the discussion considered the most pressing research and development needs to combat the variety of types of impaired driving and reduce the resulting crashes, injuries, and fatalities.

Correcting Misperceptions about Cannabis Use and Driving

Sarah Hacker (University of California)

The study aimed to enhance public health and community awareness by designing and deploying a comprehensive nationwide survey on cannabis use and driving behaviors, engaging 2,000 respondents across eight U.S. states. Across all participants, 85% reported driving the same day they used cannabis, with breakdowns by state legality showing 78% in fully legal states, 87% in medicinal-only states, and 88% in non-legal states. Within this group, risk classification revealed that 53% were ultra-high risk (driving within one hour of use), 20% high risk (within three hours), 12% medium risk (three to eight hours), and 15% low risk (next day or more). This nuanced risk stratification accounted for product variability, dosage, and user tolerance, underscoring the complex landscape of cannabis-impaired driving behaviors nationwide.

Messaging around cannabis-impaired driving elicited polarized responses across risk groups. The ultra-high-risk group rated message appeal—defined as “extremely” or “very” appealing—at below 50% for all messages tested, whereas high- and medium-risk groups rated these categories above 50%, sometimes reaching as high as 72%. The message “Feel Different, Drive Different” stood out, with 62% of total users indicating they were “very likely” to increase their wait time before driving after use, 58% “very likely” to take alternate transportation, 60% “very likely” to stay put, and 29% “very likely” to reduce cannabis use; these were the highest ratings in each behavior category among all messages tested. Trusted sources—including doctors, scientists, cannabis industry representatives, and safe driving advocates—were identified as critical messengers, particularly dispensaries in fully legal states. These findings suggest that non-preachy, fact-based messaging can positively influence attitudes and behaviors,

encouraging many users to reconsider driving after cannabis use for their own and public safety

Incorporating Emerging Technology to Detect Impaired Driving

Timothy Brown (University of Iowa)

In 2023, the National Highway Traffic Safety Administration (NHTSA) issued an Advanced Notice of Proposed Rulemaking on Advanced Impaired Driving Prevention Technology in response to the Infrastructure Investment and Jobs Act, which requires NHTSA to conduct rulemaking with regard to preventing or limiting vehicle operation when a driver is impaired. This has increased the focus on how to detect impaired drivers during vehicle operation and how to mitigate the effects of the impairment. Methods for monitoring the driver to derive their current state using vehicle-based, environmental-based, or driver-based sensors hold the promise of identifying the driver's state (impaired/unimpaired). With the increased presence of these sensors in increasingly automated vehicles, the feasibility of access to this data continues to increase. This presentation reviewed the current state of technology in this area, discussed the challenges of detecting and differentiating types of impairment, and provided insights from research studies with drowsiness, alcohol, and cannabis.

Technical Session 5: Understanding Risk Factors: Driving Styles, Aging, and New Approaches

[Session Based on Submitted Abstracts]

The End of the Beginning for Telematics Data: Pioneering the Next Revolution in Road Safety Insights

Alexander Kerin (Cambridge Mobile Telematics)

Telematics data has fundamentally reshaped the discussion around analyzing and addressing road safety challenges. By leveraging data streams from vehicles and devices, such as hard braking and speeding events, we have seen the emergence of intuitive visualizations like heatmaps that highlight high-risk areas. These tools have provided agencies, municipalities, and researchers with unprecedented visibility into road safety trends and patterns, enabling targeted interventions and policies. Yet, while these innovations mark significant progress, they are only the beginning.

This presentation explored the next frontier for telematics data in road safety. The current paradigm often oversimplifies the complex interplay of factors that contribute to risk, limiting our ability to create comprehensive solutions. By moving beyond foundational metrics like hard braking and speeding, we can unlock deeper insights into road safety dynamics. Key advances on the horizon include the following:

1. **Intersection vs. Mid-Block Analysis:** Telematics data must be refined to distinguish between risks at intersections and mid-block segments. Intersections present unique hazards due to increased traffic conflict points, pedestrian activity, and variable signalization. Combining telematics data with geospatial road network metadata allows for nuanced insights that can inform intersection-specific safety interventions.
2. **Scientifically Proven Risk Scores:** Current telematics metrics, while insightful, lack comprehensive frameworks to quantify risk holistically. Future approaches will incorporate multifactorial risk scores that synthesize telematics events, crash history, road geometry, and traffic volume to identify systemic issues. These scores will help prioritize investments and interventions more effectively.
3. **Integration of Crash and Contextual Data:** The inclusion of historical crash data, traffic citations, and metadata about road conditions or intersection configurations can contextualize telematics observations. For example, pairing hard braking data with crash reports can reveal whether certain maneuvers are leading indicators of collisions, creating actionable correlations for predictive modeling.

4. **Equity in Road Safety:** Disparities in traffic safety outcomes across socioeconomic groups remain a critical issue. By integrating data from underrepresented areas, such as underserved neighborhoods with inadequate infrastructure, telematics tools can prioritize equitable safety initiatives. Identifying and addressing risk factors in these communities will ensure fairer distribution of resources and interventions.
5. **Speeding Relative to the Limit:** Generic speeding data lacks the nuance needed for effective risk assessments. By analyzing deviations from posted speed limits, telematics insights can identify where excessive speeds pose disproportionate risks, especially near schools, hospitals, and other vulnerable locations.
6. **Vulnerable Road Users (VRUs):** Pedestrians, cyclists, and other non-motorized users are often omitted from telematics analyses. Incorporating VRU data into telematics-based safety platforms will enable more inclusive solutions, such as improved crosswalk designs, dedicated bike lanes, and targeted awareness campaigns.
7. **Measuring Intervention Effectiveness:** The efficacy of interventions, such as traffic calming measures or updated signal timings, often goes unassessed. Telematics can fill this gap by monitoring changes in driving behaviors and collision rates before and after interventions, providing data-driven feedback loops to refine strategies.

This evolution will require enhanced collaboration between telematics providers, policymakers, and transportation researchers. It will also demand new data collection and processing methodologies, including advanced machine learning algorithms capable of synthesizing diverse datasets into actionable insights.

In conclusion, while telematics has revolutionized the way we understand road safety, its full potential remains untapped. By advancing beyond hard braking and speeding heatmaps, we can build a robust, equitable, and scientifically grounded framework for reducing traffic fatalities and improving road safety for all. This session outlined a roadmap for this transformation, offering actionable strategies to harness telematics data for the next generation of road safety solutions.

Understanding Driving Styles: Differences in Personal Characteristics, Cultural Attitudes, and Beliefs

Rebecca Steinbach (AAA Foundation for Traffic Safety)

Reducing risky driving behavior and conversely encouraging safe driving behavior are important contributions to “Safer People,” a key pillar of the Safe System Approach. However, changing behavior is challenging, as “driving styles” develop into habits over people’s lives, guided by a variety of factors including personality,

demographics, driving experiences, vehicle characteristics, and both the physical and cultural environments. Further, the way drivers understand their own driving style may guide which countermeasures they are most receptive to. This presentation explores driving styles in-depth using both quantitative and qualitative data to unpick differences in personal characteristics, cultural attitudes, and beliefs and to hypothesize how these differences may influence amenability to countermeasures.

First, a latent class analysis of survey data on self-reported engagement in risky driving behavior was used to classify drivers into driving styles. Next, using a Bolck, Croon, and Hagenaars correction to account for misclassification bias; associations between driving style and demographic, geographic, vehicle-related, and driving-habit characteristics were explored, along with differences in attitudes and beliefs. Survey data comes from the 2023 Traffic Safety Culture Index (TSCI), a nationally representative survey of over 3,000 Americans recruited from a probability-based panel. Findings were then triangulated with a thematic analysis of qualitative data generated from eight focus groups to empirically examine the ways in which drivers talk about their own driving style. Implications for matching countermeasures to driving style were discussed.

Based on the patterns of self-reported risky driving behavior engagement, the latent class approach identified five unique groups:

- Safe Drivers (34.9%): Rarely engaged in any risky driving behavior
- Distracted Drivers (19.0%): Predominantly engaged in all distracted driving behaviors
- Speeding Drivers (32.6%): Predominantly engaged in speeding behavior only
- Distracted and Aggressive Drivers (11.0%): Predominantly engaged in both distracted driving and aggressive driving behaviors, including speeding
- Most Dangerous Drivers (2.5%): Engaged in all risky driving behaviors

Comparing the distribution of demographic, geographic, vehicle-related, and driving-habit characteristics across driving styles helped paint a detailed picture of who these drivers were, beyond their risk tendencies. There was strong evidence that driving style differed by age, sex, educational attainment, presence of children in household, marital status, age of vehicle, presence of vehicle safety features, and driving frequency. Perceptions of danger and social disapproval varied by driving style; however, there was little evidence that perceptions of risk of apprehension differed by driving style.

In focus group discussions, drivers rendered rich descriptions of their own driving styles. While many drivers described a “cautious” or “courteous” driving style, others described their style as more “aggressive” or “offensive.” These descriptions helped shed light on mechanisms linking associations between driving style and factors noted in the quantitative findings. For instance, participants noted that frequent driving could lead to higher levels of confidence behind the wheel and feelings of ownership over the road. These feelings, in turn, could translate into risky behaviors such as

speeding or aggressive driving as drivers proved their self-proclaimed superior driving ability by demonstrating these otherwise risky behaviors in a “safe” and “considerate” way.

These findings are critical to our understanding of the different types of drivers currently on U.S. roads and are useful for generating hypotheses on what types of countermeasures may work to curb risky behavior among different driving styles. For instance, triangulating quantitative findings indicating that Speeding Drivers perceive speeding behaviors as comparatively less dangerous, with qualitative findings that engaging in speeding behavior is a way to signal a superior driving ability, may indicate that educational campaigns highlighting the dangers of speeding may be less salient for those with a Speeding driving style. Instead, findings that Speeding Drivers tend to drive vehicles with more safety features suggest that vehicle solutions may resonate better with this group.

Health and Demographic Predictors of Driving Avoidance in Older Adults

Alan Mintz (Dunlap and Associates, Inc.)

Older adults often face increasing challenges with driving due to natural age-related changes in physical, cognitive, and visual abilities. These changes can make certain driving conditions (e.g., nighttime, bad weather, or high-speed interstates) more hazardous. Many older adults choose to accommodate by avoiding driving in these demanding situations. This study aimed to investigate the extent that health-related factors could predict driving avoidance behaviors in a sample of older adults. Additionally, this research examined the relationship between demographic factors and driving avoidance to identify potential contributing influences. The findings from this study are intended to provide data on the driving habits of older adults and to better understand how health-related factors may influence their decision to avoid challenging driving conditions. This work provides valuable insights that could inform strategies to enhance driving safety and mobility among older populations.

This study conducted secondary analyses of driving avoidance behaviors among 72 older drivers, aged 65 to 85 years old. These analyses examined the relationship between participants' driving avoidance behaviors and their scores on a battery of health assessments. Driving avoidance was self-reported using a five-point Likert scale, ranging from “never” to “always” avoiding specific situations, such as driving at night. Demographic data did not demonstrate significant correlations with driving avoidance, except for gender, which was incorporated into the statistical models. Linear regression analyses were conducted for each individual driving avoidance question and for the numerical average of responses. Model predictors included physical, cognitive, and visual health composite variables, along with gender. Composite health metrics were developed by identifying intercorrelated assessment outcomes in the physical, cognitive,

and visual health evaluations. These variables were normalized and aggregated to create a single score for each domain:

- Physical health: 360-degree turn test and timed get-up-and-go test
- Cognitive health: Useful Field of View, NAB Mazes, Trails B, and Wechsler Memory Scale assessments
- Visual health: Visual acuity and Pelli-Robson contrast sensitivity tests

Regression analyses identified composite scores for physical, cognitive, and visual health, as well as gender, to be statistically significant predictors of driving avoidance behaviors. The analyses indicated that women tended to avoid driving in potentially dangerous conditions more frequently than men. Additionally, individuals with poorer physical, cognitive, or visual health reported more frequent driving avoidance than those with better health metrics. Specifically, gender and physical health were found to predict average driving avoidance ($p < 0.05$). Female participants demonstrated greater driving avoidance at night, on high traffic roads, in unfamiliar areas, and on high-speed interstates ($p < .05$), as well as in bad weather ($p < 0.10$). Poorer physical health was a key predictor of avoiding driving at night and making left hand turns across oncoming traffic ($p < .05$). Cognitive health was marginally significant in predicting avoidance of night driving ($p < 0.10$), and visual health was predictive of avoiding left hand turns crossing traffic ($p < 0.05$). Overall, these results demonstrate that women and individuals with poorer physical, cognitive, or visual health are more likely to engage in driving avoidance behaviors.

These findings highlight the role of health and gender in influencing self-regulatory driving decisions among older adults. The results suggest that more emphasis should be placed on understanding the physical factors contributing to driving decisions, as well as designing transportation systems that accommodate gender and physical health disparities. The limited predictive value of visual and cognitive health could stem from exclusion criteria screening out individuals who scored below the threshold for visual or cognitive health, or drivers who avoided hazardous driving frequently and did not drive often enough to be included. Future research should include a broader range of participants and assess additional health-related factors to expand the understanding of these relationships. These insights are critical for creating strategies to enhance the safety and mobility of aging populations.

Technical Session 6: Towards the Modernization of State DOTs' Crash Data Systems

[Session with Invited Speakers]

The modernization of crash data systems is essential to advancing national traffic safety goals, including the reduction of fatalities and serious injuries on U.S. roadways. Accurate, timely, and detailed crash data empowers state DOTs and other stakeholders to identify high-risk scenarios, develop targeted safety interventions, and measure the effectiveness of implemented strategies.

In December 2024, NHTSA announced \$171 million in federal grants to 19 states and territories to support the upgrade of their crash data systems. These grants aim to facilitate electronic data sharing between state and federal systems, improve the accuracy of crash reports, and enhance data availability for VRU safety analysis. While many states are beginning their modernization journeys with federal support, others, such as Wisconsin, have independently advanced efforts to digitize crash databases and improve data element collection, setting a high standard for crash data systems.

This session highlighted how state DOTs are leveraging both federal funding and internal initiatives to align with the MMUCC and Vision Zero principles. Panelists discussed case studies showcasing the integration of advanced technologies, the addition of critical data fields, and the transition to digital reporting platforms. The session also addressed the challenges of coordinating across agencies and jurisdictions, ensuring data quality, and translating data insights into actionable safety improvements.

Participants gained a deeper understanding of the practical steps required to modernize crash data systems, the importance of federal-state collaboration, and how enhanced data capabilities can drive safety outcomes. These insights are crucial for policymakers, transportation agencies, and researchers aiming to “move the needle” toward eliminating traffic fatalities.

Crash Data in Arizona: Opportunities and Gaps in the Modernization Era

Alyssa Ryan (University of Arizona)

Dr. Alyssa Ryan presented the current state of crash data and data reporting in Arizona, focusing on the opportunities and challenges associated with the modernization of crash reporting systems. The presentation included a discussion on Arizona's Crash Information System (ACIS), its current capabilities, and its limitations, including data gaps in key areas such as race/ethnicity, disability status, and seatbelt usage. Dr. Ryan also discussed the ongoing Crash Hub Modernization project in Arizona, which aims to improve data access and reporting times, while reducing backlogs and enhancing overall crash data usage for various stakeholders.

Lessons from Developing a 10-State Pedestrian & Bicycle Crash

Robert J. Schneider (University of Wisconsin–Milwaukee)

Our effort to develop a 10-state pedestrian and bicycle crash database was driven by the increase in U.S. pedestrian fatalities over the last 15 years. Annual pedestrian fatalities in the U.S. have increased by more than 50% since 2010, while most other high-income countries have seen pedestrian fatalities decrease. We need a better understanding of pedestrian crash locations, causes, and circumstances to reverse this troubling trend. Our specific goal was to develop a multi-state database to analyze pedestrian crash trends between 2008 and 2021.

To create our database, we searched for states that had publicly available police-reported crash data that included, at a minimum, the crash date, hour, latitude, longitude, party type (e.g., pedestrian, bicyclist), and injury severity. While some crash data were available for dozens of states, 10 states met these baseline criteria. Some states did not qualify because they required a lengthy, formal user agreement, only provided their data on a dashboard (rather than in database form), or did not keep data that was older than 10 years.

Among the 10 states that met our baseline criteria, we still found many data inconsistencies that required significant cleaning. Time formats were recorded differently. Geocoding rates (records with latitude and longitude) were lower in earlier years in most states. Pedestrians and bicyclists were identified using person/unit type, first harmful event, crash type, or within 0/1 flag variables. Injury severity was defined differently (for “severe” crashes, in particular), and sometimes injury severity was only summarized at the crash level. Ultimately, our cleaned database was useful for conducting an eight-state analysis of fatal and severe injury pedestrian crashes at the census tract level.

The Model Minimum Uniform Crash Criteria, Version 6.0 (MMUCC6), will hopefully address some of these inconsistencies between crash databases, though it will take a number of years to be implemented across different states, and older datasets will still need cleaning for consistency. Beyond this, we wish that crash databases provided more extensive and reliable information about roadway design characteristics, pedestrian and driver socioeconomic characteristics, roadway 85th percentile speeds, and collision speeds. These could be areas for future crash database development.

Modernize Crash Narratives

Xiao Qin (University of Wisconsin–Milwaukee)

As a critical component of a crash report, the crash narrative is a police officer’s account of how a crash occurred. It often includes key contextual details such as the sequence of events leading to the crash, as well as supplemental information not captured in structured data fields. This presentation introduces several techniques to

enhance the accessibility and analysis of crash narratives. The first technique involves using natural language processing tools to identify, extract, and redact personally identifiable information, thereby improving data usability while preserving privacy. The second technique leverages large language models (LLMs) to provide a more complete and accurate narrative by integrating information from structured data. Another application of LLMs is demonstrated through the automatic generation of a Haddon Matrix from the crash narrative. Finally, the presentation explores text mining techniques, including network diagrams and semantic analysis, to uncover deeper insights from narrative data.

Wisconsin Crash Data Systems Modernization

Steven Parker (University of Wisconsin–Madison)

Over the past decade, WisDOT has partnered with the University of Wisconsin–Madison to modernize the state’s crash data systems and improve alignment with national traffic safety standards. This effort included the introduction of a new crash report, a redesigned database, and a reorganization of data ownership. A key focus was meeting NHTSA’s performance measures—timeliness, accuracy, completeness, consistency, accessibility, and integration—supported by tools like Community Maps and engagement through Wisconsin’s seventy-two county Traffic Safety Commissions. Today, all police-reported crashes are submitted electronically and available the next day, with over 99% geo-coded by the reporting officer, enabling advanced spatial analysis and predictive analytics. Ongoing work includes aligning with MMUCC6 and further integrating crash data with other state traffic records systems to expand its impact and accessibility.

Technical Session 7: Safety and Automation: Hazard Response at Different Levels of Automation

[Session with Invited Speakers]

Iiona D. Scully and Steve Como (Exponent, Inc.)

The evolution of vehicle automation has brought about significant advancements in mobility, safety, and efficiency. This presentation delves into the SAE International (SAE) levels of automation, focusing on how both humans and vehicles may respond to hazards as automation progresses from Level 0 (no driving automation) to Level 5 (full driving automation). Understanding these responses, or lack of responses, is crucial for developing effective safety protocols and supporting optimal human-vehicle interaction. The presentation aligns with the conference theme on vehicle technology and safe mobility.

At Levels 0 to 2, ADAS requires that the human driver remains in control of the vehicle and is responsible for all driving tasks. These levels range from warnings or intermittent support such as forward collision warning and automatic emergency braking at Level 0, to sustained vehicle control of both lateral and longitudinal motion combining features like ACC and LKA for Level 2 assistance. Even under Level 2 operation with vehicles maintaining lateral and longitudinal control, the human driver must remain vigilant and ready to respond to any hazards as they remain responsible for the entirety of the dynamic driving task. Transitioning to Level 3, the dynamic shifts as both the human driver and the vehicle share responsibility for driving tasks. At this level, the vehicle can handle certain driving functions under specific conditions, allowing the driver to disengage temporarily. However, the human driver must be prepared to take over when the system requests. This dual responsibility introduces unique challenges, such as maintaining driver readiness and ensuring timely handovers. As automation advances to Levels 4 and 5, the vehicle assumes full control of driving tasks, significantly reducing or removing the need for human intervention. At Level 4, the vehicle can operate autonomously within defined conditions or geofenced areas, while Level 5 represents complete automation, with the vehicle capable of handling all driving scenarios without human input.

This presentation provided a detailed examination of the current state of the industry as it relates to human and vehicle hazard response across the levels of automation. ADASs involve rapidly evolving technology and as such, the ways in which we interface with and think about this technology are also changing. The presentation introduced the SAE levels of automation, beginning with Levels 0 through 2 and highlights recent research on how humans respond to hazards in the presence of the assistance of ADAS, as well as the vehicle's role and the capabilities and limitations in its ability to respond. Level 3 explored the evolving role of the driver, examining hazard response from the vehicle's perspective and emphasizing the importance of

communication between the driver and the vehicle through takeover requests. While Level 5 vehicles remain a future goal of full automation, Level 4 vehicles (e.g., Robotaxis) have made appearances from different providers and in different locations over the past few years. Vehicle hazard response poses interesting challenges when no human-in-the-loop is present, which introduces additional challenges beyond that of responding to potential roadway hazards. Level 0 through 5 automation is continuing to shape the future of the automotive landscape and further research will continue to reveal insight into the potential benefits in addition to challenges surrounding this technology.

Technical Session 8: Safeguarding First Responders in the Era of Emerging Mobility Technologies—Panel Discussion

[Session with Invited Speakers]

First responders—police officers, firefighters, paramedics, safety service patrols, and tow truck operators—are essential to traffic incident management and emergency response. However, their safety is often overshadowed by the focus on protecting road users such as drivers, pedestrians, and cyclists. As emerging mobility technologies like EVs and autonomous vehicles (AVs) transform the transportation landscape, first responders face new and complex challenges, including EV-related fire risks, AV operational unpredictability, and gaps in on-scene communication and protocols. This session focuses on the often-overlooked safety concerns of first responders in the context of these technological advancements. It brings together experts from diverse sectors to explore innovative strategies, policies, and tools aimed at ensuring the safety and effectiveness of first responders. Topics included the implications of EV and AV technologies on emergency response, training and preparedness for evolving mobility scenarios, and leveraging technology to enhance situational awareness and coordination. Participants gained valuable insights into the critical needs of first responders and actionable solutions to address these emerging challenges.

Protecting Those Who Protect Us on Roadways Responder Safety Research by NextGen Transportation Lab/ATI

Jun Liu (University of Alabama)

First responders—including police officers, firefighters, paramedics, and tow truck operators—play a critical role in traffic safety management. However, their own safety is often overlooked. While significant efforts are made to maintain traffic operations and protect road users such as vehicle occupants, pedestrians, and cyclists, the risks faced by first responders remain underexplored in structured research. Through national surveys conducted among first responders, this presentation underscored the critical need to ensure first responder safety, examining the challenges they encounter amid the rapid rise of EVs and AVs. The presentation also highlighted ongoing responder safety research conducted by the NextGen Transportation Lab at the University of Alabama. Featured projects included those supported by the National Science Foundation, Centers for Disease Control and Prevention, AAA Foundation for Traffic Safety, Alabama DOT, and the Alabama Transportation Institute (ATI). These initiatives aim to deepen understanding of the hazards faced by responders and to develop strategies and technologies that enhance their protection in increasingly complex and evolving traffic environments.

Remarks from Guest Panelists

John M. Sullivan (Pegram Fire Department Emergency Responder Safety Institute)

Emergency personnel that respond to roadway incidents have several critical needs to be met in order to safely operate and protect themselves, the victims, and the road user's safety. The needs are: The public's awareness that responders are working in, on, and near roadways 24 hours a day, 7 days a week, 365 days a year. Responders need to better recognize and plan on the need for advance warning to approaching traffic, and a greater ability to utilize technology and smart transportation advancements for safety. Responders also need the ability and proper resources to clear incidents from roadways safely and quickly. There are actionable solutions to meet these critical needs such as public education and outreach, responder training on roadway incident tactics and best practices, continued study and utilization of smart vehicle technology, continued outreach and partnership of emerging vehicle technologies, training and planning of EV/AV incidents and scenarios, and continuing the advancement of roadway and pedestrian safety overall to reduce fatalities. These needs can all be met using communication, cooperation, and coordination and by embracing the emergence of newer, smarter, advancing technology and developing best practices of these technologies.

Kyle Clark (International Association of Chiefs of Police) Police share many risk factors with other first responders on the side of the road, including compliance with slow-down move-over laws, adequate lighting and conspicuity, shoulder space to work within, and the duration of a roadside event. Police also have challenges unique to their function. These include uncooperative violators, limited staffing, and potential impaired driving investigations. Crash scenes and disabled vehicles can be particularly hazardous, as the site can be its own hazard, and safety threats associated with EVs can be unpredictable. Many of these factors can be effectively mitigated through the adoption and compliance of slow-down move-over laws, attentive drivers, and technology, such as vehicle-to-vehicle connectivity. Advance warning and the effective use of emergency lighting can provide important notice to traffic and help ensure a safe and orderly flow around the incident.

Technical Session 9: Effectiveness of Behavioral Interventions and Programs

[Session Based on Submitted Abstracts]

Traffic Safety Impacts of Positive Youth Development

Christine Yager (Texas A&M Transportation Institute)

Young drivers have an increased risk of car crashes compared to other age groups due to driver inexperience. This risk is exacerbated when young drivers engage in certain risky behaviors, such as distracted driving, speeding, etc. Nationally in 2022, 8% of fatal crashes involved driver distraction, resulting in the loss of over 3,300 lives ([NHTSA FARS, 2022](#)). Speeding is another risky behavior that was a factor in almost 1 in 3 fatalities in 2022 according to NHTSA data. To address the prevalence of these risky driving behaviors among young people, the Texas A&M Transportation Institute (TTI) created a smartphone app to encourage safe driving behaviors by rewarding the young user for avoiding phone use and excessive speeding while driving. Furthermore, TTI developed a peer-to-peer youth traffic safety program called Teens in the Driver Seat (TDS) to educate high school students about the top risky driving behaviors and equip them with tools to avoid these dangerous behaviors. Started in 2002 in Texas, TDS has expanded nationwide and is currently available in 29 states at no cost to the school. The TDS program utilizes frameworks like Positive Youth Development and the Theory of Planned Behavior to empower young participants to educate their peers about the top driving risks and increase youth traffic safety. In addition to the smartphone app data that is collected, TTI also collects annual surveys of high school students to understand their attitudes about and self-reported frequency of performing certain risky driving behaviors. Schools that are enrolled in the TDS program are also asked to perform field observation activities about three risky behaviors: phone use while driving, phone use while walking as a pedestrian, and seat belt use. Students first collect pre-observation data of these behaviors on their school campus and then spend 3 to 6 weeks conducting peer-to-peer traffic safety outreach about these risky behaviors. The students then complete post-observations of the same behaviors to see what kind of impact their outreach work had on the particular behavior. A recent analysis of these three data sources—the smartphone app, annual student surveys, and field observation activities—was performed to assess the effectiveness of the positive youth development and incentives approach implemented by the TDS program. The analysis of the smartphone app data looked at the effectiveness of long-term use of this app amongst young users. The young app user data collected between 2020 to 2024 was divided into two categories: short-term users (n = 732) vs. long-term users (n = 594). Short-term users were defined as those who made ten or fewer scored driving trips, whereas long-term users were those who made 11 or more scored trips. The percentage values of safe trips amongst all scored trips and average driving score values were compared between the two groups. An analysis of these two cohorts showed that long-term users had on average 69% higher

safe trip percentage values and 53% higher average driving scores compared to short-term users, supporting the idea that the app and its positive incentives help young drivers avoid distractions and form safer driving habits with long-term use. These results were statistically significant at a 95% confidence interval. An analysis of the annual student surveys from the 2023–2024 school year was also performed. Results show a good amount of consistency between the students' attitudes about and frequency of performing certain risky driving behaviors like talking on a phone (60% vs. 62%), using social media while driving (93% vs. 83%), and seat belt use (88% vs. 79%). Texting while driving (93% vs. 72%) and speeding behavior (72% vs. 56%) showed a need for improved consistency between attitudes and self-reported behavior. An analysis of the field observation activity data was conducted for each of the three types of activities: phone use while driving, phone use while walking, and seat belt use. Each of these activities started at different times in the history of the TDS program, but data was analyzed for each across all the years that they have been available for schools to complete. Results of comparing pre- and post-observation data from these activities showed a 33% decrease in phone use while driving and walking, a 5% increase in teen driver seat belt use, and a 10% increase in teen passenger seat belt use. All three of these analyses demonstrate that using the peer-to-peer, Positive Youth Development, rewards/incentives, and behavior change theory approaches have a measurable improvement in youth traffic safety and driver behavior. Additional research is needed to better understand the additional benefits and effectiveness of similar approaches over time.

Safeguarding Children in Vehicles: Evaluating Countermeasures for Pediatric Vehicular Heatstroke

Peter Burns (Transport Canada)

Pediatric Vehicular Heatstroke (PVH) is a life-threatening condition that occurs when a child left in a vehicle experiences rapid and dangerous increases in body temperature. This can result in heat-related illness, injury, or death, even with moderate outside temperatures. In the United States, over half of PVH-related fatalities occur when caregivers forget a child in a vehicle. An additional 25% result from children accessing unlocked vehicles and becoming trapped, while 20% are due to caregivers intentionally leaving children unattended (<https://www.noheatstroke.org/>). Occupant Monitoring Systems (OMS) show promise in preventing PVH fatalities. These systems rely on cameras, door-logic systems, and sensors to detect occupants and notify drivers. However, their effectiveness depends not only on accurate detection but also on timely, reliable communication of warnings to prompt appropriate interventions.

To evaluate OMS technologies, four vehicles and two aftermarket systems were tested using the 4activeOD-newborn dummy. This advanced dummy simulates human-like breathing, limb movement, and head motion to create realistic detection profiles. A test protocol based on existing methods in the literature assessed system efficacy,

reliability, repeatability, and accuracy under three scenarios: (a) a child forgotten in a vehicle, (b) a child gaining access to a vehicle, and (c) a child intentionally left unattended. Testing covered OEM and aftermarket systems, as well as combined configurations.

Rear-door logic systems demonstrated consistent reliability, but variations in alert types affected their effectiveness. Audible alerts ranged from distinct chimes to sounds indistinguishable from other vehicle alerts, with differences in duration, loudness, and trigger mechanisms (e.g., ignition off vs. door handle). Visual alerts varied in visibility and duration. Despite their promise, rear-door logic alerts may lose impact over time as drivers learn to dismiss them or confuse them with other signals. Smartphone notifications, when combined with vehicle alerts, were effective. A child seat clip sensor and rear-door logic system performed better if combined, whereas a pressure-based sensor was less reliable. Ultrasonic sensors were insufficient for infants but may be effective for older children, while mmWave radar showed superior results across scenarios.

A range of innovative OMS technologies is emerging to address PVH, with some systems already becoming standard in vehicles. However, further validation and refinement are required to ensure consistent and reliable performance. A standardized testing protocol is essential to evaluate the full range of available technologies. Human factors guidelines should be developed to optimize warning interfaces, ensuring alerts are distinct, actionable, and effectively prompt driver responses. A scoring methodology is proposed, assigning higher points to systems with distinct and prolonged alerts, multimodal alerts, saliency, and additional features like smartphone notifications or secondary exterior alerts.

Nudging Safe Driving: Assessing the Effects of a Minimal Behavioral Science Intervention on Madison Public Works Drivers' Safety

Ilknur Uludag (City of Madison)

This presentation presented the results of a randomized controlled experiment to improve safe driving behaviors including seatbelt usage, speeding, hard acceleration, harsh braking, and idling incidents among City of Madison Public Works drivers using telematics data. The goal of the study is to assess whether a minimal behavioral science-informed nudge (reminder decals on vehicles that inform drivers that their behavior is being tracked) causes safe driving.

We investigated whether visual reminders that people's driving behavior was being tracked caused them to drive more safely. We randomly assigned drivers/cars within stratified blocks of drivers based on departmental characteristics to one of two groups. In the treatment group, cars received a sticker both on the dashboard of the vehicle's cab and on the rear bumper that reminded them that their vehicle's location

and their driving behavior were being tracked. In the second (control) group of vehicles, no stickers were added to the car at all. Stickers were added to all vehicles in the treatment group in early 2023, and we measured both pre- and post-intervention vehicle telematics data from the 612 vehicles in the experiment using Geotab Telematics. We compared drivers' behavior between the two experimental groups to assess the effect of this small behavioral nudge.

Across all outcomes (overall number of trips and numbers of specific unsafe driving infractions, as well as rates of these behaviors per vehicle trip), the placement of reminder stickers on drivers' vehicles had no detectable effect on the prevalence of unsafe driving. We also investigated whether the experimental intervention had different effects on drivers with different levels of pre-treatment unsafe driving behavior, but found that the stickers treatment was not effective at reducing unsafe behavior among any subgroup.

Our null experimental findings indicate the difficulty of using "gentle" nudge interventions to change long-standing and regular behaviors. Though social pressure is well-known to produce large effects on irregular behaviors as well as socially-valued behaviors, our null effects show that influencing behaviors that are normalized (and therefore potentially not considered undesirable) may require both nudge interventions and some form of mandate or penalty.

Technical Session 10: Examples and Strategies for Safe System Implementation

[Session Based on Submitted Abstracts]

TARGET Setting for High Severity Collisions: Tolerance-based Assessment of Risk for Generalized Event Thresholds

Eamon Campolettano (Waymo)

Vision Zero represents a road safety approach with aspirations toward eliminating serious and fatal injuries associated with traffic collisions. Given the well-described relationship between speed at impact and injury outcomes, many researchers have used a variety of methodological approaches to develop speed thresholds associated with human injury tolerance levels for serious and fatal injuries. Safe speed thresholds can be used in a variety of ways, from informing speed limit policy to evaluating the potential effect of speed compliance interventions. Given that most previous studies used expert judgment, small sample sizes, or outdated data, the principal aim of this study was to present the framework for a Tolerance-based Assessment of Risk for Generalized Event Thresholds (TARGET) to support Vision Zero. This framework leverages state-of-the-art injury risk models with biomechanically relevant predictor variables and modern collision data to enable increased precision. Thresholds for safe speeds at impact, which are representative of the current traffic population, were estimated through a generalized application of these objective injury risk functions for serious and fatal injuries to present kinematic-based thresholds reflective of biomechanical tolerance limits for several common collision crash configurations.

A 10% risk at the MAIS3+ severity level was selected as the injury tolerance level, in accordance with previous research and [ISO 26262-3](#). TARGET values for safe speeds were estimated using this tolerance level. These estimates were generated for several common vehicle-to-vehicle collision configurations and for vehicle collisions with pedestrians, cyclists, and motorcyclists. All safe speed estimates were generated for both a population-average age and for a 65-year-old person to illustrate the effect of decreased injury tolerance with age. Additionally, comparisons to existing safe speed threshold estimates were made.

Leveraging models built on German collision data for VRUs, which represents the best available data source at present, the safe impact speed thresholds for an average person were 34 kph (21 mph) for pedestrians and 49 kph (30 mph) for cyclists and motorcyclists. These safe speed thresholds decrease to 18 kph (11 mph), 29 kph (18 mph), and 41 kph (25 mph), respectively for a 65-year-old person. Using models built on U.S. vehicle collision data for collisions involving passenger vehicles, the thresholds for closing speed were 99 kph (62 mph) for a frontal collision, 73 kph (45 mph) for a near-side collision, and 126 kph (78 mph) for a rear-end collision, with corresponding

decreases to 80 kph (50 mph), 59 kph (37 mph), and 103 kph (64 mph) for a 65-year-old person. The TARGET values established in this study are consistent with those previously developed, with observed differences associated with variations in inclusion criteria, data quality, and injury definitions. This work can serve as a validation of these previous studies. Safe speed thresholds for vehicle occupants were observed to vary slightly based on seating position, suggesting that vehicle occupancy is an important consideration in meeting the goals of Vision Zero.

Using a data-driven approach with state-of-the-art injury risk models built on the most modern collision data and featuring biomechanically relevant predictors, this study improved precision in safe impact speed threshold estimation, and the TARGET values presented in this study are consistent with what has been published previously when applying the framework to answer the same research question as those studies. This approach, which considers generalized biomechanical tolerance, may reasonably be applied for other injury severity levels or risk of injury thresholds, as exemplified by modeling the effect of increased age and seating position on safe speed thresholds. Given the relationships between speed and injury risk, reducing speed in a collision below these thresholds is key to mitigating serious and fatal injury outcomes. The objective injury risk approach used in this study enables traffic safety practitioners to determine the relative effect of related safety countermeasures on reaching the goals of Vision Zero and a Safe System Approach. For example, this study showed that achieving 100% seatbelt compliance could justify higher travel speeds on roads.

Safe Systems in Action: Multi-Agency Collaboration to Achieve Vision Zero on Highway 1

Katelyn Costa (Bay Area Metro Center)

This presentation explored a successful multi-agency collaboration aimed at reducing fatalities and serious injuries at the intersection of Highway 1 at Pescadero Creek Road in San Mateo County. Fatal and serious injuries have occurred at this location when drivers pass a stop sign and continue straight into a beach parking lot, ultimately driving off a cliff into the ocean. Due to the location, the area of interest has a disproportionate amount of right of way conflicts, improper turning, and DUI-related crashes compared to the county and greater Bay Area. As a result, 36% of crashes at this intersection have resulted in fatality or serious injury, whereas county wide only 8% of crashes end in fatality or serious injury.

The Metropolitan Transportation Commission (MTC) manages a multi-disciplinary Incident Management Task Force (IMTF), which focuses on the safe, quick clearance of incidents to reduce fatal and serious crashes. The group's work is rooted in a regional strategic plan that tackles incident management issues from different training, technology, operations, policy, and data perspectives. Incidents are often addressed sub-

regionally by groups of local agency personnel who identify safety issues and raise them for a coordinated solution facilitated by MTC and the IMTF.

Prompted by the San Mateo County Coroner in winter of 2023, MTC's Incident Management Team initiated a project involving key stakeholders, including Caltrans, Pescadero Fire, CHP, San Mateo County Public Works, California State Parks, and others. The project leveraged crash statistics research conducted by MTC and Caltrans, combined with on-the-ground feedback from the Coroner, CHP, and Fire Department. Quarterly meetings reviewed possible short- and long-term solutions, with Caltrans, San Mateo County, and State Parks coming to an agreement on infrastructure improvements that are predicted to reduce fatal and serious injury crashes as well as facilitate easier emergency response by local agencies.

Short-term improvements include refreshing the "Stop Ahead" signage, adding transverse rumble strips, and restriping with speed reduction markings approaching the intersection. Long-term plans involve a highway realignment where Caltrans will assume some of the State Parks' right of way. This will allow for the relocation of the parking lot entrance, preventing drivers from crossing straightaway and maintaining beach access. The County has slated countermeasures to be implemented in early 2025. Caltrans has planned for this project to enter design and environmental planning in summer of 2025.

Over the past decade, the IMTF has built strong, trust-based relationships with first responders and state agencies, becoming a reliable partner in addressing safety issues without assigning blame. The dedicated, solutions-oriented attention from local responders has prompted state agencies to act swiftly in resolving these concerns. This project exemplifies the Safe Systems Approach, which prioritizes safe roads with an acknowledgment that humans make mistakes, responsibility is shared, safety is proactive, redundancy is crucial, and of course, that death and serious injury are unacceptable. The area was previously impacted by a fatal and serious injury crash rate of 4.5x the county rate. The measures to be implemented aim to protect lives despite inevitable human mistakes.

As an outcome of this project, Caltrans has decided to complete a corridor safety study on 40 miles of Highway 1 due to the increased attention this area is receiving. Although final implementation of both the short- and long-term countermeasures is still forthcoming, this collaborative working group process has already been successfully applied in other areas.

This case study underscores the importance of multi-agency collaboration and community involvement in achieving Traffic Incident Management and Vision Zero goals. The lessons learned and collaboration best practices from this project provide valuable insights for other local transportation agencies aiming to enhance road safety and reduce fatalities.

Supporting the Safe System Approach Decision-Making Through Crash Sequence Analysis

Cesar Andriola (University of Wisconsin–Madison)

The Safe System approach represents a shift from traditional road safety thinking by designing a system with numerous redundancies and considering the vulnerability and error-prone human characteristics, moving away from a silo-based approach. Historical crash data plays a vital role in the Safe System approach by helping designers better understand the specific issues existing at a site. Traditional crash analysis, however, does not consider the elements of crash progression and contributing factors. In this context, the present study applied Crash Sequence Analysis to address the issues of traditional crash analysis, providing a holistic and comprehensive understanding of the existing crashes and their potential relationship with the Safe System approach. The method uses sequence-of-events information from crash data to generate clusters of crashes with similar underlying characteristics, providing better insights about crash progression and contributing factors. Crash sequences are sets of chronologically ordered pre-crash and crash events, which are usually extracted from police crash reports and are available in the United States' national-level crash databases. Data from fatal and serious injury crashes from urban intersections in the State of Ohio between 2018 and 2022 were used in the analysis.

The results demonstrate that the 12 clusters generated through the sequence-of-events approach offer a more nuanced understanding of crash types, surpassing the outcome-based categories of the conventional manner/type of collision classifications. The cluster interpretation suggests a strong influence of several different elements of the Safe System approach in each cluster, showing the necessity of considering these elements together in safety evaluations. State and local jurisdictions can use the presented methodology in transportation safety programs, by focusing on the clusters that represent local challenges or on countermeasures related to the issues of multiple clusters. Finally, the method can also be associated with site-specific analysis, providing a comprehensive toolkit for practitioners.

Technical Session 11: The Role of Vehicle Automation to Achieve Safe Mobility

[Session Based on Submitted Abstracts]

Evaluating the Impact of Distraction Mitigation Strategies on Teenage Drivers Using Level 3 Automation

Apoorva Hungund (AAA Foundation for Traffic Safety)

Vehicle automation can provide partial or complete control of the driving task. These systems can potentially reduce human error and, consequently, crash injuries and fatalities. However, previous research on use of vehicle automation in the presence of non-driving-related tasks (NDRTs) has revealed some behavioral concerns. Literature reviews ([de Winter et al., 2014](#); [Hungund et al., 2021](#); [Hungund & Pradhan, 2023](#)) found that, if possible, drivers will engage in distraction tasks, potentially reducing situation awareness and increasing reaction times. This is an issue, as drivers may need to react quickly and safely to traffic situations. It is particularly concerning when it comes to teenage drivers, given their inexperience and risk-taking tendencies. Young drivers have been known to have delayed reactions to traffic situations and increased engagement in NDRTs ([Gershon et al., 2019](#); [Klauer et al., 2015](#)). This is not a concern for systems that fully control driving (SAE Levels 4 and 5), but only for Level 3—a system that provides conditional control of the driving task but may require human interventions. Therefore, the aim of this study was to evaluate two mitigation methods to reduce unwanted effects of distraction while using Level 3 automation. The goal of these methods was to properly communicate the need for takeover requests (TORs) and provide details to help drivers respond safely.

This study evaluates two mitigation methods—Contextual Human-Machine Interface (CHMI) and Driver State Monitoring (DSM)—designed to address distraction behaviors and improve takeover conditions for drivers while using Level 3 automation.

A driving simulator study was conducted with 36 fully licensed teenage drivers (Mean=18.5 (0.57)). Participants were randomly assigned to one of three groups: CHMI, DSM, or Control. The CHMI provided contextual cues regarding TOR, while DSM issued real-time alerts when participants' attention deviated from driving-related areas (DRA). Participants drove four mini-drives and engaged in two NDRTs—Surrogate Reference Task and Cellphone Task—under Level 3 automation. Dependent variables included glance behavior, TOR reaction times, NDRT engagement, and post-disengagement driving performance.

Compared to the Control group, both DSM and CHMI interventions reduced takeover reaction times, though the differences were not statistically significant. A significant effect of NDRT was observed, with drivers engaged in the cellphone task taking longer to respond to TORs. DSM significantly reduced total duration of eyes-off-

DRA. While CHMI also reduced this metric, it was not significantly different from the other groups. Analysis of frequency of glances over two seconds showed that DSM group exhibited significantly fewer glances toward non-DRA than the other groups. DSM participants also engaged less in NDRTs, although all participants engaged more with the Surrogate Reference Task than with the Cellphone Task. Descriptive analyses indicated that drivers in the DSM and CHMI groups demonstrated more stable lane-changing behaviors than the Control post-disengagement.

Only DSM emerged as a more effective intervention, significantly reducing both the frequency and duration of off-DRA glances compared to Control. This suggests that while contextual information is beneficial, it may not be sufficient to reduce off-DRA glances, particularly during takeover conditions. Participants may face challenges in processing and responding to contextual information, especially under time constraints or high cognitive load. Future research could combine the two methods and test the effectiveness of providing alerts and contextual information. The findings from this research also offer a framework for enhancing the safety of Level 2 automation systems, especially in terms of ensuring that drivers are ready to intervene. This study also addresses three topics directly related to the conference: (a) countermeasures and strategies to alleviate dangerous road user behaviors, (b) road users' attitudes and behaviors, and (c) vehicle technology and safe mobility. This study evaluates advanced vehicle technologies, namely Level 3 automation, and evaluates two methods to alleviate and counter potential distracted driving behaviors, thereby promoting safer mobility, and examines drivers' behaviors as they experience the two methods while using Level 3 automation.

Navigating Mixed Traffic: The Behavioral Impact of Increasing Autonomous Vehicle Penetration

Yiqi Zhang (Pennsylvania State University)

As the penetration of autonomous vehicles (AVs) increases in traffic, there will be a transition period of mixed-autonomy traffic during which AVs and human-driven vehicles (HVs) will share the road. Despite the growing prevalence of AVs, few studies have focused on driver behavior in HV–AV interactions. A major concern of the HV–AV interaction is that human drivers may “bully” AVs and behave more aggressively if they perceive AVs to minimize their driving risks ([Ma & Zhang, 2022](#)). Prior research on mixed traffic concentrated on the simulation of mixed-traffic characteristics and the development of AV algorithms (e.g., [Arvin et al., 2020](#); [Sinha et al., 2020](#); [Ye & Yamamoto, 2019](#)). The primary limitation of these simulation studies was that they did not address the potential adverse effects of mixed traffic on human drivers' driving behaviors. Recent survey studies have revealed that HV drivers may alter their driving behavior and become more aggressive when interacting with AVs on the road ([Liu et al., 2020](#)). The increasing prevalence of AV deployment on the road may further exacerbate the

problem, hence diminishing the positive impact of AVs on transportation safety and efficiency. To ensure driver safety, it is essential to understand if and how drivers change their behavior in mixed traffic. Such research will provide insights into the design of AVs and the development of interventions that promote safe interactions between AVs and HVs in mixed traffic.

Thirty-six participants (18 males and 18 females) participated in this study. All participants had held a driver's license for at least two years. Participants were divided into three groups based on their Aggressive Driving Scale score, which categorized them as aggressive, moderate, or defensive drivers.

The experiment adopted a 3×4 mixed factorial design with drivers' driving style (aggressive vs. moderate vs. defensive) as a between-subject variable and AV penetration rate (0%, 25%, 50%, and 75%) as a within-subject variable. Each participant was required to experience all AV penetration rates with the order being balanced across participants. Two scenarios in an urban environment were created in the STISIM driving simulator. In the "left turning" scenario, participants made a left turn at an intersection when prompted by a navigation message. The percentage of trials during which turning left without waiting was recorded. In the "lane change" scenario, participants changed lanes when prompted by a navigation message at a time they deemed appropriate within 60 seconds. The gaps between the subject vehicle and the other three vehicles were measured as indicators of driving performance.

Each scenario involved three vehicles that interacted directly with the subject vehicle and could have the most impact on the subject vehicle drivers' decision-making and driving performance. The AV penetration rate in each trial was determined by altering the percentages of HVs and AVs among four vehicles, including three other vehicles and the subject vehicle. The percentage of AVs among other vehicles was equal to the percentage of AVs among these four vehicles. There were twelve trials for each scenario and three trials for each AV penetration rate. The trial sequence was balanced using a Latin Square design for each of the three driver groups and repeated for both scenarios. Drivers' decision-making was recorded using STISIM Drive® M300WS-Console system.

There was a significant main effect of AV penetration rate ($\chi^2(3) = 26.91$, $p < 0.001$) and driver's driving style ($\chi^2(2) = 6.21$, $p = 0.04$), and an interaction effect ($\chi^2(6) = 17.75$, $p = 0.007$) on the percentage of turning left without waiting. The results indicated that aggressive drivers were significantly more likely to turn left without waiting with the increasing AV penetration rates, indicating their tendency to take advantage of AVs in mixed traffic. For the lane change scenario, there were significant main effects of AV penetration rate ($\chi^2(3) = 27.80$, $p < 0.001$) and driver's driving style ($\chi^2(2) = 6.68$, $p = 0.04$) on the gap distance between the subject vehicle and vehicle #3 when starting to change lanes. In the "lane change" scenario, both aggressive and moderate drivers were more

likely to maintain a greater distance from the following vehicle in the target lane before initiating a lane change as the AV penetration rates increased.

This study provides valuable insights into understanding how human drivers perceive and interact with AVs and HVs differently on the road under varying AV penetration rates. One concerning finding is that aggressive drivers may become even more aggressive and exploit AVs as the penetration rate of AVs increases. Such effects must be carefully considered when evaluating mixed traffic characteristics, designing AV algorithms, and educating drivers to ensure driver safety.

Safety Aware Neural Network for Integrated Connected and Automated Vehicle Prediction and Planning

Handong Yao (University of Georgia)

Connected automated vehicles (CAVs) with trajectory prediction and planning capabilities have the potential to enhance transportation systems significantly. However, conventional studies have treated trajectory prediction and planning as separate models, leading to safety concerns due to prediction errors. To address this, a Safety-Aware Neural Network (SANN) was proposed in this study, which integrated trajectory prediction and planning into a single neural network. The SANN employed a car-following model-based recurrent neural layer to ensure safety. Numerical experiments demonstrate the superiority of the SANN over both the separated trajectory prediction and planning models and the ACC model. The SANN significantly enhanced safety performance, achieving a remarkable 44% improvement compared to the separated trajectory prediction and planning models. Despite this safety boost, there was only a minor decrease in mobility, with a -7% loss. Additionally, sensitivity analysis reveals that the SANN excelled when the prediction/planning period is relatively long. This finding further reinforces the effectiveness of the SANN in maintaining safety and mobility, making it a superior alternative to the ACC model for CAV operations.

Technical Session 12: Improving Vulnerable Road User Safety via Mixed Methods Research

[Session with Invited Speakers]

According to NHTSA, there were 42,939 and 42,795 fatalities from traffic crashes in the United States in 2021 and 2022, respectively. These were the highest numbers of fatalities in over a decade. Of even greater concern are the statistics for VRUs, including pedestrians, bicycles, and other mobility devices, which have led to increased calls for action. Presentations in this session outline several recent efforts that employed myriad research methods to evaluate measures aimed at improving VRU safety.

Evaluating the Context of VRUs within Crash Reporting and General Laws by State across the U.S.

Michael Knodler (University of Massachusetts–Amherst)

The statistics for VRUs, including pedestrians, bicycles, and other mobility devices, are of national concern. Between 2011 and 2021, the number pedestrian deaths in the United States increased 66%, to over 7,400 per year; the highest number of reported pedestrian fatalities in more than 40 years. Similarly bicycle fatalities have trended upwards since 2010, with an increase from 623 to 966 fatalities per year from 2010 to 2021 ([Stewart, 2023](#); [NCSA, 2022](#)), with bicyclists accounting for 2.2% of total traffic fatalities in 2021 while only representing about 1% of trips ([Sanders, 2015](#); [Vargo et al., 2015](#)). Bicyclists are similarly overrepresented in injuries, with an estimated 41,000 injuries in 2021. These statistics, coupled with the increased prevalence of multiple (micro)mobility devices (e.g., scooters), have led to increased calls for action. The Federal Highway Administration required states to complete a VRU safety assessment by 2023 for the purpose of identifying safety challenges for VRUs and contributing towards the development of strategies that mitigate these concerns. More specifically, the current trends surrounding VRU safety, nationwide adoption of the Safe System paradigm as well as insights provided from the statewide VRU assessments across the United States, suggest direct need for added consistency in reporting VRU traffic safety records, which in turn will improve the potential for better policies, countermeasure development, and crash analyses. This presentation outlines the context of VRUs within crash reporting and general laws by state across the United States. Despite the increased focus upon VRU safety there is considerable variance in the ways in which VRUs are defined and categorized across the country. Moreover, there is an equally ambiguous number of provisions within the general laws within each state related to both the definition and legal requirements (both allowances and restrictions) for VRUs. This presentation described research that provides a blend of quantitative and qualitative data related to VRUs by state.

Sensor Networks to Increase Safety for Vulnerable Road Users

Nicholas J. Kirsch (University of New Hampshire)

In comparison to other traffic participants, VRUs—including pedestrians, bicyclists, and construction workers—face a higher risk of severe injuries or fatalities in road accidents due to their limited external safeguards. In today’s urban landscapes, prioritizing road safety and ensuring the well-being of VRUs has become an essential concern. Therefore, it is essential to develop a comprehensive, low-cost, and practical VRU detection system that assists both drivers and VRUs to avoid collisions.

Our approach to increasing VRU safety without requiring them to “opt in” to a system lies in the passive detection of VRUs. Passive detection includes the fusion of data from opportunistic signals (sources of electromagnetic energy) from devices such as smartphones and headphones, that can be detected and localized to provide further information of a VRUs location. Although cooperative systems for VRU safety have been widely explored by research communities, VRU passive sensing using opportunistic signals has yet to be investigated, which is the goal of this current research. This passive detection system can be further fostered by fusing data from multiple sensors, like camera, radar, or LiDAR, deployed in roadside infrastructures. Through collaborative efforts between infrastructure, sensors, and intelligent vehicles, a seamless exchange of critical information concerning vehicle and VRU interactions becomes feasible.

A Naturalistic Study of Driver Attention and Response to Vulnerable Road Users

Niloufar Shirani (Connecticut Transportation Safety Research Center)

This presentation described an ongoing study investigating how drivers naturally detect and respond to VRUs, such as pedestrians and cyclists, across diverse real-world contexts. Using a combination of portable eye-tracking glasses, physiological monitoring (heart rate, blood pressure, skin response), and vehicle kinematics via OBD-II, the project aims to generate a rich naturalistic dataset linking driver attention, stress, and behavior. A key objective is to determine how context, such as urban density, clutter, and speed, affects visual fixation patterns and biometric indicators of workload. The study also incorporates a novel “stream of consciousness” narrative method to capture drivers’ internal perceptions in real time. Findings are expected to support the Safe System approach by identifying how roadway design influences driver awareness of VRUs, ultimately contributing to data-driven strategies for improving safety and reducing fatalities.

Technical Session 13: Complete Streets Handbook and Design Leads to Safer Mobility in Milwaukee

[Session with Invited Speakers]

Overview of Presentations from Invited Speakers: Jennifer Pangborn (WSP), David Tapia (City of Milwaukee), and Kevin Muhs (City of Milwaukee)

Milwaukee is a vibrant city offering a blend of rich culture, welcoming streets, and strong community spirit. Known for its unique cultural festivals, Milwaukee stands out among mid-sized cities. The streets here are more than thoroughfares—they are spaces for connection, joy, and justice, brought to life by the people who inhabit them, including local icons like the “Milverine.” Historically, Milwaukee’s streets have been a hub for gatherings and celebrations, even predating the Complete Streets movement. Research highlights that walkable, bikeable, and connected communities create equitable access to jobs, education, and healthcare, while promoting healthier lifestyles. Yet, marginalized and racialized groups are often excluded from these networks. To combat inequity, strategies like Vision Zero initiatives, protecting vulnerable road users, and designing efficient, safe transportation systems must prioritize safe mobility for everyone, regardless of background or identity. Today, ensuring safe mobility for all is more critical than ever and was a guiding factor for the Complete Streets Handbook completed in 2023.

In 2018 the City of Milwaukee passed one of the most progressive Complete Streets policies—with the focus that all streets should be complete streets. The City of Milwaukee’s Complete Streets policy requires the Department of Public Works to “incorporate Complete Streets principles into all public way improvements and project phases, including planning, programming, [and] design.”

WSP was chosen by the city to develop the handbook that aligns the policy, design, implementation and public input—all with a focus on pedestrian safety first, slowing vehicle speeds, and integrating equity into how projects should be prioritized and delivered. This progressive handbook lays out procedures and policies to identify projects on Milwaukee streets, how to evaluate and prioritize projects, how and when to get community input, design criteria for street typologies and traffic calming for safety, and all the steps through design and maintenance. The handbook walks through multi-tiered steps for transformative investments, targeted capital, and safety and maintenance. The process is intended to be transparent and help all project managers and community partners understand expectations.

Part of the process involved convening a Community Action Group (CAG) that was representative of the City of Milwaukee’s diverse communities. The CAG included community-based organizations and provided stipends to ensure that voices who had not been at the table in the past had the means to participate. The CAG’s input was

incorporated into the handbook and procedures, and helped define what was needed for effective engagement. A final training was created for DPW staff and the CAG to help guide all future champions of Milwaukee streets to build consensus for the future of project delivery in the city.

Since adoption, the City of Milwaukee has used the Complete Streets Handbook process and guidance on some transformative projects, including Howard Avenue, Oklahoma Avenue, West Walnut Street, and Wells Street. These projects used the decision making and process from the handbook and include traffic calming and design improvements that will slow vehicles, with goals to get cars traveling at or below the posted speed limit, and enhance walkability and safety for pedestrians. Improvements include raised crosswalks, bump outs, roundabouts, speed tables, lane reductions, lane width reductions, parking modifications, and other improvements to meet the project goals. Each project established specific goals that elevate safe mobility.

Technical Session 14: The Trend of Motorcycle Crashes and Fatalities in the U.S.

[Session with Invited Speakers]

Motorcycles hold a unique position among motor vehicles in the United States. They serve not only as a practical means of transportation but are also widely embraced by enthusiasts for recreational purposes, offering a sense of adventure, freedom, and connection to the road. In other words, for many riders, motorcycling is primarily a recreational activity rather than a daily necessity. As such, it is often seasonal or intermittent, influenced by factors like weather conditions, personal schedules, and lifestyle changes. This makes motorcycle usage more variable compared to other motor vehicles, which are predominantly used for routine transportation needs. For this reason, understanding motorcycle riding and their correlation to crash statistics can be particularly challenging.

According to NHTSA, the U.S. recorded more than 6,000 motorcyclist fatalities in both 2021 and 2022. Despite motorcycles represent only about 3% of registered motor vehicles on U.S. roads, motorcyclists have accounted for approximately 14% of annual U.S. traffic fatalities over the past decade. Motorcyclist fatalities in the United States have exhibited a significant upward trend from 2002 to 2022, according to data from the NHTSA's Fatality Analysis Reporting System (FARS). In 2002, annual motorcyclist fatalities were reported at 3,270. Over the following two decades, this number steadily increased, peaking at 6,218 fatalities in 2022.

During the last two decades, motorcyclist fatalities experienced a sharp increase between 2002 and 2008, with an average annual growth rate of approximately 8%. A significant reduction in fatalities was observed between 2008 and 2009, coinciding with the economic recession. Following this period, annual motorcyclist fatalities fluctuated somewhat but continued to trend upward over time. Another notable surge occurred between 2019 and 2021, with fatalities increasing by approximately 10% over two consecutive years. This dramatic rise coincided with the COVID-19 pandemic, a period marked by changes in traffic patterns, reduced enforcement of traffic laws, and an increase in risky behaviors, such as speeding, which likely contributed to the spike in fatalities.

Since motorcyclist fatalities account for a significant portion of annual traffic fatalities, their upward trend becomes even more evident when analyzed separately and compared to fatalities among other vehicle occupants. Between 2002 and 2022, fatalities among other vehicle occupants decreased by nearly 20%, dropping from 34,105 in 2002 to 27,344 in 2022. However, both motorcyclist and other vehicle occupant fatalities increased substantially in 2020 and 2021, aligning with the COVID-19 pandemic period.

Trends in Motorcycle Fatalities in the U.S.

Chanyoung Lee (University of South Florida)

The United States has experienced a continued and disproportionate increase in annual motorcyclist fatalities. This presentation highlights the correlation between motorcycle registrations and motorcyclist fatalities by analyzing national fatality trends over the past two decades. It documents a sharp rise in registrations from 2002 to 2009, followed by a plateau and then renewed growth after 2014. This trend closely parallels the increase in motorcyclist fatalities, which exhibit a statistically significant positive correlation with registration data, particularly in the periods 2002–2008 and 2015–2022. Although motorcycles represent only about 3% of registered motor vehicles and less than 1% of total vehicle miles traveled, they account for a disproportionately high share of traffic fatalities. The presentation also underscores considerable variability in fatality trends across states, influenced by factors such as climate, helmet use laws, licensing procedures, and seasonal riding patterns. States like Florida, Nevada, and Oregon not only recorded high absolute numbers of fatalities but also experienced significant percentage increases over successive decades. Additionally, the analysis of motorcycle types involved in crashes, the monthly distribution of fatalities, and the age demographics of riders further reveals the multifaceted and complex nature of motorcycle crash risks across all 50 states.

Motorcycling in a Safe System and Broader Traffic Safety Goals

Eric Teoh (Insurance Institute for Highway Safety)

With the United States repeatedly experiencing record-high annual motorcyclist fatality numbers, what do we do about it? This presentation articulated a Safe System approach to motorcycle safety highlighting the need for action on a variety of effective countermeasures and a strategy for accelerating progress.

Safe System thinking improves motorcycle safety only if it results in actions we were not already taking. Countermeasures known to be effective need to be implemented at greater levels, and there is an opportunity to improve some countermeasures and develop new ones. Specifically, the presentation discussed ways to address speed (lower speed limits, speed safety cameras), helmet laws that apply to all riders, antilock braking systems on motorcycles, and front crash prevention and left turn assist technologies on passenger vehicles. There are, of course, many other countermeasures, but addressing these would be an important start and save many lives. The presentation also discussed the 30x30 vision (www.ihs.org/30x30) for reversing the trend of increasing traffic fatalities and accelerating progress toward zero.

Technical Session 15: From Data to Safety Solutions

[Session Based on Submitted Abstracts]

Investigating Pedestrian Crashes on High-Speed Roads and Identifying Effective Countermeasures: A Focus on Urban and Suburban Corridors in Michigan

Valerian Kwigizile (Western Michigan University)

Overall, compared to other traffic fatalities in the United States since 2010, pedestrian deaths have increased by 75%. Historical data from Michigan show that 20% of the pedestrian crashes and 40% of the pedestrian fatal crashes have occurred on corridors with a speed limit of 45 mph or higher. The majority of these crashes occurred during night conditions. Similarly, the U.S. pedestrian fatality data show that most of pedestrian death increases occurred at night on urban arterials and collector roads. These national and Michigan statistics are likely more severe when considering the fact that only a small proportion of all traffic volumes occurs after dark.

This study examined the causes of crashes along higher speed roads (45 mph or more) and identified potential effective countermeasures to reduce pedestrian fatalities along high-speed roads with a particular consideration on night-time pedestrian crashes. The study examined proven countermeasures for their suitability on higher speed roads, focusing on applications at traffic signals, uncontrolled intersections, midblock locations, and corridor-wide improvements, including measures to reduce speeding and enhance lighting. The study conducted a detailed analysis of statewide crash data from 2009 to 2020 to identify high-crash locations, focusing on severity, area type, lighting conditions, and crash location, and other characteristics of the crashes. To clearly understand the crash site conditions, the research team pinpointed the crash sites using Geographic Information System (GIS) techniques and conducted site visits, which allowed the determination of factors related to each crash and the potential types of countermeasures that would likely be effective. The research team visited the crash sites one hour or more after sundown and measured lighting levels using a Konica Minolta T-10A Illuminance Meter to determine the light intensity in Lux. Finally, the research team narrowed down the countermeasures and developed a methodology for conducting cost-benefit analysis of potential countermeasures to aid the selection process.

The significant findings of this study were as follows:

1. That fatal and incapacitating nighttime crashes were typically associated with low measured light level reading
2. That whether the crash site was recorded on the UD-10 Police Crash Report as lighted or unlighted may be an unreliable indicator of actual lighting conditions at the crash site

3. That a limited number of countermeasures were appropriate for application to higher speed roads and likely most effective in reducing crashes
4. That many of the countermeasures identified as potentially effective were low or medium cost

This study makes specific recommendations for effective countermeasures to reduce pedestrian crashes along high-speed corridors. Some of the recommended effective countermeasures for reducing pedestrian crashes at traffic signal locations on high-speed roads include LED light bars, LED luminaires, tighter turning radii, high visibility crosswalk markings, and leading pedestrian intervals. At unsignalized intersections and midblock crosswalks, useful measures include Pedestrian Hybrid Beacons (PHBs), Rapid Rectangular Flashing Beacons (RRFBs), advance stop or yield markings, refuge islands, and dynamic crosswalk lighting. For corridor-wide improvements, adding sidewalks, solar-powered dynamic feedback signs, widening shoulders, and upgrading to LED street lighting are recommended. This research and its findings align well with the goal of searching for solutions and best practices aimed at achieving safer mobility for all road users

An Analysis of Pedestrian Safety at Bus Stops Using FARS Data

Allison Rewalt (University of Tennessee–Knoxville)

The multimodal nature of public transit requires bus stops to be safely accessible to passengers who begin and end their trips as pedestrians. Prior studies have investigated pedestrian safety at bus stops; however, a significant challenge in transit-related safety research is the lack of crash data that clearly identifies stop/station-related crashes. As a result, many prior studies have made location-based assumptions, introducing uncertainty about the true extent of pedestrian involvement in bus stop-related crashes. This research begins to address this gap in the literature by conducting a three-part analysis using pedestrian crash data from FARS, which reported 297 pedestrians involved in fatal “bus stop-related” crashes between 2014 and 2022. First, a hierarchical clustering analysis was used to group the bus stop-related crashes into similar types based on crash characteristics. Then, a binary logit model was estimated to further investigate the factors associated with the crash types identified in the clustering analysis. Finally, a before-and-after comparison of transit bus stop infrastructure was manually conducted using historical images from Google Street View to identify countermeasures implemented at the stop level.

The results of the clustering analysis revealed three types of bus stop-related crashes: (a) school bus stop-related crashes on higher-speed local roads and collectors, (b) transit bus stop-related crashes on higher-speed arterials near intersections, and (c) transit bus stop-related crashes on higher-speed arterials at non-intersection locations. The binary logit model compared school and transit bus stop-related crashes and

generally confirmed the clustering results, suggesting that transit bus stop-related crashes are more likely to occur on arterials. Finally, crosswalks, seating, shelters, bus pads, and curbside-pull out stops were the most common post-crash improvements identified through the manual inventory of stop-level changes.

By systematically analyzing pedestrian safety challenges at bus stops, this study found that school bus stop- and transit bus stop-related crashes have distinct characteristics, suggesting that these stops should be treated separately, with countermeasures designed to meet the specific needs of each type of bus stop. Additionally, this study found an association between arterials and an increased risk for pedestrians accessing bus stops. Given this finding, speed reductions and bus stop infrastructure improvements may reduce the risk of pedestrian–vehicle conflicts near bus stops on arterials. Overall, this study contributes to a more nuanced understanding of bus stop-related crashes, offering data-driven insights that can help make transit a more effective solution for reducing traffic fatalities by improving pedestrian safety at bus stops.

Examining the Effects of Spillover Effects of Crashes: Prioritizing Safe Speeds in Communities Near Interstates

Jessica McDonough (AAA Foundation for Traffic Safety)

This study investigated unintended safety challenges propagated onto local roadway networks after increases in posted speed limits on nearby Interstates. Study objectives included the following:

- Conducting a literature review on speeding behaviors that can be inadvertently maintained after transitioning from Interstates into lower-speed roadways
- Analyzing the variability of speeding behaviors at a mesoscopic level, by examining its cascading effects across multiple roadways across diverse landscapes
- Developing a statistical significance criterion that quantifies “crash spillovers” on local roadways
- Helping local transportation agencies identify high-risk locations experiencing increases in speed-related crashes

The study followed a dual-method approach to comprehensively analyze speeding behaviors. First, a multi-staged search process was used to identify spillover literature, as well as to identify any emergent themes, quantitative analysis, and relevant adjacent literature. Next, a quantitative analysis was conducted for a set of local roadway networks in Georgia, Oregon, and Michigan in proximity with Interstate segments from I-85, I-84, and I-75/I-69, respectively. The analysis used state crash data resources, excluding crashes reported on the Interstate where the speed limit increased, and

omitted crash counts from the year when the speed limit change was effective. Crashes reporting “speeding as a contributing factor” were normalized by the total number of crashes to compute crash rates. A speed-related crash ratio per grid within a 1-mile buffer zone from an Interstate was estimated for each study area. The research team used QGIS, a free and open-source geographic information system application to measure how speed-related crashes are related to each other based on spatial proximity; also known as “hot spot” analysis. In this manner, z-scores and p-values were computed using 0.25 by 0.25-mile grids overlayed on a geographical area to facilitate a structured spatial analysis across all study sites.

An initial directed search yielded few results, indicating that the spillover phenomenon was not well represented in existing literature. A more comprehensive approach was used to capture any other relevant or adjacent results, and a total of 98 results were retained. Across the literature, spillover was described in both spatial and temporal terms, and both speed-related and crash-related outcome measures were employed to explore it. The literature review provided evidence of “spillover effects”; however, results are not consistent across different contexts. A key takeaway was that holistic spatial methods could provide greater insight into the issue. To better capture the complexity of spillovers, this study developed an analytical framework that visualizes the difference between hot spots in the before and after scenarios. The ranking of p-values and z-values led to three distinct categories that quantify the “spillover” effect and capture the variation in magnitude of the change. The categories were classified as follows:

- New hot spots or new areas of safety concern
- Maintained hot spots or areas with intensifying and prevailing statistical significance
- Historical hot spots showing areas where speed-related crashes are no longer significant after the speed limit was raised

The spillover effect is a complex phenomenon that necessitates further exploration. To better understand the potential safety impacts of spillover and to explore evaluation methods that are widely accessible and easily reproducible by a wide range of stakeholders, the study focused on the “crash” spillover effect. Results of the reviewed case studies demonstrated that operational changes can lead to adverse effects of varying magnitudes through adjacent transportation networks. To some extent, all case studies examined in this project showed the emergence of new hot spots on roads adjacent to Interstates where speed-related crashes were not common previously. To minimize unintended traffic safety consequences, state transportation departments need to proactively work with local agencies to identify mitigation strategies and allocate resources to implement countermeasures. Adopting a Safe System approach is an example of how to proactively manage and operate a transportation network to improve safety.

Technical Session 16: Safety Initiatives from Local Transportation Agencies

[Session Based on Submitted Abstracts]

Safety First Initiative

Maryne Taute (Wisconsin Department of Transportation)

The Wisconsin Department of Transportation's (WisDOT) mission is to provide leadership in the development and operation of a safe and efficient transportation system. In March 2023, WisDOT began the Safety First Initiative which is dedicated to building on WisDOT's safety investments by establishing a shared space for WisDOT staff to fully utilize safety-related knowledge and available resources, actively inform our partners of the department's safety work, conduct research to support initiatives, and to implement best practices.

The department's Safety First Initiative embodies the Safe Systems Approach through a three pronged approach to deepen the culture of safety at WisDOT:

- Internal Community of Practice
- Active Messaging and Outreach with Partners
- Research, Demonstration, and Pilot Projects

Community of practice involves (a) department-wide collaboration space designed for sharing best practices, data resources, and knowledge about WisDOT's safety-related work and (b) cross-pollination of ideas and information between divisions and offices.

Active messaging conveys the department's safety-related activities and engages with our transportation partners, such as other state DOTs, in-state and federal agencies, and the public.

Research, demonstrations, and pilot projects utilize new technology and innovative best practices to maximize and strengthen resources and to improve safety on the roadways and for all transportation system users.

Achievements of the WisDOT Safety First Initiative's three-pronged approach are as follows:

- Community of Practice
 - Established a core, cross-divisional, group of WisDOT safety subject-matter experts to provide key safety insights related to department-wide initiatives. This work-group meets quarterly.
 - Created an internal quarterly and virtual Safety Speaks Lecture Series that brings regional and national guest speakers to share best practices, innovations, safety trends, and more with WisDOT staff.

- Designed an internal MyDOT Safety First webpage to broaden the department's knowledge of the Safety First Initiative.
- Developing a Safety-First Analytics System Project, which will increase accessibility and integration of the department's datasets to support safety-related decision-making throughout the agency through a data linkage platform and safety hub.
- Active Messaging
 - Hosted WisDOT's first Safer Together—Summer Safety Open House. The event was open to the public and showcased the many safety initiatives, technologies, and collaborations throughout WisDOT. The department is planning the event again for summer 2025.
 - Redesigned the department's Safety First external webpage to provide a comprehensive look into WisDOT's safety-related programs and information.
 - Continued to invest time and resources into the National Roadway Safety Strategy's Allies in Action.
 - Reviewing WisDOT safety messaging and identify opportunities for growth, innovation, and efficiency.
- Research, Demonstrations, and Pilot Projects
 - Development of safety-related research, demonstrations, and pilot project ideas from across the department.
 - Research projects topics have included pedestrian visibility, safety campaigns and messaging, and engineering countermeasures

The Safety First Initiative is continuing and evolving—just as the needs of all transportation users are changing across the state. This initiative supports and creates opportunities for partnerships to connect, share information, identify challenges, and generate innovative solutions.

WisDOT is committed to safety and will continue to seek out opportunities to strengthen the department's safety culture and commit to creating a diverse and inclusive environment that draws and serves individuals from an array of backgrounds and experiences.

New York City Intelligent Speed Assistance Pilot Evaluation

Donald Fisher (University of Massachusetts-Amherst) presenting on behalf of Alexander Epstein

Close to 30% of traffic fatalities involve excessive speed. Although interventions such as traffic enforcement and road modifications can help reduce speeding, individual vehicle technology has not been widely studied or implemented in the United States.

Starting in 2022, USDOT Volpe Center and New York City conducted the largest pilot of active Intelligent Speed Assistance (ISA) in the country, with approximately 500 vehicles equipped with a device that prevents acceleration beyond a set parameter over the speed limit. In an analysis of 270 vehicles equipped with ISA, there was a 64.18% relative decrease in the time driven >11 mph over the posted speed limit following ISA activation compared to before activation, and a similar decrease was observed in the ISA-equipped vehicles compared to non-equipped control vehicles. Speeding drive time reduction ranged from ~50% on 25 mph local roads, which have speed safety cameras set to the same enforced speed threshold, to 82% reduction on 50 mph roads. In addition, the impact of ISA on speeding behavior of habitual speeders in 130 vehicles was similar to that on the primary cohort, indicating ISA is effective at significantly reducing severe speeding across a wide range of drivers.

Enhancing Vulnerable Road User Safety Analysis through Improved Crash Data Collection in Wisconsin

Yang Li (University of Wisconsin–Milwaukee)

This study examined how the WisDOT's transition to an improved crash reporting system (DT4000) in 2017 has contributed to reducing fatalities and injuries among VRUs, such as pedestrians and bicyclists. The objective was to demonstrate how detailed data collection empowers local transportation agencies to identify critical safety challenges and implement effective interventions.

Using crash data from 2017 to 2020, this study applied different data analytic methods, such as exploratory data analyses and chi-square automatic interaction detector, to evaluate the added value of new data fields in the DT4000 form. The analysis compared the old (MV4000) and new forms to highlight how enhanced data attributes support better safety decision-making.

The DT4000 form introduced more granular data fields, such as VRU actions, specific roadway characteristics, and driver conditions, enabling improved analysis of crash dynamics. Key findings include the identification of high-risk scenarios, such as VRUs at intersections and driver distraction impacts. Analysis also revealed critical variables influencing crash outcomes, offering actionable insights for local transportation agencies. The findings underscore how enhanced reporting can align with Vision Zero goals to reduce VRU fatalities.

WisDOT's crash data improvement initiative serves as an exemplary case of how local agencies can “move the needle” on road safety. By leveraging comprehensive crash data, transportation agencies can target interventions more effectively, making strides toward eliminating fatalities. The study reinforces the value of systematic, data-driven approaches in reducing fatalities and supporting safer mobility for all road users.

Technical Session 17: Paving the Way to a Future Free of Impairment—Panel Discussion

[Session with Invited Speakers]

Impaired driving remains a top cause of fatalities on roads. Technologies exist to prevent these tragedies. Alcohol detection and driver monitoring systems can play complimentary roles to advance these technologies to the point of ubiquity, necessary to save lives on a large scale.

Remarks

Natalie Draisin (FIA Foundation)

In her presentation, Natalie Draisin, North American Director and United Nations Representative for the FIA Foundation, tackled the persistent and preventable issue of impaired driving. Highlighting the human and economic toll, Natalie emphasized that traditional approaches—relying on personal responsibility—are insufficient to address the crisis. She underscored the potential of systemic solutions, such as driver alcohol detection and monitoring systems, to curb both distracted and drunk driving.

Ms. Draisin also facilitated a dynamic discussion among experts representing public health, research, and technology sectors. Together, they identified four critical barriers—misinformation, circular dependence, consumer acceptance, and political resistance—and proposed actionable solutions to overcome them. The session concluded with a call to action, urging industry leaders, policymakers, and communities to champion evidence-based technologies and collaborative approaches, paving the way to safer roads for all.

Jeffrey P. Michael (Johns Hopkins University)

Misinformation about driver impairment prevention technology has circulated for several years. In 2022, an *AP Fact Check* was published regarding information that was being spread about “government kill switches” that were going to be installed allegedly to stop drunk driving, but actually so that citizen’s cars could be controlled from some central location. The *Fact Check* found no support for this claim that impairment prevention technology was either a “kill switch” or that it is being developed for the purpose of external vehicle control.

Similar misinformation was disseminated claiming that drunk driving prevention technology is imprecise and will result in innocent people being stopped and stranded in their cars. Hypothetical stories were offered such as innocent citizens who swerve to miss a squirrel, are judged by the technology as being drunk, and have their car instantly immobilized without recourse. These stories do not reflect reality and purposely attempt

to undermine public confidence in a technology that the IIHS estimates will save more than 10,000 lives per year.

Such rationales were also used to support proposed appropriations amendments (such as HR6563) to prevent further government action on the Congressional mandate to develop a Federal Motor Vehicle Safety Standard to require impairment prevention technology in new vehicles.

It is important that safety advocates be well informed regarding the Congressional mandate and the nature of impairment prevention technology so that they can counter such misinformation when it appears.

Safety technologies cannot reach their full potential unless they are both effective in preventing crashes, injuries, and deaths, and acceptable by consumers. Often when federal regulators are considering a new rule, the technology is familiar to consumers but may not be available in all new cars. Automatic emergency braking is a current example of a familiar technology being mandated in all new cars by federal standard. In the case of driver impairment prevention, the technology promises very high effectiveness and there is substantial public benefit from its implementation as soon as it is available; however, consumers lack experience in its function and use.

The USDOT is developing a rule on driver impairment prevention technology in response to a Congressional mandate and is naturally interested in how consumers will react to the new technology so they can specify system functions that will be acceptable and foster confidence. Having commercial deployments of such technology underway would provide an opportunity to observe consumer reaction. Meanwhile, industry members are naturally reluctant to invest in a technology approach and offer cars with this new feature without confidence that their approach will comply with the new federal standard.

Strategies could be devised for gaining experience with new technology while limiting investment risk. For example, regulators could invite manufacturers to submit plans for new impairment prevention technologies and if the government feels that the technology is reasonable, they could offer the manufacturer assurance that they would be viewed as compliant with a new rule for a period of time long enough to allow the manufacturer to cover its investment.

The public benefit from impairment prevention technology is very high—an estimated 10,000 lives saved per year. We need to explore every opportunity to deploy successful technology as quickly as possible.

Jessica Cicchino (Insurance Institute for Highway Safety)

In her presentation, Dr. Cicchino, Senior Vice President–Behavior and Infrastructure Research, noted that data from field research with prototypes and fleet deployments can create evidence necessary to overcome circular dependence. Other incentives for automakers to implement technology, such as the voluntary agreement that spurred equipment with automatic emergency braking, can similarly help. Consumer ratings of technology and fleet adoption could also build momentum that increases uptake in the absence of a government mandate. Dr. Cicchino mentioned that minimizing false alarms is crucial for public acceptance. Staging a rollout for impairment technology that first detects higher BACs could be a strategy to minimize false alarms while getting the public used to the technology.

Technical Session 18: Enabling Safe Mobility through Research & Development & Deployment

[Session with Invited Speakers]

This session highlighted the research, development, and deployment of the USDOT National Transportation Centers—focusing on those that have successfully used technology to address real world problems impacting safe mobility.

Presenters focused on the recently completed research projects from the New England University Transportation Center, which was funded by the Bipartisan Infrastructure Law (BIL), that presented innovative approaches to analyzing and preventing crashes and of course, then related that to the importance of crash analysis for safe mobility. Presenters also focused on development and deployment projects from the BIL-funded Safety21 National Transportation Center that showcase how it is leveraging new technologies and revolutionary trends in transportation. This work aims to research, develop, and deploy cutting edge technologies and policies, and develop workforce and educational programs that directly address the challenges of integrating AVs, CAVs, EVs, and shared vehicles with a transformative focus on safety, equity, sustainability, and economic growth. Presenters provided case studies that have informed technology and policy decisions alike.

Karen Lightman (Carnegie Mellon University)

[Safety21](#), a USDOT National University Transportation Center housed at Carnegie Mellon University, leads national efforts to improve transportation safety through research, development, and deployment. Its mission centers on addressing real-world safety challenges via innovations in autonomy, intelligent systems, and digital–physical infrastructure integration. Through partnerships with academia, industry, and government, Safety21 advances technology transfer, influences safety policy, and fosters workforce development. It plays a leading role in national convenings, including the [2025 National Safety Summit](#), which brought together over 125 stakeholders to explore cutting-edge topics such as artificial intelligence (AI) in transportation, connected and autonomous mobility, and cybersecurity.

Ms. Lightman’s presentation highlighted the tangible impacts of Safety21 and its partners, including commercial spinoffs, novel simulation and diagnostic technologies, and educational initiatives across numerous institutions. Key themes emphasized the importance of accelerating innovation deployment, sharing real-world use cases, and fostering collaboration across sectors. In summary, with decades of academic research yielding actionable results, now is the time to invest in scalable implementation to realize the safety, efficiency, and economic benefits of transformative mobility technologies.

Michael Knodler (University of Massachusetts–Amherst)

According to the NHTSA, there were 42,939 and 42,795 fatalities from traffic crashes in the United States in 2021 and 2022, respectively. These were the highest number of fatalities in over a decade. The statistics for VRUs, including pedestrians, bicycles, and other mobility devices, are of even greater concern. Between 2011 and 2021, the number U.S. pedestrian deaths increased 66%, to over 7,400 per year—the highest number of pedestrian fatalities in more than 40 years. Additionally, pedestrian fatalities now comprise more than 17% of all traffic fatalities, up from 14% in 2010 ([Hu & Cicchino, 2018](#); [NHTSA, 2022, 2023](#)). Preliminary analyses of 2022 crash data suggest that pedestrian deaths grew further between 2021 and 2022 ([Governors Highway Safety Association, 2023](#)). Similarly bicycle fatalities have trended upwards since 2010, with an increase from 623 to 966 fatalities from 2010 to 2021 ([Stewart, 2023](#); [NCSA, 2022](#)), with bicyclists accounting for 2.2% of total traffic fatalities in 2021 while only representing about 1% of trips ([Sanders, 2015](#); [Vargo et al, 2015](#)). Bicyclists are similarly overrepresented in injuries, with an estimated 41,000 injuries in 2021. These statistics, coupled with the increased prevalence of (micro)mobility devices (e.g., scooters), have led to increased calls for action. The Federal Highway Administration required states to complete a VRU safety assessment by 2023 for the purpose of identifying safety challenges for VRUs and contributing towards the development of strategies that mitigate these concerns. More specifically, the current trends surrounding VRU safety, nationwide adoption of the Safe System paradigm, as well as insights provided from the statewide VRU assessments across the United States, suggest a direct need for research that advances countermeasures addressing specific VRU safety concerns. This presentation outlines several recent efforts that employed myriad research methods to evaluate measures aimed at improving VRU safety, including field deployments and/or studies of novel technologies and policies, laboratory-based simulation studies that isolate specific variables, and data fusion across unique data sets. Ultimately these research efforts will be leveraged to inform VRU policy and roadway design as well public information and education resources used to improve roadway user behavior and consequently, safety.

Shannon C. Roberts (University of Massachusetts–Amherst)

The goal of the presentation was to highlight research projects undertaken by two University Transportation Centers—New England University Transportation Center (NEUTC) and the SaferSim University Transportation Center (SaferSim)—that focused on analyzing and preventing roadway crashes. The mission of the NEUTC is to advance transportation safety through transformational research, education, and technology transfer. The goal of the SaferSim was to use innovative simulation approaches ranging from microsimulation to human-in-the-loop simulation to promote safety. During the presentation, five projects were highlighted: three within NEUTC and two with SaferSim. Across all projects, researchers are using advanced techniques, like machine learning

and AI, and multifaceted datasets (e.g., from naturalistic driving studies and national databases) to identify and measure crash types. In addition, innovative technologies, like driving assistance and driving automation, are being explored and perfected to mitigate future crashes, which may be particularly relevant for certain demographic groups and geographic areas (e.g., those prone to hurricanes).

Technical Session 19: Innovative Approaches for Safe Mobility

[Session Based on Submitted Abstracts]

Development of Effective Communications Infographics to Mobilize Community Members and Decision-Makers to Implement Evidence-Based Cross-Sector Safe Systems Interventions

Audrey Payne (University of North Carolina)

Though there is a rise in the popularity of Vision Zero in the United States, there are significant gaps and limitations to implementing Safe Systems approaches and realizing Vision Zero in communities. One goal of North Carolina's Vision Zero is to encourage sustainable cross-sector collaboration. To realize this goal, we bolstered our communication efforts by creating infographics. These infographics inform community advocates, public-sector decision-makers, and safety professionals about actionable, accessible strategies to create safe and reliable transportation systems.

Infographic content is grounded in interviews with Safe Systems approach and Vision Zero thought leaders, implementers, and communication professionals. By using interview findings to inform infographics, we leverage an underutilized and accessible communication tool to mobilize those with a vested interest in safer mobility for all road users (e.g. government leaders, industry, advocacy organizations, etc.).

Infographics will focus on three themes from interviews: (a) addressing misconceptions, (b) shaping systems and behavioral change, and (c) mitigating risk through safety, policy, and land-use strategies.

This presentation briefly reviews interview findings, their analysis, and creation process, but focuses on highlighting the finished infographics and how they can be disseminated to address community mobility and public health concerns. We hope our infographics will be another tool for attendees to use in their jurisdictions to encourage discussion about innovative approaches that advance the mission of Vision Zero.

A Digital Twin Framework for Physical-Virtual Integration in V2X-Enabled Connected Vehicle Corridors

Pei Li (University of Wisconsin–Madison)

Transportation Cyber-Physical Systems (T-CPS) are critical in improving traffic safety, reliability, and sustainability by integrating computing, communication, and control in transportation systems. The connected vehicle corridor is at the forefront of this transformation, where Cellular Vehicle-to-Everything (C-V2X) technology facilitates real-time data exchange between infrastructure, vehicles, and road users. However,

challenges remain in processing and synchronizing the vast C-V2X data from vehicles and roadside units, particularly when ensuring scalability, data integrity, and operational resilience. This presentation presents a digital twin framework for T-CPS, developed from a real-world connected vehicle corridor to address these challenges. By leveraging C-V2X technology and real-time data from infrastructure, vehicles, and road users, the digital twin accurately replicates vehicle behaviors, signal phases, and traffic patterns within the CARLA simulation environment. This framework demonstrates high fidelity between physical and digital systems and ensures robust synchronization of vehicle trajectories and signal phases through extensive experiments. Moreover, the digital twin's scalable and redundant architecture enhances data integrity, making it capable of supporting future large-scale C-V2X deployments. The digital twin is a vital tool in T-CPS, enabling real-time traffic monitoring, prediction, and optimization to enhance the reliability and safety of transportation systems.

Wisconsin Tribal Crash Mapping Improvements

Steven Parker (University of Wisconsin–Madison)

Recent advances in crash data collection and management in Wisconsin have afforded the opportunity to improve the effectiveness of traffic safety planning and analysis through improvements in the timeliness, accuracy, accessibility, and completeness of police reported crash data. Since 2017, Wisconsin's police crash reports have been submitted 100% electronically through the Wisconsin Badger TraCS crash reporting software with 99% of all crashes now geo-coded to latitude and longitude coordinates directly by the reporting law enforcement officer. The Wisconsin crash report is highly MMUCC compliant with additional locally defined elements to identify crashes occurring within tribal areas. The majority of Wisconsin's eleven tribal nations also actively report crashes through the state crash database system. Despite these advancements, identifying and analyzing tribal crashes remains a challenge. This presentation reviewed tribal crash identification shortcomings with the current Wisconsin crash report along with recent automation enhancements by the Wisconsin Traffic Operations and Safety Laboratory at the University of Wisconsin–Madison that have made it possible to associate crashes to specific tribal lands based on GIS spatial analysis with U.S. Census tribal nation boundary files. These crashes are updated on a nightly basis and are available the next day to tribal agencies and safety partners through the Wisconsin Community Maps system, which provides timely and accessible crash mapping, advanced search, and predictive analytics crash hotspot detection based on prevailing safety emphasis areas. Over 4,600 crashes since 2017 have mapped to specific tribal areas, providing a rich source for safety analysis at the tribal level, as well as a starting point to better understand the overall completeness and accuracy of the tribal crash analysis dataset.

Technical Session 20: Special Risk Factors: The Big, the Small, and the Sleepy

[Session Based on Submitted Abstracts]

Identifying Massive Hazards: Compiling the Research on How Light Truck Design Impacts Road Safety

Julia Kite-Laidlaw (National Safety Council)

The Road to Zero Coalition (RTZ), an initiative of the National Safety Council, is the nation's largest traffic safety alliance, with the goal of ending roadway deaths in the United States by 2050. Embracing the Safe System Approach and a focus on promoting evidence-based strategies, an RTZ working group aimed to compile the academic, professional, and government research available regarding how the shift towards light trucks (SUVs, pickups, vans) and away from sedans in recent decades has impacted road safety. The urgency for this work stems from the need to understand and address the rise in fatalities among people traveling outside of vehicles. Notably, 2022 was the deadliest year for pedestrians in the United States since 1981, and the deadliest for bicyclists in the 47-year existence of NHTSA's FARS. These grave statistics represent the latest results of a decades-long trend in which vehicle occupants (drivers and passengers) comprise a smaller proportion of total motor vehicle fatalities, while the proportion of non-occupants (those walking, rolling, biking, or otherwise moving outside of the vehicle) continues to grow. Simultaneously, the breakdown of passenger vehicles produced in the United States has shifted from 30% light trucks and 70% sedans in 1990, to almost the inverse—73% light trucks, 27% sedans—in 2022. By pursuing this research, RTZ aimed to identify potential design features of light trucks that contribute to greater danger to other road users, and use that evidence to provide recommendations that lead to “Safer Vehicles,” a core component of the Safe System Approach. Knowing that extensive research had been performed, but had never been compiled in one cohesive document aimed at non-technical advocate audiences, the goal of the resulting RTZ report was to create a useful, practical resource summarizing statistics and evidence.

Members of an RTZ working group representing a wide range of traffic safety professionals conducted a literature review and drew upon professional networks to locate additional research studies. Papers were read, summarized, and adapted into layperson-friendly language to maximize utility for road safety advocates outside academia and without strict technical backgrounds. From the conclusions drawn in published research, RTZ formulated recommendations for policy, regulation, further research, and public education at the federal, state, local, and private sector levels.

A comprehensive review of available literature identified the following features of light trucks that pose a hazard to other road users:

- Height and weight (particularly relative to pedestrians)
- Crash incompatibility with smaller cars
- Unique front-end geometry and stiffness
- Large blind zones
- Compounding impacts of speed and acceleration

The RTZ report included chapters on each topic, summarizing research findings, providing clear quantitative data, and posing additional questions for future research. One topic that arose as a relevant data gap concerned the potential safety implications of a greater shift towards battery-electric vehicles, which are heavier and stiffer-framed than their internal combustion engine counterparts.

A wide range of academic, professional, and governmental research has been able to quantify the increased risk light trucks pose to VRUs and drivers of smaller vehicles. This research had not previously been compiled for a lay audience of advocates working towards improving vehicle design for safety.

Examining Motorcycle Visibility for Left Turn Across Path Vehicles

Pravar Parashar (University of Massachusetts–Amherst)

In recent years, motorcycle crashes have continued to remain a critical concern in traffic safety. In 2021, there were a total of 5932 motorcyclist fatalities recorded in the United States, which not only represented 14% of the total traffic fatalities but also the highest number of recorded motorcycle fatalities since 1975. Left turn across path crashes remains one of the most dominant crash cases, specifically when the motorcyclist is traveling straight and the opposing vehicle is turning left. According to NHTSA, 42% of motorcyclist crashes reported in 2020 followed this pattern. This research study focuses on investigating the conflict between motorcyclists and left-turning vehicles by evaluating both the visibility of the motorcycle as well as the “look but do not see” phenomenon that may exist when drivers see a motorcyclist but fail to cognitively process their presence. Specifically, the research identifies how preceding or following vehicles of varying types may impact the detection of a motorcyclist. The study was conducted using a full-scale driving simulator, and vehicle action/driver behavior was measured, as well as eye glances for left-turning drivers in the presence of motorcyclists. The experimental design includes 12 scenarios varying in vehicle composition of the oncoming traffic stream (e.g., motorcycles, cars, trucks, etc.) and includes 36 subject drivers. In an effort to evaluate the participants’ behavior, their eye tracking data was categorized into “detect” or “not detect” through an analysis of their visual look/no-look data paired with concurrent foot pedal behavior. The findings provide insights into the

influence of the vehicle configuration on motorcycle visibility, contributing to strategies for improving road safety and reducing left turn-related crashes.

Insights on Drowsy Driving and Break Taking Propensity

John Gaspar (University of Iowa)

Drowsiness plays a large and often underestimated role in traffic crashes, injuries, and deaths. While official statistics from the USDOT indicate that driver drowsiness is a factor in only about 2% to 3% of crashes, injuries, and deaths nationwide, most experts regard these statistics as a substantial underestimate. There is a need to understand the factors that impact the likelihood that drowsy drivers will stop to rest. Research is needed to understand the relationship between self-perceived and objective measures of drowsiness, as well as how perceived and objectively measured drowsiness relate to drivers' decisions regarding whether or when to stop driving or employ other countermeasures to attempt to mitigate their drowsiness and maintain safety.

This study investigated the relationship between subjective ratings of drowsiness, objective measures of drowsiness, and measures of driving performance among participants in a driving simulation study designed to induce drowsiness. The study also examined what factors influence drowsy drivers' decisions regarding whether to take breaks during long drives. Finally, the study measured the magnitude and duration of performance improvements following break taking.

The study utilized a novel driving simulator methodology to examine drowsy driving during a long overnight drive. Participants followed a protocol designed to induce partial sleep deprivation prior to the session, and then drove a route designed to induce drowsiness. Participants had the option to stop to rest at designated areas throughout the drive. At various points throughout the session, several measures of drowsiness, including self-ratings and objective measures derived from video-coded eyelid closures, were collected. To replicate the motivational tradeoffs of drowsy driving, the study utilized a novel incentive methodology to mimic the decision-making tradeoff between continuing to drive to reach their destination more quickly versus stopping to rest to maintain safety.

Results showed that self-assessments of drowsiness were often poorly calibrated with objective drowsiness based on eyelid closures. This indicates that drowsy drivers might over- or underestimate their level of drowsiness, which could lead to situations in which drivers might decide to continue driving despite high levels of objective drowsiness. Furthermore, the data showed that self-ratings of drowsiness were the key predictor of the likelihood that drivers would stop to take a break. Other factors, including objective drowsiness and driving performance, were not significantly associated with the likelihood of stopping to take a break. This suggests that despite the finding that self-assessments of drowsiness may be poorly aligned with objective

measures, drowsy drivers rely on self-ratings when determining whether to stop to take a break. Importantly, many drivers continue driving even when they rate their drowsiness as very high. Breaks were beneficial and resulted in improved driving performance in the period of time immediately following the break. This benefit lasted up to 40 minutes post-break.

These results can help inform efforts to educate the public about drowsy driving. Drivers should understand that their self-perceived drowsiness may not align with other established objective measures of drowsiness. Thus, drivers should be encouraged to consider stopping to rest before they feel severely drowsy. This has additional important implications for driver monitoring approaches. The results of this study can also help to inform drowsy drivers that their own self-evaluations of drowsiness may be inaccurate and focus on promoting the use of effective, evidence-based countermeasures in the challenging context of drowsy driving.

Technical Session 21: Emerging Technology and Commercial Motor Vehicle Safety: Two Naturalistic Studies

[Session with Invited Speakers]

Sarah Hacker (University of California-San Diego)

Two studies conducted by TREDIS Center at UC–San Diego leverage the emerging technologies of artificial intelligence and electronic logging devices to enhance commercial motor vehicle (CMV) safety, addressing critical public health challenges posed by crashes involving large trucks. These studies align with the themes of Countermeasures and Strategies to Alleviate Dangerous Road User Behaviors by demonstrating practical interventions to address high-risk driving behaviors like speeding and distraction, as well as Vehicle Technology and Safe Mobility, showcasing the potential of scalable safety tools.

Study 1: Real-Time Driver Alerts Using Electronic Logging Devices

The first study presents early findings from analysis of vehicle speed behavior before and after in-cab work zone alerts. CMVs are disproportionately involved in fatal crashes in work zones, where challenges like speeding, distraction, and fatigue compound risks. This study investigates the effectiveness of in-cab alerts in mitigating such crashes. Participating fleets receive real-time alerts via electronic logging devices, notifying drivers of upcoming work zones. Vehicle speed, hard braking, and location are collected before and after alerts to measure behavioral changes. Comparable data are collected from control vehicles that do not receive the work zone alerts on their electronic logging devices.

Analyses from April 1 through September 16, 2024, for 88,742 vehicle visits at 2,331 unique work zones across nine California counties indicate that, within the first 10 seconds post-alert, alerted drivers traveling above 55 mph reduce their speed by a magnitude of 1.46 mph compared to control group ($p=0.02$). For each 1 mph reduction a control vehicle makes post-alert, an alerted vehicle will reduce their speed nearly 1.5 mph. Lane-specific alerts may also be more effective than generic alerts, with slopes of deceleration up to 2.2 times steeper ($p<0.001$).

A key insight emerged when researchers stratified the data by vehicle speed 1 second prior to the alert: 63.5% of both control and alerted vehicles were traveling over 55 mph at that moment. For these higher-speed vehicles, alerts were associated with a notably steeper decline in speed indicating a 30% greater rate of deceleration. While we observed a similar trend for vehicles already under 55 mph, the actual magnitude of change was small enough to have negligible real-world impact. For vehicles exceeding 55 mph, however, the alert was associated with a mean reduction of 0.5 mph within 10 seconds, translating to up to a 3 mph difference over 1 minute. This seemingly modest

reduction could result in an additional 3.4 seconds of buffer time when traveling 1 mile—enough to significantly reduce the likelihood of a rear-end crash, especially given the extended stopping distance required by commercial vehicles.

Literature review and stakeholder interviews indicate that work zone alerts are valued by drivers, enhancing situational awareness without causing distraction. A survey is currently being deployed to confirm this sentiment in drivers participating in the present study.

In Year 2 of this study, we will expand analyses to incorporate more factors present in naturalistic data collection to pinpoint the conditions under which in-cab alerts improve safety. Survey data will be analyzed to confirm driver perception of these alerts and their impact on safer driving in high-risk areas. Potential crash reduction if fully scaled in California will be estimated.

Study 2: AI Technology for High-Risk CMV Driving Behavior Detection

Unsafe driving behaviors like speeding, seatbelt noncompliance, and handheld phone use are significant contributors to CMV crashes. High resolution cameras collecting naturalistic driving data, combined with AI technology, hold promise to better understand prevalence of these unsafe driving practices while preserving driver anonymity. This two-year study leverages AI technology to observe risky driving behaviors and evaluate the effectiveness of targeted safety messaging in reducing risks.

In this study, we shared insights from a two-year Federal Motor Carrier Safety Administration-funded project using roadside AI technology (Acusensus) to anonymously monitor risky behaviors among CMV drivers in real time. Over 160,000 CMVs were observed across 16 locations, with AI identifying behaviors such as speeding, cellphone use, and seatbelt non-use. Overall, 10.79% of drivers exhibited at least one of these unsafe behaviors, with 4.49% speeding (defined as over 65 MPH), 4.45% not wearing a seatbelt, and 2.64% using a phone while driving. When examined by day of the week, offense rates were highest on weekends—even though CMV volume was lowest—suggesting a more concentrated group of high-risk drivers. Similarly, early morning hours (4 AM to noon) saw elevated offense rates despite lower vehicle volumes, pointing to increased risk among a smaller driving population. These insights inform a second-year field experiment involving portable changeable message signs (PCMS) deployed downstream of detection trailers. Real-time alerts—such as “Hey You! Slow Down” or “Cell Phone Detected”—are triggered by observed behavior, with a second trailer positioned after the PCMS to assess changes in driving behavior. Varying distances between units across four experimental setups will help determine the most effective configuration for reducing risky behaviors among CMV drivers.

In Year 1, prevalence of high-risk driving behaviors was measured at 16 sites using stationary AI-enabled roadside cameras. Analysis of prevalence and frequency of

risky driving behaviors for 160,671 observed CMVs found that 7,143 (4.45%) vehicle occupants were not wearing seatbelts, 4,241 (2.26%) were holding or using cell phones, and 90,684 (56.44%) were exceeding the posted speed limit. Saturdays and Sundays had the highest overall offense rate, despite being the days that had the fewest CMVs on the road. The highest overall rate of traffic offenses occurred during the time periods of 4:00–9:59 AM and 8:00–11:59 AM—time periods that had the fewest CMVs on the road.

In Year 2, a variable message sign will be deployed between two roadside cameras at four locations to deliver real-time safety messages based on observed behaviors (e.g., “Put down your phone”). Changes in driver compliance following message delivery will be compared to a control group that receives no message. Analyses of behavioral shifts post-message delivery will identify which subgroups respond best to targeted interventions, shedding light on the potential of AI-driven systems to inform broader safety policies and countermeasures.

Both studies illustrate the potential of technology to address the complex safety challenges associated with CMVs. Attendees are encouraged to consider the broader implications of these findings for policy, fleet management, and technology integration. Collaboration between researchers, transportation agencies, and industry stakeholders remains essential to achieving safer mobility for all road users.

Technical Session 22: Automated Vehicle Safety: The Past, Present, Future

[Session Based on Submitted Abstracts]

Retrospective Safety Impact for Autonomous Vehicles: Best Practices and Results

Kristofer Kusano (Waymo)

Autonomous vehicles, in the form of SAE Level 4 Automated Driving Systems (ADSs), are starting to be deployed on public roads. This on-road driving provides the opportunity to evaluate these ADSs' retrospective safety impact by comparing the ADS crash rates to comparable human benchmarks. The retrospective safety impact topic has been heavily studied in the past for various safety systems (e.g., seat belts, airbags), active safety (e.g., electronic stability control, anti-lock brakes), and ADAS (e.g., forward crash prevention, lane departure prevention). SAE Level 4 ADSs pose some challenges when conducting retrospective studies, namely the ADS crash reporting requirements are different from most human crash data. Therefore, there have been studies, both in published literature and informal analyses, that have flawed analysis methods that lead to biased results. The purpose of this work was to: (a) present best practices developed by an expert group of safety impact researchers to aid in the conducting and evaluating ADS safety impact studies and (b) present retrospective safety impact results for Waymo's rider-only (RO) ride-hailing service using these best practices.

A workshop was held with representatives with safety impact research experience from industry and academia to discuss the most important considerations when conducting ADS safety impact studies. After the workshop, a group of participants codified the recommendations discussed at the workshop into a written paper. Using these recommendations, researchers at Waymo conducted a safety impact study of Waymo's RO (i.e., driving on public roads without a human behind the steering wheel) ride-hailing service. The Waymo crashes were sourced from the NHTSA Standing General Order database. Miles driven in RO are not required to be reported in the NHTSA database or any other national reporting systems, and thus were provided by the company for this study. The Waymo crash rates were then compared to relevant human benchmarks that were aligned to match the inclusion criteria of the ADS data derived from state crash and vehicle miles traveled data. Crash rates were compared on police-reported, any-injury-reported, and airbag deployment outcomes. Confidence intervals for the percent reductions were computed using a rate ratio of Poisson occurrence rates.

The expert group of 14 co-authors published a paper outlining 15 recommendations in a Retrospective Automated Vehicle Evaluation Checklist. The paper, which was accepted for publication in a peer-reviewed traffic safety journal, lists required and recommended sub-recommendations with accompanying justifications and examples for applying each requirement. The paper has led to the start of developing an International Standards Organization (ISO) technical specification on ADS safety impact.

An analysis of 25.3 million RO miles found that the Waymo RO service had an 81% reduction in airbag deployment, 72% reduction in any-injury-reported, and 57% reduction in police-reported crashes compared to human benchmarks. These reductions were statistically significant across all outcomes. Compared to an average human with the benchmark crash rate driving those same 25.3 million miles, the Waymo RO serviced had an estimate of 34 fewer airbag crashes, 67 fewer any-injury-reported crashes, and 81 fewer police-reported crashes.

The best practices in the Retrospective Automated Vehicle Evaluation Checklist paper and the forthcoming ISO standard provide stakeholders with clear standards to conduct and evaluate ADS safety impact research. Given that automation in vehicles is a nascent and evolving technology, there is a great need to have valid and transparent research results that can inform policy decisions. The Waymo RO safety impact research demonstrates the application of these best practices, and is one of the first studies to examine purely RO data. Although the results are promising across police-reported, any-injury-reported, and airbag-deployment crashes, there is insufficient data to draw statistically significant conclusions retrospectively for higher severity outcomes, such as serious injuries and fatalities. Future work will investigate these higher severity outcomes as more miles are driven. Future work will also investigate how the principles of Vision Zero can be applied to assessing the potential safety impact of ADS (e.g., speed limit compliance, promoting proper restraint use).

How Do Driver Assistance Technologies Affect Transportation Safety?

Jonathan Hall (University of Alabama)

Advanced driver assistance systems, designed to promote safety and reduce car crashes, have become commonplace in recent years. These driver assistance technologies include warning systems such as visual or audible warnings about vehicles located in one's "blind spot," intervention systems such as automatic emergency braking, and driver aids such as lane keeping assist. One might expect these new safety features to improve overall road safety as ADAS-equipped vehicles make up an increasing share of the U.S. vehicle stock. The National Safety Council, however, reports that traffic fatalities increased from 35,332 in 2010 to 46,980 in 2021, a 33% jump.

In this research, we examine whether ADAS can reduce collisions or help to avoid injuries and deaths. It is important to establish the causal impact of ADAS because the technology adds thousands of dollars to the price of a new vehicle. While one might expect ADAS to lead to improved safety, these features may be less effective in real-world driving scenarios relative to their performance in "test track" settings. Alternatively, these technologies might cause drivers to feel safer—consciously or not—and, as a result, drive less carefully. At the extreme, certain autonomous interventions could lead to an

increase in the number and severity of crashes if they take control away from a human driver.

To estimate the impact of ADAS, we use a difference-in-differences approach that measures changes in crash rates involving cars with and without ADAS—defined here as having at least one ADAS feature—when exposed to an exogenous change in crash risk. We cannot simply compare crash rates of vehicles with and without driver assistance technology, as there are likely unobserved confounding factors that would leave any such estimates biased. For example, perhaps more cautious or more experienced drivers self-select into vehicles with advanced safety systems. To avoid this source of confounding, our main estimates use precipitation as a risk shifter, focusing on total crashes and fatal crashes within 20 kilometers of a weather station. Using crash data from 39 state transportation agencies and FARS, our primary outcome of interest is hourly crash counts where at least one vehicle has driver assistance technology relative to hourly crash counts where no vehicles have driver assistance technology. If the technology helps drivers avoid crashes, we should see a smaller increase in crashes involving ADAS-equipped vehicles when there is precipitation.

When using rain as a risk shifter, summary statistics suggest that ADAS is associated with a 7.7 percentage point (22.9%) decline in crashes. In a regression framework, our estimates show a 19.1% reduction in crashes involving at least one vehicle with ADAS when there is rain. On the other hand, summary statistics indicate driver assistance technologies are associated with between a 4.9 and 11.5 percentage point relative increase in instances of fatal crashes. For fatal crashes, our regression-based estimates indicate a 14.6% relative increase in crashes involving ADAS-equipped vehicles compared to the outcome mean. One potential explanation for this pattern is that ADAS helps to eliminate minor crashes but increases the relative severity of major crashes due to driver inattention. Our estimates represent the causal effect of ADAS on crashes if drivers with and without cars that have driver assistance technology respond to changes in driving conditions the same way. Implicitly, this means we assume that in the absence of driver assistance technology, the effect of rain on crashes would be the same for drivers of both types of vehicles. We support a causal interpretation for our findings using a variety of robustness, sensitivity, and heterogeneity exercises.

To further support our main findings, we use a regression discontinuity analysis centered on the annual transition to daylight savings time. The change occurs on the second Sunday in March throughout our 2016 to 2020 sample period. [Smith \(2016\)](#) shows that people sleep less, experience more fatal crashes, and that the effect is caused by the loss of sleep because there is no similar effect when we “gain” an hour in the fall. Our daylight savings time analyses again reveals that shifts in crash risk—likely driven by the loss of sleep for some drivers—affect crash types differently. Specifically, we observe a small increase in fatal crashes, in line with [Smith \(2016\)](#), but the overall number of crashes declines. Consistent with our estimates using rain as a risk shifter, driver

assistance technology seems to help drivers in avoiding minor collisions, but the risk of severe crashes (i.e., fatal crashes) increases more for ADAS-equipped vehicles when fatal crash risk is greater.

Quantitative Risk Assessment of Autonomous Vehicle Behavior Utilizing On-Road Driving Data: A SOTIF-based Approach

Michio Hayashi (TIER IV North America, Inc)

Autonomous vehicles have great potential to serve communities by filling in for labor shortages in areas with declining or aging populations. However, ensuring the safety of SAE Level 4 autonomous vehicles is a challenging yet crucial problem for integrating this technology into society. Many companies developing autonomous vehicle software have adopted the “Globally At Least As Good” framework to set safety goals, aiming to demonstrate that their systems are statistically safer than competent human drivers. However, this approach reduces a rigorous safety engineering problem to a statistical numbers problem.

This paper proposes a quantitative risk assessment method for autonomous vehicles based on [ISO 21448:2022](#) safety of intended functionality (SOTIF) principles. We use real-world autonomous driving data collected by TIER IV to demonstrate the method’s effectiveness and use cases. The proposed method focuses on clause 13 operation phase activities and utilizes a quantitative risk model based on the SOTIF-related hazardous event model. The model uses on-road driving data as input and produces quantitative risk scores that can be analyzed continuously in the operational phase to determine risk mitigation activities to avoid unreasonable risk.

The proposed behavior risk assessment method uses a risk model that considers risk a composite metric of occurrence, exposure, controllability, and severity.

We define three new variables to reformulate the SOTIF-related hazardous behavior model into the quantitative risk model:

- r : The rate of hazardous scenario category on a per-operating distance basis (s.a. events/mile). Use gamma distribution estimation to account for uncertainty.
- s : The items and relative severity scores of harms (and losses, for non-safety related risks) associated with a hazardous event.
- p : The likelihood of each associated harm/loss materializing given the knowledge of the underlying hazardous event occurring. This is determined by simulation or by an expert, such as a trained safety driver.

Here, the variable s is a pre-definable list of harms/losses that the risk assessor wants to consider, while r and p are parameters to be estimated using on-road driving

data. The variable s can be seen as directly modeling severity, r as a combination of exposure to a scenario and the occurrence of the triggering conditions, and p as controllability in a probabilistic term.

We applied the risk model to quantify the risk of a TIER IV autonomous bus system being developed for a fixed-route operation in Shiojiri City, Japan. The scenario categories were divided into 20 segments, and the harm/loss list and their relative severity scores were defined. The risk scores for each scenario segment were computed following the proposed risk score calculation. Parameters r and p were estimated from a total of more than 450km worth of real-world autonomous driving data acquired in Shiojiri. Notably, in some segments, while the distribution of r is similar, the risk score distribution is skewed significantly higher. This highlights the importance of capturing behavior risk in a proper unit of risk rather than pure statistical rates such as hazardous event rates. The method was also found to successfully distinguish high-risk segments from low-risk segments.

We have proposed a quantitative risk model for autonomous vehicle behavior risk measurement and showed how risk assessments can be conducted using real-world driving data. In addition to the benefits of measuring behavior risk quantitatively for risk assessments, the distribution of risk scores also provides valuable support for assurance argument construction and decision-making. Furthermore, continuously monitoring real-world driving risk data using this method allows for a demonstrable and highly reproducible assessment of the autonomous system's maturity and behavioral tendencies when faced with uncertainties.

APPENDIX A: 2025 Safe Mobility Conference Organizing Team

- Alycia Bayne, *NORC*
- Andrea Bill, *University of Wisconsin–Madison*
- Dr. Peter Burns, *Transport Canada*
- Dr. John Campbell, *Exponent*
- Dr. Donald Fisher, *University of Massachusetts–Amherst*
- Natalie Draisin, *FIA Foundation*
- Shaina Harris, *AAA Foundation for Traffic Safety*
- Dr. William Horrey, *AAA Foundation for Traffic Safety*
- Dr. David Hurwitz, *Oregon State University*
- Nick Jarmusz, *The Auto Club Group*
- Ansley Kasha, *AAA Foundation for Traffic Safety*
- Dr. Michael Knodler, *University of Massachusetts–Amherst*
- Dr. Charlie Klauer, *Virginia Tech Transportation Institute*
- Dr. Tony McDonald, *University of Wisconsin–Madison*
- Dr. Daniel McGehee, *University of Iowa*
- Dr. David Noyce, *University of Wisconsin–Madison*
- Dr. Anuj Pradhan, *University of Massachusetts–Amherst*
- Dr. Alicia Romo, *AAA Foundation for Traffic Safety*
- Carlyn Ross, *University of Wisconsin–Madison*
- Dr. Alyssa Ryan, *University of Arizona*
- Dr. Laura Sandt, *University of North Carolina–Chapel Hill*
- Dr. Renée St. Louis, *UMTRI*
- Dr. C. Y. David Yang, *AAA Foundation for Traffic Safety*

APPENDIX B: 2025 Safe Mobility Conference Program

2025
SAFE
MOBILITY
CONFERENCE

📍 **MADISON, WI**

APRIL 7-9



FTS

FOUNDATION FOR TRAFFIC SAFETY



College of Engineering
UNIVERSITY OF WISCONSIN-MADISON



DELIVERING SAFE AND RELIABLE TRANSPORTATION SYSTEMS

Welcome to the 2025 Safe Mobility Conference, a collaboration between the AAA Foundation for Traffic Safety and the University of Wisconsin-Madison. The theme for this year's conference, *Delivering Safe and Reliable Transportation Systems*, brings together transportation practitioners and researchers from both public and private sectors to share information and solutions in achieving safe mobility.

Our plenary sessions, technical sessions, and workshops are carefully curated to address relevant and timely topics crucial in sustaining safe mobility within our transportation systems. These sessions are designed to provide participants with insights and practical solutions for delivering efficient and safe transportation systems for their users. We invite you to use this conference to engage in discussions and connect with others who have a shared mission to improve the safety and efficiency of our transportation systems.

We extend our gratitude to the 2025 Safe Mobility Conference sponsors, whose generous contributions have enabled us to deliver a high-quality event at an affordable cost. Additionally, we would like to recognize and thank the 2025 conference organizing team for volunteering their time and efforts. Lastly, we sincerely appreciate those who submitted abstracts, proposals for technical sessions with invited speakers, workshop proposals, or posters to the 2025 Safe Mobility Conference.

C. Y. David Yang, Ph.D.
President & Executive Director
AAA Foundation for Traffic Safety
Conference Co-Chair

David A. Noyce, Ph.D.
Executive Associate Dean
University of Wisconsin-Madison
Conference Co-Chair



PLEASE JOIN US IN THANKING OUR 2025 ORGANIZING COMMITTEE:

Conference Program Coordination

Alicia Romo, AAA Foundation for Traffic Safety

Andrea Bill, University of Wisconsin-Madison

Conference Logistics Coordination

Shaina Harris, AAA Foundation for Traffic Safety

Carlyn Ross, University of Wisconsin-Madison

Committee on Abstract Reviews

William Horrey, AAA Foundation for Traffic Safety

Peter Burns, Transport Canada

David Hurwitz, Oregon State University

Committee on Technical Sessions with Invited Speakers

Donald Fisher, University of Massachusetts Amherst

John Campbell, Exponent

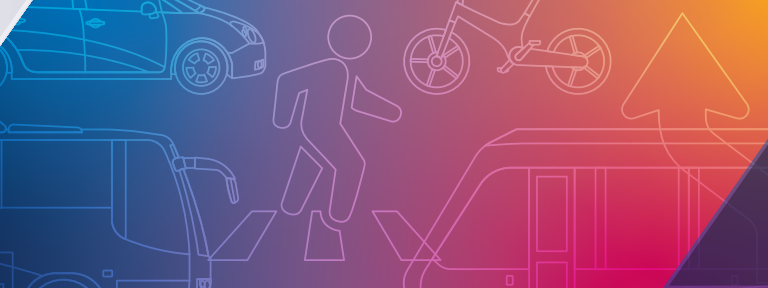
Michael Knodler, University of Massachusetts Amherst

Committee on Workshops

Anuj Pradhan, University of Massachusetts Amherst

Alycia Bayne, NORC

Laura Sandt, University of North Carolina at Chapel Hill



Committee on Posters

Sheila Klauer, Virginia Tech Transportation Institute

Daniel McGehee, University of Iowa

Renée St. Louis, University of Michigan Transportation
Research Institute

Committee on Conference Outreach

Tony McDonald, University of Wisconsin-Madison

Nicholas Jarmusz, The Auto Club Group

Ansley Kasha, AAA Foundation for Traffic Safety

Committee on Conference Sponsorship

Natalie Draisin, FIA Foundation

Alyssa Ryan, University of Arizona

CONFERENCE AGENDA

MONDAY, APRIL 7

11:00 am – 12:00 pm..... *Capitol Building*
Pre-Conference Activity
Wisconsin State Capitol Tour

12:00 pm – 5:00 pm..... *Reception*
Registration

1:00 pm – 5:00 pm
Workshop 1..... *Conference I*
Advancing Transportation Equity
through the Safe System Approach

Workshop 2..... *University CD*
Automation and the Future of Trucking –
Fostering Collaboration for Sustainable
Industry Evolution

Workshop 3..... *Conference II*
Driving and Aging: Precision Medicine and
Decision Making

Workshop 4..... *Conference V*
How to Effectively Implement
the Safe System Approach in Your Community

Workshop 5..... *University A*
Improving Pedestrian Safety on Urban Arterial Roads:
Understanding the Problem and Identifying Solutions

TUESDAY, APRIL 8

8:00 am – 4:00 pm..... Reception
Registration

Breakfast..... *Capitol Ballroom AB*

9:00 am – 10:00 am..... *Madison Ballroom*
Opening Plenary Session

Gene Boehm, *President & CEO, AAA, Inc.*

Ian Robertson, *Professor and Dean of the College of Engineering,
University of Wisconsin-Madison*

10:00 am – 11:00 am..... *Madison Ballroom*
Plenary Session 1: What is Safe Mobility to You?

John Lee, *Professor, University of Wisconsin-Madison*

Roger Millar, *President, Millar Consulting Services*

Jessica Cicchino, *Senior Vice President for Behavior and
Infrastructure Research, Insurance Institute for Highway Safety*

11:30 am – 12:30 pm

Technical Session..... *Conference I*
Micromobility: Attitudes, Adoption, and Safety

Technical Session..... *Conference II*
Assessing and Addressing Knowledge Gaps
Related to Vehicle Technology

Technical Session..... *Conference IV*
Addressing Work Zone and Incident Safety

Technical Session..... *Conference V*
Emerging Countermeasures and
Strategies to Address Impaired Driving

Technical Session..... *University A*
Understanding Risk Factors:
Driving Styles, Aging, and New Approaches

Technical Session..... *Wisconsin Ballroom*
Towards the Modernization of
State DOTs' Crash Data Systems

12:30 pm – 1:30 pm..... *Capitol Ballroom AB*
Lunch

1:30 pm – 2:30 pm..... *Madison Ballroom*
Plenary Session 2: Why is Safe Mobility Important?

Satya Rhodes-Conway, *Mayor, City of Madison*

Kristina Boardman, *Secretary, Wisconsin Department of
Transportation*

Luca Pascotto, *Head of Road Safety and Global Advocacy,
Federation of International de l'Automobile*

2:30 pm – 3:30 pm..... *University BCD*
Poster Session 1

3:30 pm – 4:30 pm

Technical Session..... *Conference I*
Safety and Automation:
Hazard Response at Different Levels of Automation

Technical Session..... *Conference II*
Safeguarding First Responders in the
Era of Emerging Mobility Technologies

Technical Session..... *Conference IV*
Effectiveness of Behavioral Interventions and
Programs

Technical Session..... *Conference V*
Examples and Strategies for Safe System
Implementation

Technical Session..... *University A*
The Role of Vehicle Automation to Achieve Safe Mobility

Technical Session..... *Wisconsin Ballroom*
Improving Vulnerable Road User Safety via Mixed
Research Methods

5:30 pm to 9:00 pm

Conference Dinner & Networking Event

800 Langdon Street, Madison, WI 53706

WEDNESDAY, APRIL 9

8:00 am – 10:00 am *Reception*
Registration

Breakfast..... *Capital Ballroom AB*

9:00 am – 10:00 am

Technical Session..... *Conference I*
Complete Streets Handbook and
Design Leads to Safer Mobility in Milwaukee

Technical Session..... *Conference II*
The Trend of Motorcycle Crashes and
Fatalities in the U.S.

Technical Session..... *Conference V*
From Data to Safety Solutions

Technical Session..... *University A*
Safety Initiatives from Local Transportation
Agencies

Technical Session..... *Wisconsin Ballroom*
Paving the Way to a Future Free of Impairment

10:00 am – 11:00 am *University BCD*
Poster Session 2

11:00 am – 12:00 pm.....*Madison Ballroom*

**Plenary Session 3:
How to Achieve Safe Mobility for Everyone?**

Patricia Hu, Director, *Bureau of Transportation Statistics*
(Retired), *U.S. Department of Transportation*

Victoria Sheehan, *Executive Director, Transportation Research Board*

Joe Zietsman, *Deputy Agency Director, Texas A&M Transportation Institute*

Steve Kuciemba, *President & CEO, Institute of Transportation Engineers*

12:00 pm – 1:00 pm.....*Capitol Ballroom AB*
Lunch

1:00 pm – 2:00 pm

Technical Session..... *Conference I*
Enabling Safe Mobility through Research & Development
& Deployment

Technical Session..... *Conference II*
Innovative Approaches for Safe Mobility

Technical Session..... *Conference III*
Safe System Approach and the FHWA Research
Portfolio

Technical Session..... *Conference V*
Special Risk Factors: The Big, the Small, and the
Sleepy

Technical Session..... *University A*
Emerging Technology and Commercial Motor Vehicle
Safety: Two Naturalistic Studies

Technical Session..... *Wisconsin Ballroom*
Automated Vehicle Safety: The Past, Present, and
Future

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APPENDIX C: List of Organizations that Participated in the 2025 Safe Mobility Conference

- AAA Club Alliance
- AAA Foundation for Traffic Safety
- AAA, Inc.
- AAA Mountain West Group
- AAA Northeast
- AAA Northern California, Nevada, & Utah
- AAA Oregon/Idaho
- AAA Washington
- AAA Western and Central New York
- AMTRAK
- Applied Research Associates
- Arizona State University
- Auto Club Enterprises
- Brown University
- Cambridge Mobile Telematics
- Carnegie Mellon University
- Chicago Metropolitan Agency Planning
- City of Columbus
- City of Madison
- City of Milwaukee
- Colorado State University
- Columbus Public Health
- Delaware Department of Transportation
- DENSO
- Dunlap and Associates
- Emergency Responder Safety Institute
- Exponent
- Federation International de l'Automobile
- Foundations for Families
- Georgia Governor's Office of Highway Safety
- General Motors
- Griffin Strategies
- HAAS Alert
- HNTB Corporation
- Institute of Transportation Engineers
- Insurance Institute for Highway Safety
- International Association of Chiefs of Police
- Johns Hopkins University
- KEA Technologies
- Kittleson & Associates

- Lakeside Engineers
- LifeSafer Intelligent Speed Assist
- Metropolitan Transportation Commission
- Michael Baker International
- Mid-Ohio Regional Planning Commission
- Millar Consulting Services
- Missouri Department of Transportation
- Motus Ventures
- National Safety Council
- National Transportation Safety Board
- New Mexico Department of Transportation
- NORC at the University of Chicago
- Oregon State University
- Pennsylvania State University
- Purdue University
- raSmith
- Revelation PR, Advertising & Social Media
- SCRAM Systems
- TADI (Traffic Analysis & Design, Inc)
- Texas A&M Transportation Institute
- TF Health Co.
- The Auto Club Group
- The Hong Kong Polytechnic University
- The Ohio State University
- The Pew Charitable Trusts
- TIER IV
- Torc Robotics, Inc.
- Toyota Motor North America
- Transport Canada
- Transportation Research Board
- U.S. Department of Transportation
- University at Buffalo
- University of Alabama
- University of Arizona
- University of California–San Diego
- University of Connecticut
- University of Georgia
- University of Iowa
- University of Massachusetts–Amherst
- University of Memphis
- University of Michigan Transportation Research Institute
- University of Nevada
- University of New Mexico

- University of North Carolina–Chapel Hill
- University of New Hampshire
- University of South Florida
- University of Tennessee–Knoxville
- University of Washington
- University of Wisconsin–Madison
- University of Wisconsin–Milwaukee
- Virginia Tech Transportation Institute
- Volpe National Transportation Systems Center
- Washington University–St Louis
- Waymo LLC
- Western Michigan University
- Wisconsin Department of Transportation
- WSP USA