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Advancing Pedestrian Safety through Simulation

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Abstract

This study investigates the role and methodological relevance of simulation-based approaches in transportation safety research, with particular emphasis on their applicability to pedestrian safety. Through a systematic review of existing simulator studies, we demonstrate that virtual environments, eye-tracking technologies, and agent-based modelling provide controlled experimental conditions for examining distraction effects, perceptual limitations, and pedestrian–vehicle interactions. Previous findings consistently indicate that distractions - most notably mobile phone use - substantially impair pedestrian awareness, hazard perception, and decision-making processes. A key methodological contribution of this work is the assessment of the DYNA4 simulation platform, which, despite its advanced physics-based modelling, sensor fusion capabilities, and hardware-/software-in-the-loop testing environment, has not yet been utilized in pedestrian-focused research. Our analysis highlights that DYNA4's integrated vehicle dynamics and real-time validation framework offer significant potential for investigating pedestrian detection systems, autonomous vehicle behavior, and safety-critical interventions under reproducible and risk-free conditions. The review identifies important research gaps, including the need for simulation-driven analyses of autonomous vehicle–pedestrian communication, cognitive load, demographic variability, and the empirical validation of VR-based behavioral measurements. Expanding the methodological application of simulation tools - particularly DYNA4 - may substantially advance pedestrian protection strategies and contribute to the development of more effective, evidence-based transportation safety solutions.

Keywords

pedestrian safety, DYNA4, driving simulator, transportation safety, vehicle-pedestrian interaction

1 Introduction

Transportation safety is a fundamental aspect of modern mobility, aiming to minimize traffic-related fatalities, injuries, and economic losses while ensuring efficient and sustainable transport systems (Bertolini, 2020; Simsekoglu et al., 2015). The research in this domain is of paramount importance, as it provides data-driven insights into the underlying causes of accidents, risk exposure, and the effectiveness of preventive measures (Sakhare and Kasbe, 2017; Sundar Kumar et al., 2019). Advancements in transportation safety research contribute to the development of intelligent vehicle technologies, improved road infrastructure design, and enhanced traffic management strategies (Goniewicz et al., 2016). Furthermore, such research informs policymakers and urban planners in devising regulations and interventions that promote safer mobility for all road users, including pedestrians, cyclists, and motorists (Jutila et al., 2017; Krizsik and Sipos, 2025; Sana and Safa, 2025; Scholliers et al., 2016).

Key areas of research in transportation safety encompass human factors (Petridou and Moustaki; 2000), vehicle safety innovations (Turno, Yatskiv 2023), intelligent transportation systems (Janušová and Čičmancová, 2016), traffic engineering, and urban planning (Schepers et al., 2018). Research on human factors investigates driver behavior (Farooq et al., 2019), cognitive load (Aksan et al., 2015), reaction times (Campisi et al., 2018), and impairment-related risks (e.g., fatigue, distraction, and substance use), which are crucial for designing effective driver-assistance technologies and educational programs (Kandeel et al., 2021). Vehicle safety research focuses on crashworthiness, active and passive safety systems, autonomous driving capabilities, and vehicle-to-everything communication. The development

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of ITS integrates artificial intelligence, real-time data analytics, and connected infrastructure to optimize traffic flow, reduce congestion, and enhance situational awareness.

Additionally, transportation safety studies extend to the analysis of roadway design, including intersection safety, pedestrian-friendly urban planning, and the implementation of smart traffic control mechanisms (Budzynski et al., 2019; Del Serrone et al., 2023). The effectiveness of legislative measures, such as speed regulations, seatbelt enforcement, and impaired driving laws, is also a critical research area that directly influences policy decisions (Borucka and Sobecki, 2023). Through interdisciplinary collaboration and technological advancements, transportation safety research not only reduces accident rates but also fosters the evolution of a safer, more resilient, and more efficient transportation ecosystem for future generations (Ehsani et al., 2023).

The application of simulators in research plays a crucial role in studying complex systems, analyzing human behavior, and evaluating technological innovations in a controlled and replicable environment (Bobermin et al., 2021; Meuleners and Fraser, 2015;). Simulation technology enables researchers to model real-world scenarios with high precision, allowing for the assessment of risk factors, human decision-making processes, and system performance without exposing participants to actual hazards (Goedicke et al., 2018). In transportation research, driving simulators provide invaluable insights into driver behavior, reaction times, and cognitive load under various traffic conditions, supporting the development of advanced driver-assistance systems and autonomous vehicle algorithms (Aleksa et al., 2024; Elgharbi et al., 2024; Jiménez et al., 2016). The integration of virtual reality, artificial intelligence, and real-time data analytics further expands the potential of simulations, enabling dynamic scenario adjustments and enhanced predictive modeling. As computational power and sensor technologies advance, simulators will continue to evolve, providing increasingly sophisticated tools for experimental research, risk assessment, and the optimization of human-machine interactions across multiple disciplines (Cheng et al., 2022; Halim et al., 2016; Poddar et al., 2024; Riera et al., 2021).

The DYNA4 simulator plays a pivotal role in transportation safety research by providing a high-fidelity virtual testing environment for the development, validation, and optimization of advanced driver assistance systems and autonomous vehicle technologies (Chacko, 2024; Kaths et al., 2019; Keler et al., 2018;). This simulation platform enables researchers to conduct reproducible experiments under diverse driving scenarios, including hazardous conditions that would be difficult or unsafe to replicate in real-world testing. DYNA4's physics-based modeling allows for precise analysis of vehicle dynamics, sensor fusion, and control algorithms, facilitating the assessment of safety-critical systems such as emergency braking, lane-keeping assistance, and collision avoidance. Furthermore, its integration with hardware-in-the-loop and software-in-the-loop methodologies enhances real-time testing capabilities, bridging the gap between simulation and real-world implementation. As transportation safety research increasingly relies on virtual prototyping to reduce costs and improve efficiency, the DYNA4 simulator remains an essential tool for accelerating innovation and ensuring the reliability of intelligent mobility solutions.

Our research aimed to identify the scope and results of current simulator research in the field of road safety, especially the link between the use of vector DYNA4 and road safety. Our aim was to systematically review and organize the research field and to identify possible future research directions. In addition to this, the aim of our research was to identify the possible hardware and software environment of the DYNA4 simulator in the field of pedestrian safety.

2 Simulator-based pedestrian safety research

We reviewed simulator research in pedestrian safety to date. The results of our research are summarized systematically in Table 1, with a description of the purpose of the measurements, the simulation environment, and the results.

Research consistently shows that distractions, particularly mobile phone use, significantly impair pedestrian safety. Studies using virtual environments and eye-tracking technology demonstrate that phone use reduces situational awareness, visual perception, and the ability to assess crossing opportunities. Additionally, infrastructure-related distractions and high visual load affect both children and adults, leading to missed crossing opportunities. Research also suggests that interactions between pedestrians and autonomous vehicles influence crossing behavior, highlighting the importance of clear communication. The validity of VR-based pedestrian simulations has been confirmed, supporting their use in future studies.

The results of our research show that although there are simulator measurements related to pedestrian safety, their number is very low, and thus a future research direction in this area can be identified: autonomous vehicle-pedestrian interaction, cognitive load and attention distribution, real-world validation of VR simulations, age and demographic differences, and intervention strategies.

Table 1 Simulator-based pedestrian safety research

Research	Purpose	Environmental	Results
Schwebel et al., 2012	The effect of distractions on gaze	Virtual environment	Pedestrians using distracting devices were more likely to divert their gaze from traffic infrastructure
Lin and Huang, 2017	Negative impact of phone use while walking	Virtual environment with eye-tracking system, treadmill	Smartphone use significantly impaired visual perception of the environment
Stavrinos et al., 2009	Two types of experiments on the distracting effects of phone use in pedestrian traffic	Trail Making Test and Stroop Test for attention measurement; pedestrian crossing in a simulation environment	Mobile phone conversations significantly distracted pedestrians, however, the content of the conversation did not affect the experiment
Neider et al., 2010	Mobile phone use and safe road crossing	CAVE software, LifeGear Walkease treadmill	Pedestrians were less likely to cross the road successfully while talking on a mobile phone. Additionally, mobile phone use impaired their ability to recognize crossing opportunities
Tapiro et al., 2020	The impact of infrastructure-related distractions on pedestrian crossings	VT-MAK simulator and ASL eye-tracking system	High visual load affected both children's and adults' road-crossing behavior, leading to missed crossing opportunities
Rad et al., 2020	Changes in pedestrian crossing behavior between autonomous and conventional vehicles	Agent-Based Modeling technique	The decision to cross was significantly influenced by communication between autonomous vehicles and pedestrians
Sween et al., 2016	Examining pedestrian behavior	Unity 5 environment, Oculus Rift VR headset	Simulator development, identification of limitations, and future research directions
Deb et al., 2017	Development of a pedestrian simulator	Unity 5 environment, Vive headset	Measurements conducted in virtual reality corresponded to real-world results

In addition, our research did not identify any area of pedestrian safety that used the DYNA4 simulator module.

3 DYNA4 hardware simulation environment in pedestrian safety

The DYNA4 simulation platform provides a robust hardware-supported environment for conducting in-depth research on pedestrian safety. By integrating real-time simulation capabilities with hardware-in-the-loop and sensor emulation, DYNA4 enables the validation of pedestrian protection systems, including advanced driver assistance systems and automated emergency braking functions.

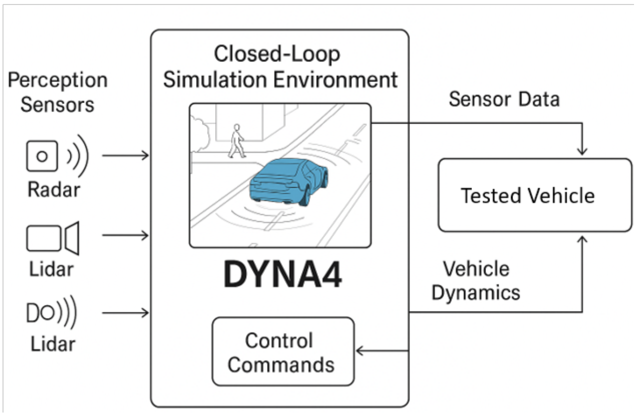

Fig. 1 DYNA4 simulation environment

In pedestrian safety research, model-in-the-loop and software-in-the-loop simulations form the foundation of early function development (Fig. 1). DYNA4 facilitates PC-based simulations where pedestrian detection algorithms, collision risk estimation, and emergency intervention strategies can be tested without requiring physical prototypes. These simulations allow researchers to analyze how sensor models, including camera, radar, and LiDAR, perceive pedestrians under various environmental and traffic conditions.

As pedestrian protection systems move towards real-world validation, DYNA4's hardware-in-the-loop capabilities become essential. The platform can be deployed on real-time hardware, interfacing with electronic control units responsible for executing pedestrian detection and avoidance maneuvers. This setup enables precise testing of system responses under real-time constraints, ensuring that safety-critical interventions - such as automated braking - meet regulatory and performance requirements.

DYNA4's hardware-in-the-loop configuration supports various hardware architectures, including dSPACE and NI VeriStand, providing seamless integration into existing automotive testing environments. The ability to simulate pedestrian crossings, sudden obstacles, and complex urban scenarios in real-time ensures that safety algorithms function reliably in unpredictable conditions.

A key aspect of pedestrian safety research is understanding how vehicle sensors perceive and classify pedestrians in different lighting, weather, and occlusion scenarios. DYNA4's hardware ecosystem allows for sensor fusion testing, where radar, camera, and LiDAR data streams are synchronized and processed in real-time. By incorporating physics-based sensor models, researchers can evaluate detection accuracy and reaction times for advanced driver assistance systems features, ensuring pedestrian warning and intervention systems operate effectively.

Moreover, the hardware environment supports open-loop and closed-loop testing of environmental perception models, allowing researchers to refine AI-driven pedestrian recognition and trajectory prediction algorithms. These capabilities are particularly valuable when developing safety mechanisms for urban environments, where pedestrians frequently interact with vehicles at crosswalks, intersections, and shared spaces.

DYNA4's hardware-in-the-loop capabilities align with Euro NCAP and international safety testing standards for pedestrian protection. Virtual testing scenarios, including frontal pedestrian impact simulations and child pedestrian emergency braking evaluations, can be executed using real-time hardware setups. This allows to fine-tune vehicle safety functions to comply with evolving regulatory requirements while optimizing reaction speeds and braking performance.

By leveraging DYNA4's hardware capabilities - including real-time simulation, hardware-in-the-loop testing, and sensor fusion - pedestrian safety research can be conducted with high precision and reliability. The platform's ability to integrate with advanced driver assistance systems and autonomous driving development environments ensures that pedestrian protection systems are rigorously tested across all phases, from software validation to real-world deployment. With DYNA4, vehicle safety strategies can enhance, ultimately reduce pedestrian-related accidents and fatalities.

4 DYNA4 software simulation environment in pedestrian safety

In pedestrian safety research, software tools play a crucial role in developing, simulating, and validating advanced safety systems before they are deployed in real-world scenarios. DYNA4 offers a comprehensive software environment that enables to test pedestrian protection mechanisms using virtual scenarios, sensor emulation, and real-time system validation.

DYNA4 provides a physics-based 3D simulation environment where pedestrian behavior, road layouts, and environmental conditions can be modeled in detail. The software allows to create complex test scenarios, including pedestrians crossing unexpectedly at intersections, children running into the street from behind parked cars, low-visibility conditions affecting pedestrian detection (e.g., fog, night, or rain), and multi-agent traffic interactions involving cyclists, vehicles, and pedestrians.

By integrating vehicle dynamics with pedestrian motion models, DYNA4 enables comprehensive safety assessments without requiring physical prototypes.

DYNA4 software supports high-fidelity sensor simulation, allowing for the virtual testing of pedestrian detection algorithms used in ADAS and autonomous vehicles. It enables the emulation of various perception technologies, including camera-based pedestrian recognition with deep learning-based classification, radar and LiDAR sensor models for detecting pedestrian movement and distance estimation, and sensor fusion techniques to improve pedestrian recognition accuracy.

By simulating sensor outputs under different lighting, weather, and occlusion conditions, researchers can evaluate how well a vehicle's perception system detects pedestrians in critical situations.

With built-in AI integration capabilities, DYNA4 allows for the development and testing of pedestrian trajectory prediction models. This is essential for systems such as: forward collision warning, automatic emergency braking, and pedestrian avoidance steering assistance. Using predictive algorithms, the software can assess how well an autonomous system anticipates pedestrian movement and reacts to avoid collisions. Machine learning-based models can be trained and validated within the DYNA4 simulation environment before real-world deployment.

DYNA4 enables early-stage software validation through model-in-the-loop and software-in-the-loop. The software allows to test pedestrian safety algorithms directly within a virtual testbed, iterating rapidly on control logic without the need for physical hardware. Benefits include faster-than-real-time execution for rapid iteration cycles, debugging of safety functions before hardware implementation, compatibility with MATLAB/Simulink for advanced control system modelling. These simulations allow for the validation of software-driven safety features, ensuring robust performance before integration with physical systems.

DYNA4 supports predefined test scenarios aligned with Euro NCAP pedestrian safety assessment protocols. The software allows to run compliance simulations for regulatory testing, including pedestrian AEB system evaluation, vulnerable road user impact risk assessment, safety performance benchmarking against industry standards. By using DYNA4, it can be ensured that pedestrian safety features meet the latest regulatory requirements and optimize them for real-world conditions.

DYNA4's software environment provides a powerful framework for pedestrian safety research, enabling virtual scenario testing, sensor modeling, AI-based prediction, and compliance validation. By integrating with hardware-in-the-loop and real-time testing environments, DYNA4 ensures that pedestrian protection systems are rigorously developed and optimized before real-world deployment.

5 Conclusion

Our study examined the role of driving simulators in transportation safety research, with a particular focus on the potential applications of the DYNA4 simulation platform in pedestrian safety. Through our analysis, we have demonstrated that simulation-based studies play a crucial role in understanding human factors, vehicle interactions, and advanced safety technologies in controlled environments.

Based on our review of existing research, we found that distractions - especially mobile phone use - significantly impair pedestrian awareness and decision-making. Furthermore, interactions between pedestrians and autonomous vehicles require further investigation to ensure safe and predictable behavior. While virtual reality-based pedestrian simulations have proven to be valid, their real-world applicability and demographic considerations remain largely unexplored.

Despite the widespread use of simulators in transportation safety research, we identified that pedestrian safety studies using simulation technology remain relatively limited. Additionally, our findings suggest that the DYNA4 simulator has not yet been utilized in this field, even though its advanced hardware and software capabilities - such as hardware-in-the-loop and software-in-the-loop testing, sensor fusion, and high-fidelity physics-based modeling - make it highly suitable for expanding pedestrian safety research.

The broader implications of our research highlight the need to further integrate simulation-based methodologies into pedestrian safety studies. The effectiveness of advanced driver assistance systems, automated emergency braking, and vehicle-to-pedestrian communication systems should be rigorously tested in virtual environments before real-world deployment. As autonomous mobility continues to evolve, understanding pedestrian interactions with self-driving vehicles will be essential in ensuring safer urban environments.

Our study also identified several key research gaps that warrant further investigation. Future studies should focus on autonomous vehicle-pedestrian interaction, exploring how pedestrians interpret vehicle intent in the absence of a human driver. Additionally, research on cognitive load and attention distribution could provide insights into how distractions affect pedestrian decision-making, particularly among vulnerable populations such as children and elderly pedestrians. Another critical direction involves validating VR-based simulations by comparing simulated pedestrian behavior with real-world observations. Furthermore, demographic differences in pedestrian risk perception should be examined to develop more inclusive safety interventions. Lastly, investigating new strategies - such as auditory and visual alerts - could help mitigate pedestrian-related accidents.

Overall, our research underscores the potential of simulation-based methods, particularly the DYNA4 platform, in advancing pedestrian safety. While existing studies provide valuable insights, further research is needed to fully harness the capabilities of simulation technology in preventing pedestrian-related accidents. Expanding the use of DYNA4 in this field could bridge the gap between vehicle safety development and pedestrian protection strategies, ultimately contributing to a safer and more efficient transportation system.

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References

Aksan, N., Anderson, S. W., Dawson, J., Uc, E., Rizzo, M. (2015) "Cognitive functioning differentially predicts different dimensions of older drivers' on-road safety", Accident Analysis & Prevention, 75, pp. 236–244.
https://doi.org/10.1016/j.aap.2014.12.007

Aleksa, M., Schaub, A., Erdelean, I., Wittmann, S., Soteropoulos, A., Fürdös, A. (2024) "Impact analysis of Advanced Driver Assistance Systems (ADAS) regarding road safety – computing reduction potentials", European Transport Research Review, 16(1), 39.
https://doi.org/10.1186/s12544-024-00654-0404

Bertolini, L. (2020) "From "streets for traffic" to "streets for people": can street experiments transform urban mobility?", Transport Reviews, 40(6), pp. 734–753.
https://doi.org/10.1080/01441647.2020.1761907

Bobermin, M. P., Silva, M. M., Ferreira, S. (2021) "Driving simulators to evaluate road geometric design effects on driver behaviour: A systematic review", Accident Analysis & Prevention, 150, 105923.
https://doi.org/10.1016/j.aap.2020.105923

Borucka, A., Sobecki, G. (2023) "A road safety evaluation model in the context of legislative changes", Transport Problems, 18(3), pp. 41–51.
https://doi.org/10.20858/tp.2023.18.3.04

Budzynski, M., Guminska, L., Jamroz, K., Mackun, T., Tomczuk, P. (2019) "Effects of Road Infrastructure on Pedestrian Safety", IOP Conference Series: Materials Science and Engineering, 603(4), 042052.
https://doi.org/10.1088/1757-899X/603/4/042052

Campisi, T., Canale, A., Tesoriere, G. (2018) "The importance of reaction time on children and drivers during safely crossing phase", AIP Conference Proceedings, 2040(1), 140014.
https://doi.org/10.1063/1.5079203

Chacko, J. (2024) "Addressing Challenges in ADAS Validation: An Advanced Framework for Scalable Testing and Simulation", In: 2024 International Conference on Vehicular Technology and Transportation Systems (ICVTTS), Bangalore, India, pp. 1–5. ISBN 979-8-3503-5552-9
https://doi.org/10.1109/ICVTTS62812.2024.10763936

Cheng, Y. Q., Mansor, S., Chin, J. J., Karim, H. A. (2022) "Driving Simulator for Drivers Education with Artificial Intelligence Traffic and Virtual Reality: a Review", In: Proceedings of the 8th International Conference on Computational Science and Technology, Labuan, Malaysia, pp. 483–494. ISBN 978-981-16-8514-9
https://doi.org/10.1007/978-981-16-8515-6_38

Deb, S., Carruth, D. W., Sween, R., Strawderman, L., Garrison, T. M. (2017) "Efficacy of virtual reality in pedestrian safety research", Applied Ergonomics, 65, pp. 449–460.
https://doi.org/10.1016/j.apergo.2017.03.007

Del Serrone, G., Cantisani, G., Peluso, P., Coppa, I., Mancinetti, M., Bianchini, B. (2023) "Road Infrastructure Safety Management: Proactive Safety Tools to Evaluate Potential Conditions of Risk", Transportation Research Procedia, 69, pp. 711–718.
https://doi.org/10.1016/j.trpro.2023.02.227

Ehsani, J. P., Michael, J. P., Mackenzie, E. J. (2023) "The Future of Road Safety: Challenges and Opportunities", The Milbank Quarterly, 101(S1), pp. 613–636.
https://doi.org/10.1111/1468-0009.12644

Elgharbi, E., Zöldy, M., Bhar Layeb, S. (2024) "Autonomous Vehicle and Pedestrian Interaction", Cognitive Sustainability, 3(1).
https://doi.org/10.55343/CogSust.90

Farooq, D., Moslem, S., Duleba, Sz. (2019) "Evaluation of Driver Behavior Criteria for Evolution of Sustainable Traffic Safety", Sustainability. 11(11), 3142.
https://doi.org/10.3390/su11113142

Goedicke, D., Li, J., Evers, V., Ju, W. (2018) "VR-OOM: Virtual Reality On-rOad driving siMulation", In: CHI '18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, New York, USA, 165. ISBN 9781450356206
https://doi.org/10.1145/3173574.3173739

Goniewicz, K., Goniewicz, M., Pawłowski, W., Fiedor, P. (2016) "Road accident rates: strategies and programmes for improving road traffic safety", European Journal of Trauma and Emergency Surgery, 42(4), pp. 433–438.
https://doi.org/10.1007/s00068-015-0544-6

Halim, Z., Kalsoom, R., Bashir, S., Abbas, G. (2016) "Artificial intelligence techniques for driving safety and vehicle crash prediction", Artificial Intelligence Review, 46(3), pp. 351–387.
https://doi.org/10.1007/s10462-016-9467-9

Janušová, L., Čičmancová, S. (2016) "Improving Safety of Transportation by Using Intelligent Transport Systems" Procedia Engineering, 134, pp. 14–22.
https://doi.org/10.1016/j.proeng.2016.01.031

Jiménez, F., Naranjo, J. E., Anaya, J. J., García, F., Ponz, A., Armingol, J. M. (2016) "Advanced Driver Assistance System for Road Environments to Improve Safety and Efficiency", Transportation Research Procedia, 14, pp. 2245–2254.
https://doi.org/10.1016/j.trpro.2016.05.240

Jutila, M., Scholliers, J., Valta, M., Kujanpää, K. (2017) "ITS-G5 performance improvement and evaluation for vulnerable road user safety services", IET Intelligent Transport Systems, 11(3), pp. 126133.
https://doi.org/10.1049/iet-its.2016.0025

Kandeel, A. A., Elbery, A. A., Abbas, H. M., Hassanein, H. S. (2021) "Driver Distraction Impact on Road Safety: A Data-driven Simulation Approach", In: 2021 IEEE Global Communications Conference (GLOBECOM), Madrid, Spain, pp. 1–6. ISBN 978-1-7281-8105-9
https://doi.org/10.1109/GLOBECOM46510.2021.9685932

Kaths, H., Keler A., Kath, J., Busch, F. (2019) "Analyzing the behavior of bicyclists using a bicycle simulator with a coupled SUMO and DYNA4 simulated environment", EPiC Series in Computing, 62, pp. 199–205.
https://doi.org/10.29007/dcmp

Keler, A., Kaths, J., Chucholowski, F., Chucholowski, M., Grigoropoulos, G., Spangler, M., Kaths, H., Busch, F. "A bicycle simulator for experiencing microscopic traffic flow simulation in urban environments", In: 2018 21st International Conference on Intelligent Transportation Systems (ITSC), Maui, HI, USA, pp. 3020–3023. ISBN 978-1-7281-0321-1
https://doi.org/10.1109/ITSC.2018.8569576

Krizsik, N., Sipos, T. (2025) "Examining the Role of Distracting Factors and Cognitive Elements in Pedestrian Safety", In: Proceedings of the 2nd Cognitive Mobility Conference (COGMOB 23 2023), Budapest, Hungary, pp. 187–196. ISBN 978-3-031-87619-6
https://doi.org/10.1007/978-3-031-87620-2_18

Lin, M. I. B., Huang, Y. P. (2017) "The impact of walking while using a smartphone on pedestrians' awareness of roadside events", Accident Analysis & Prevention, 101, pp. 87–96.
https://doi.org/10.1016/j.aap.2017.02.005

Meuleners, L., Fraser, M. (2015) "A validation study of driving errors using a driving simulator", Transportation Research Part F: Traffic Psychology and Behaviour, 29, pp. 14–21.
https://doi.org/10.1016/j.trf.2014.11.009

Neider, M. B., McCarley, J. S., Crowell, J. A., Kaczmarski, H., Kramer, A. F. (2010) "Pedestrians, vehicles, and cell phones", Accident Analysis & Prevention, 42(2), pp. 589–594.
https://doi.org/10.1016/j.aap.2009.10.004

Petridou, E., Moustaki, M. (2000) "Human factors in the causation of road traffic crashes", European Journal of Epidemiology, 16(9), pp. 819826. https://doi.org/10.1023/A:1007649804201

Poddar, K., Sharma, B., Sharma, S. (2024) "Development and Evaluation of a VR-based Driving Test Simulator,", In: 2024 8th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), Kirtipur, Nepal, pp. 1486–1491. ISBN 979-8-3503-7643-2 https://doi.org/10.1109/I-SMAC61858.2024.10714852

Rad, S. R., de Almeida Correia, G. H., Hagenzieker, M. (2020) "Pedestrians' road crossing behaviour in front of automated vehicles: Results from a pedestrian simulation experiment using agent-based modelling", Transportation Research Part F: Traffic Psychology and Behaviour, 69, pp. 101–119. https://doi.org/10.1016/j.trf.2020.01.014

Riera, J. V., Casas, S., Alonso, F., Fernández, M. (2021) "A VR-Enhanced Rollover Car Simulator and Edutainment Application for Increasing Seat Belt Use Awareness", Computers, 10(5), 55. https://doi.org/10.3390/computers10050055

Sakhare, A. V., Kasbe, P. S. (2017) "A review on road accident data analysis using data mining techniques", In: 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, India, pp. 1–5. ISBN 978-1-5090-3295-2 https://doi.org/10.1109/ICIIECS.2017.8275920

Sana, L., Safa, E. K. (2025) "Socio-Cognitive Sciences at the Service of Urban Planning: Towards a City for All for Children with Medical Complexity", In: Proceedings of the 2nd Cognitive Mobility Conference, COGMOB 23 2023, Budapest, Hungary, pp. 43–50. ISBN 978-3-031-87619-6 https://doi.org/10.1007/978-3-031-87620-2_5

Schepers, P., Lovegrove, G., Helbich, M. (2018) "Urban Form and Road Safety: Public and Active Transport Enable High Levels of Road Safety", In: Integrating Human Health into Urban and Transport Planning, Springer, pp. 383–408. ISBN 978-3-319-74982-2 https://doi.org/10.1007/978-3-319-74983-9_19

Scholliers, J., Bell, D., Morris, A., Meléndez, A., B., G., Perez, O. M. (2016) "Improving Safety and Mobility of Vulnerable Road Users Through ITS Applications", In: Traffic Safety, Wiley, pp. 251–269. ISBN 9781786300300 https://doi.org/10.1002/9781119307853.ch16

Schwebel, D. C., Stavrinos, D., Byington, K. W., Davis, T., O'Neal, E. E., de Jong, D. (2012) "Distraction and pedestrian safety: How talking on the phone, texting, and listening to music impact crossing the street", Accident Analysis & Prevention, 45, pp. 266271. https://doi.org/10.1016/j.aap.2011.07.011

Şimşekoğlu, Ö., Nordfjærn, T., Rundmo, T. (2015) "The role of attitudes, transport priorities, and car use habit for travel mode use and intentions to use public transportation in an urban Norwegian public", Transport Policy, 42, pp. 113–120. https://doi.org/10.1016/j.tranpol.2015.05.019

Stavrinos, D., Byington, K. W., Schwebel, D. C. (2009) "Effect of Cell Phone Distraction on Pediatric Pedestrian Injury Risk", Pediatrics, 123(2), pp. e179–e185. https://doi.org/10.1542/peds.2008-1382

Sundar Kumar, P., Viswanadham, V., Bharathi, B. (2019) "Analysis of Road Accident", IOP Conference Series: Materials Science and Engineering, 590, 012029. https://doi.org/10.1088/1757-899X/590/1/012029

Sween, S., Deb, S., Carruth, D. W., Waddell, D., Furuichi, M. (2016) "Development of an Effective Pedestrian Simulator for Research", In: Advances in Human Aspects of Transportation, Springer, pp. 183–191. ISBN 978-3-319-41681-6 https://doi.org/10.1007/978-3-319-41682-3_16

Tapiro, H., Oron-Gilad, T., Parmet, Y. (2020) "Pedestrian distraction: The effects of road environment complexity and age on pedestrian's visual attention and crossing behaviour", Journal of Safety Research, 72, pp. 101–109. https://doi.org/10.1016/j.jsr.2019.12.003

Turno, F. M., Yatskiv, I. (2023). Mobility-as-a-service: literature and tools review with a focus on personalization. Transport, 38(4), pp. 243–262. https://doi.org/10.3846/transport.2023.20997