HF HUMAN FACTORS

FAST LANE

Exploring Human Behavior

Turner-Fairbank Highway Research Center

Safety R&D Program

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Hot Off the Press

Calvo, J., S. F. Chao, Y. C. Lee, D. Kidd, M. Jannat, and J. Eisert. 2025. *Investigation of Key Automated Vehicle Human Factors Safety Issues Related to Infrastructure: Comparing Intersection Crossing Behaviors of Human Drivers and Automated Vehicles*. Report No. FHWA-HRT-25-025. Washington, DC: Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-25-025.pdf, last accessed December 1, 2025.

Calvo, J., Y. C. Lee, E. Bowden, M. Jannat, and J. Eisert. 2025. *Enhancing Vulnerable Road User Detection and Volumetric Data Through Advanced Infrastructure Detection Technologies*. Report No. FHWA-HRT-24-175. Washington, DC: Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-24-175.pdf, last accessed December 1, 2025.

Calvo, J., A. Svancara, S. F. Chao, Y. C. Lee, M. Jannat, and M. Arnold. 2025. *Comparing Merging Behaviors of Drivers with Vehicles Equipped with Level 3 Automation and Connected Messaging when Merging in a Mixed Vehicle Fleet Environment of Various Traffic Densities*. Report No. FHWA-HRT-25-051. Washington, DC: Federal Highway Administration. https://highways.dot.gov/media/108926, last accessed December 10, 2025.

Svancara, A., J. Calvo, S. F. Chao, Y. C. Lee, M. Jannat, and J. Eisert. 2025. *Lane-Change Response to Infrastructure Warning About Lane Closure in a Mixed Vehicle Fleet*. Report No. FHWA-HRT-25-039. Washington, DC: Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-25-039.pdf, last accessed December 1, 2025.

TRAVEL LANE

Current Research:

■ **Traffic Control Device (TCD) Consortium Pooled Fund Study (PFS). Transportation Pooled Fund (TPF)-5(554),** led by Laura Mero.

» **Pedestrian Signing at Uncontrolled Crosswalks.** The goal of the study is to use human factors experiments to test various pedestrian signing options at uncontrolled crosswalks to determine signs with high comprehension and that lead to driver yielding.

» **Comprehension and Legibility of Selected Symbol Signs, Phase V.** The objective of this research is to evaluate the legibility and comprehension of new and existing symbol- and text-based signs and related plaques, as appropriate, to determine the signs that are best understood and most effective at conveying intended meanings. Data collection included participants representative of the U.S. driving population, including older drivers.

» **Temporary Traffic Control Advance Warning Sign Placement.** This project was awarded in September 2025. The objectives of this research are to consider the differences in warning sign spacing guidance between MUTCD Part 2 (for sign spacing) and Part 6 (for signing in temporary traffic control zones) and align Part 6 and Part 2 guidance, as appropriate, based on research findings.

■ **Evaluation of Crosswalks with Aesthetic Treatments Phase ll,** led by Laura Mero. The research team is systematically documenting the progress and developments made throughout the project's duration. The objectives of the project are to determine if crosswalks with surface treatments affect road user (drivers, pedestrians, and pedestrians with low vision) behavior compared with standard crosswalk markings and what conditions or aspects of crosswalks with surface treatments affect road user behavior; this project will take place in the field. The project is a follow-on to *Evaluation of Crosswalks with Aesthetic Treatments Phase 1*, which shared the same objectives and took place in closed-course environments.

■ **Evaluation of Methods to Predict Pedestrian Volume to Support Safety Investments,** led by Laura Mero. This project was awarded in September 2025 and will evaluate and compare existing models for predicting pedestrian volume; identify which models are appropriate in different types of locations, conditions, and applications; and develop resources to apply the models.

TRAVEL LANE *(continued)*

- **Investigating Nighttime Pedestrian Safety and Conspicuity Using Bollard Lighting,** led by Michelle Arnold, was initiated in September 2023, and the team completed data collection and developed the final tech-brief and report. This closed-course study examines the feasibility of a bollard-based lighting system to provide enhanced visibility for pedestrians in crosswalks as a viable safety strategy for nighttime use while mitigating unwanted glare common in populations such as older drivers. A second phase of the study began to evaluate the results at specific sites to determine the effectiveness of the lighting designs on non-motorist conspicuity at mid-block crosswalks.

- **Lighting for Vulnerable Road Users,** led by Michelle Arnold, was initiated in September 2024. This study will build on previous work related to the need for detection of vulnerable road users, develop a set of recommendations and an implementation policy for lighting, and further evaluate lighting and vulnerable road user safety.

- **Influence of Automated Vehicles (AVs) on Speed Selection of Manual Drivers in Mixed Traffic,** led by Michelle Arnold, was awarded in September 2024. This research will investigate whether and to what extent manual drivers adjust their driving behaviors in mixed traffic with the presence of automated vehicles on the highway. The results of this work will support vehicle automation applications, development, and testing and will expand the knowledge base of interaction between AV and manual drivers in a mixed-fleet environment.

- **Development of Pedestrian Intersection Crash Modification Factors (CMFs) Phase 2,** led by Michelle Arnold, was awarded in July 2024. The objective of this task order is to determine the safety effectiveness of centerline hardening treatments in reducing non-motorist fatalities and injuries at controlled and uncontrolled intersections.

- **Enhanced Lighting Treatments for Improving Vulnerable Road User Detection Within Mixed Fleets,** led by Jesse Eisert, was awarded in November 2023. The first phase used a closed-course study to examine how various light treatments can help improve both conventional and automated vehicles' ability to detect vulnerable road users. Phase two of this project aims to evaluate and compare

Source: FHWA.

Figure 1. Photo. The VR Bicycle at ITS World Congress.

various occupancy lighting systems that are currently available. A closed-course study will evaluate these occupancy detection systems.

- **Ensuring Cooperative Driving Automation (CDA) and Vulnerable Road Users' Safety Through Infrastructure: Phase 2,** led by Jesse Eisert. This project examines how an infrastructure-based Intersection Safety System could potentially warn pedestrians of an impending conflict with a vehicle. The research team completed data collection by using the Virtual Reality (VR) Pedestrian test bed at Turner-Fairbank Highway Research Center.

- **Ensuring Cooperative Driving Automation (CDA) and Vulnerable Road Users' Safety Through Infrastructure: Phase 3,** led by Jesse Eisert, was awarded in September 2025. This project examines how an infrastructure-based Intersection Safety System and CDA could potentially warn road users of an impending conflict with a vehicle while traversing intersections and roundabouts. This project aims to build on the work completed in Phase 2.

- **Human Factors Issues Related to Infrastructure-Based Safety Systems: Phase 1,** led by Jesse Eisert, was awarded in September 2025. The objective of this research is to answer complex human factors questions related to infrastructure-based safety technologies by analyzing the current state of those technologies, identifying use cases for exploring the technologies, determining what information road users need from the technologies, and identifying if the information provided changes road user behavior.

TRAVEL LANE (continued)

■ **Investigating Key Automated Vehicle (AV) Human Factors Safety Issues Related to Transportation System Management and Operations (TSMO),** led by <u>Michelle Arnold</u>.

» **Merging Behavior When Driving in a Mixed Vehicle Fleet.** This simulator study aims to help transportation agencies assess the effect of mixed fleets on traffic safety and congestion at onramp merge points.

» **Human Factors Research Related to Highway Tunnels,** led by <u>Michelle Arnold</u>, was awarded in September 2025. The objective of this research is to conduct a literature review and gap analysis to identify the basis for existing tunnel definitions and the characteristics of enclosed roadways that affect the behavior of roadway users.

■ **Improved Traffic Models of Human Use of Advanced Driver Assistance Systems (ADAS) and Level 3 (L3) Automated Driving Systems (ADS),** led by <u>Michelle Arnold</u>, was awarded in September 2025. This project will examine how ADAS and ADS systems impact driver behavior and surrounding vehicles, and the overall impact on traffic.

RECENT ACTIVITY

Mileposts

■ **Traffic Control Device (TCD) Consortium Pooled Fund Study (PFS). TPF-5(554),** led by <u>Laura Mero</u>. The TCD PFS is now under a new TPF number, TPF-5(554); this was previously TPF-5(447). The members of the TCD PFS came together for three virtual quarterly meetings, including the 2024 Quarter 4, 2025 Quarter 1, and 2025 Quarter 2 meetings. The TCD PFS also gathered for the TCD PFS Annual Meeting in Boise, ID, and welcomed three new member States, including Utah, Virginia, and Washington. The TCD PFS is moving forward with a project on temporary traffic control advance warning sign placement. The related problem statements are posted to the TCD PFS TPF-5(447) Web page under Documents.

■ **FHWA Highway Driving Simulator (HDS) Indefinite Delivery Indefinite Quantity (IDIQ),** led by <u>Michelle Arnold</u>.

» **Highway Driving Simulator Virtual Reality Driver Upgrade.** This task order includes upgrading the current virtual reality (VR) driving simulator and integrating it into the HDS. Future goals involve connecting this system to other VR research tools in the Human Factors Laboratory. The VR driver will enable researchers to conduct human factors experiments in an immersive, three-dimensional virtual environment.

» **Highway Driving Simulator (HDS) Operator Console Upgrade (OPSCON).** The second phase of the task to upgrade the HDS hardware and software for the OPSCON, which includes replacing the audio software and outdated computers, is complete.

HUMAN FACTORS LABORATORY TOURS

The Human Factors team hosted numerous groups for tours throughout the past year, including:

■ Boy Scouts of America Troop 1131.

■ Cherokee Federal.

■ Connected Vehicle Pooled Fund Study.

■ Department of Transportation Honors Attorney Program.

■ FHWA DC Division.

■ FHWA Leadership.

■ George Washington University.

■ Kellogg Brown & Root (KBR).

■ Kittelson & Associates.

■ National Highway Institute (NHI)/Center for Accelerating Innovation (CAI).

■ FHWA Office of International Programs.

■ The Netherlands Delegation.

■ Transportation Research Board's Research and Technology Coordinating Committee (RTCC).

■ Vincent Tang, Deputy Director, Advanced Research Projects Agency – Infrastructure (ARPA-I).

■ WSP.

CONFERENCES

Conferences Attended

■ **Transportation Research Board Annual Meeting, January 4–9, 2025, Washington, DC.** Showcased VR equipment to demonstrate the team's cutting-edge research capabilities and provided updates at relevant committee meetings.

■ **National Committee on Uniform Traffic Control Devices Annual Meeting, January 8–10, 2025, Arlington, VA.** Provided updates on the TCD Pooled Fund Studies and other relevant projects.

■ **National Committee on Uniform Traffic Control Devices Midyear Meeting, June 11–13, Des Moines, IA.** Attended committee and subcommittee meetings.

■ **Institute of Transportation Engineers (ITE) International Annual Meeting and Exhibition, August 10–13, 2025, Orlando, FL.** Gave poster presentations.

■ **ITS World Congress, August 25–28, 2025, Atlanta, GA.** Showcased VR equipment from the Human Factors Laboratory during the expo.

■ **NVIDIA, GTC AI Conference, October 27–29, 2025, Washington, DC.** Attended conference sessions.

■ **SAE International, Automated Transportation Symposium, November 3–6, 2025, Tempe, AZ.** Attended conference sessions.

Upcoming Conferences

■ **Transportation Research Board Annual Meeting, January 11–15, 2026, Washington, DC.**

Source: FHWA.

Figure 2. Photo. A meeting attendee driving the VR Driver at TRB.

Meet the Team

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Syntek Technologies, Highway Driving Simulator onsite support.

U.S. Department of Transportation
Federal Highway Administration

https://highways.dot.gov/research