THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Abstract Book

15th Annual International Conference on Civil Engineering
23-27 June 2025, Athens, Greece

Edited by
Dimitrios Goulias & Afrodete Papanikou

2025

Abstracts
15th Annual International Conference on Civil Engineering
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(In Alphabetical Order by Author's Family Name)

Preface

This book includes the abstracts of all the papers presented at the *15th Annual International Conference on Civil Engineering* (23-27 June 2025), organized by the Athens Institute.

A full conference program can be found before the relevant abstracts. In accordance with Athens Institute's Publication Policy, the papers presented during this conference will be considered for inclusion in one of Athens Institute's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of Athens Institute and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. Athens Institute was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this conference (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to Athens Institute's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

Table 1. *Publication of Books of Abtracts of Proceedings, 2011-2025*

Year	Papers	Countries	References
2025	22	14	Goulias and Papanikou (2025)
2024	30	16	Goulias and Gkounta (2024)
2023	28	19	Goulias and Gkounta (2023)
2022	26	15	Goulias and Gkounta (2022)
2021	12	5	Papanikos (2021)
2020	15	9	Papanikos (2020)
2019	24	15	Papanikos (2019)
2018	34	22	Papanikos (2018)
2017	33	16	Papanikos (2017)
2016	40	17	Papanikos (2016)
2015	33	14	Papanikos (2015)
2014	40	23	Papanikos (2014)
2013	29	18	Papanikos (2013)
2012	20	10	Papanikos (2012)

2011	34	12	Papanikos (2011)

It is our hope that through Athens Institute's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, Athens Institute has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of Athens Institute for putting this conference and its subsequent publications together.

Gregory T. Papanikos
President

Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Civil Engineering. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the conference.

Athens Institute's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The 15th Annual International Conference on Civil Engineering accomplished this goal by bringing together academics and scholars from 14 different countries (Austria, Germany, Hungary, India, Israel, Japan, Lithuania, Mexico, Poland, South Africa, South Korea, Taiwan, Türkiye, USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this conference will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

Dimitrios Goulias & Afrodete Papanikou
Editors

15th Annual International Conference on Civil Engineering, 23-27 June 2025, Athens, Greece

Organizing & Scientific Committee

All Athens Institute's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of Athens Institute, who contributed by reviewing the submitted abstracts and papers.

1. Dr. Gregory T. Papanikos, President, Athens Institute.
2. Nicholas N. Patricios, Vice President of Strategic Planning & Analysis, Athens Institute, Dean Emeritus & Professor, School of Architecture, University of Miami, USA.
3. Dimitrios Goulias, Head, Civil Engineering Unit, Athens Institute and Associate Professor, Civil & Environmental Engineering Department, University of Maryland, USA.
4. Bala Maheswaran, Director, Engineering Division, Athens Institute & Professor, Northeastern University, USA.
5. Virginia Sisiopiku, Head Transportation Engineering Unit, Athens Institute & Professor, The University of Alabama at Birmingham, USA.
6. Fouad A. Mohammad, Academic Member, Athens Institute & Senior Lecturer, School of Architecture, Design and the Built Environment, Nottingham Trent University, UK.

FINAL CONFERENCE PROGRAM

15th Annual International Conference on Civil Engineering, 23-27 June 2025, Athens, Greece

PROGRAM

Monday 23 June 2025

08.30-09.00
Registration
09:00-09:30
Opening and Welcoming Remarks:

- **Gregory T. Papanikos, President, Athens Institute.**

09:30-11:00 Session 1
Moderator: Dimitrios Goulias, Head, Civil Engineering Unit, Athens Institute and Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.

1. Glen Bright, Dean of Engineering, University of KwaZulu-Natal, South Africa.
   Title: Design and Development of an Unmanned Aerial Vehicle (UAV) Integrated Inertial Stabilization Platform (ISP) Targeting Industrial, Disaster Management and Humanitarian AID Scenarios.
2. A. Zafer Acar, Professor, Dean, Faculty of Applied Sciences, İstanbul Bilgi University, Türkiye.
   Serkan Karakaş, Professor, İstanbul Bilgi University, Türkiye.
   Kenan Dinç, Head, Department of Logistics Management, İstanbul Bilgi University, Türkiye.
   Title: The Impact of Blockchain on Transforming to Sustainable Transportation.
3. Clara Guttenberger, Tunnel Project Engineer, MSc Graduate, FOM University of Applied Sciences, Germany.
   Joachim Berlak, Professor, FOM University of Applied Sciences, Germany.
   Title: A Systematic Methodology for CO_2 Accounting and Sustainability Assessment in Mechanized Tunnel Construction.
4. Govind Sharan Dangayach, Professor, Malaviya National Institute of Technology Jaipur, India.
   Alok Bihari Singh, Research Scholar, Malaviya National Institute of Technology Jaipur, India.
   Title: Evaluating the Impact of Energy-Efficient Practices on Hospitality Industry Performance: A Sustainability Perspective.

11:00-12:30 Session 2
Moderator: Virginia Sisiopiku, Head, Transportation Engineering Unit, Athens Institute, & Professor, The University of Alabama at Birmingham, USA.

1. Motao Zhu, Professor, Nationwide Children's Hospital / The Ohio State University, USA.
   Songzhu Zhao, Senior Statistician, The Ohio State University, USA.
   Title: Evaluating the Effectiveness of a Smartphone App Intervention for Improving Driving Safety in Novice Teen Drivers: A Randomized Controlled Trial.
2. Mohamed Mostafa Mostafa, Chair and Director: KZNDOT Chair in Sustainable Transportation, University of KwaZulu-Natal, South Africa.
   Dillip Kumar Das, Professor, University of KwaZulu-Natal, South Africa.
   Paul Terkumbur Adeke, Researcher, University of KwaZulu-Natal, South Africa.
   Title: Climate Change Effects on Roads Infrastructure and Adaptive Strategies in KwaZulu-Natal South Africa.

3. Thilina Ganganath Weerakoon, PhD Student, Vilnius Gediminas Technical University, Lithuania.
   Zenonas Turskis, Professor, Vilnius Gediminas Technical University, Lithuania.
   Jūratė Šliogerienė, Associate Professor, Vilnius Gediminas Technical University, Lithuania.
   Title: A Hybrid Explainable Machine Learning (XML)-Supported Fuzzy AHP Framework for Resilient Circular Supply Chains in Construction.
4. Jinesh Kumar Jain, Associate Professor, Malaviya National Institute of Technology Jaipur, India.
   Title: Supply Chain Management in Automotive Industries: Overcoming the Barriers.

12:30-14:00 Session 3
Moderator: A. Zafer Acar, Professor, Dean, Faculty of Applied Sciences, İstanbul Bilgi University, Türkiye.

1. Ming-Gin Lee, Professor, Chaoyang University of Technology, Taiwan.
   Title: Study on CO_2 Carbon Sequestration in Recycled Concrete.
2. Hong-gi Jeon, PhD Candidate, Sejong University, South Korea.
   Title: Experimental and Numerical Investigation on the Seismic Performance of Proposed Steel-Concrete Composite Joints.
3. Emre Bayraktar, Professor & Director, The University of Southern Mississippi, USA.
   Kemit Spears, Instructor, The University of Southern Mississippi, USA.
   Title: Exploring the Role of Career Fairs in Early Construction Education: A Text-Based Analysis of Student Reflections.

14:00-14:45 Session 4 – A Public Lecture on "Multidisciplinary Aspects in Research and Project Based Education on Sustainability"

Speaker: Dimitrios Goulias, Head, Civil Engineering Unit, Athens Institute and Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.

14:45-15:30 Lunch

15:30-17:30 Session 5 – A Symposium on Shaping the Future of the Sciences: Education and Research
Moderator: Timothy M. Young, Head, Agriculture Unit, Athens Institute, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

Invited Speakers (≤10 minutes):

1. Glen Bright, Academic Member, Athens Institute & Professor and Dean of the School of Engineering, University of KwaZulu-Natal, South Africa.
   Title: Project Based Learning for Undergraduate Engineering Students of the Future.
2. Elena G. Skvortsova, Head, Department of Zootechnics, Yaroslavl State Agricultural Academy, Russia.
   Title: *Teaching Genetics in Higher Education: From Classics to Genomics – Challenges and Prospects.*
3. Alexandra Duarte Castillo, Professor, Caldas University, Colombia.
   Title: *New Frontiers in Engineering Education.*
4. Bárbara J. Teruel, Professor, University of Campinas, Brazil.
   Title: *Education and Research in Agricultural Sciences.* Title: *AI and LLMs in Engineering Research and Education.*
5. Theodore Trafalis, Head, Industrial Engineering Unit, Athens Institute, Professor of Industrial & Systems Engineering and Director, Optimization & Intelligent Systems Laboratory, The University of Oklahoma, USA.
   Title: *AI and LLMs in Engineering Research and Education.*

Short Interventions (≤3 minutes):

1. Virginia Sisiopiku, Head, Transportation Engineering Unit, Athens Institute, & Professor, The University of Alabama at Birmingham, USA.
2. Mohamed Mostafa Mostafa, Chair and Director: KZNDOT Chair in Sustainable Transportation, University of KwaZulu-Natal, South Africa.
3. Emre Bayraktar, Professor & Director, The University of Southern Mississippi, USA.
4. Mona Ben Matiwane, Senior Lecturer, University of Mpumalanga, South Africa.
5. Magdalena Lewandowska, President of the Institute of Health and Social Support, Institute of Health and Social Support, Poland.
6. Huaguo Zhou, Professor, Auburn University, USA.

Discussion

18:00-20:00 Session 6 – Visit Aristotle's Lyceum

It requires pre-booking

20:30-22:30
Athenian Early Evening Symposium (Sequence of Events: Ongoing Academic Discussions, Dinner, Wine and Water, Music, Dance)

Tuesday 24 June 2025

09:30-11:00 Session 7
Moderator: Clara Guttenberger, Tunnel Project Engineer, MSc Graduate, FOM University of Applied Sciences, Germany.

1. Mareen Derda, Vice Dean for Studies, Teaching and Equal Opportunities, Technical University Berlin, Germany.
   Marco Wedel, Senior Researcher, Technical University Berlin, Germany.
   Title: Educating Future Engineers to be Responsible Citizens.
2. Kiyoshi Nagata, Professor, Daito Bunka University, Japan.
   Title: Ontology-based System for Generating Information Security Policy.
3. Joanna Raczkiewicz-Golacka, Lecturer, Head of Foreign Languages Teaching and Certification Centre, University of Life Sciences in Lublin, Poland.
   Title: Application of Content and Language Integrated Learning (CLIL) on the Example of Functional Safety Study Programme in English.

11:00-12:30 Session 8
Moderator: Vusumzi Funda, Lecturer, University of Fort Hare, South Africa.

1. Huaguo Zhou, Professor, Auburn University, USA.
   Title: Identify Communication Methods for Severely Intoxicated Drivers to Develop Effective Engineering Countermeasures for Wrong-Way Driving.
2. Roman Klementschitz, Senior Scientist, University Bodenkultur Vienna, Institute for Transport Studies, Austria.
   Roxani Gkavra, Scientist, University Bodenkultur Vienna, Institute for Transport Studies, Austria.
   Yusak Susilo, Professor, University Bodenkultur Vienna, Institute for Transport Studies, Austria.
   Title: The Usage Behavior and Perception of Public on-Demand Transport Based on three Examples in the Province of Salzburg.
3. Jacob Adedeji, Lecturer, Durban University of Technology & PhD Student, Central University of Technology, South Africa.
   Title: Road Marking Maintenance in Nigeria: Adapting South African Best Practices for Road Safety.

4. Mali Sher, Lecturer, Holon Institute of Technology, Israel.
   Yehezkel Resheff, Professor, Holon Institute of Technology, Israel.
   Yehezkel Resheff, Professor, Holon Institute of Technology, Israel.
   Elia Merran, Professor, Holon Institute of Technology, Israel.
   Nicole Adler, Professor, Holon Institute of Technology, Israel.
   Title: Analysis and Prioritization of Traffic Crash Hotspot Intervention Sites.

12:30-14:00 Session 9
Moderator: Mohamed Mostafa Mostafa, Chair and Director: KZNDOT Chair in Sustainable Transportation, University of KwaZulu-Natal, South Africa.

1. Eunsoo Choi, Professor, Hongik University, South Korea.
   Title: Estimation of Self-Centering Capacity of Mortar Beams due to Activated Shape Memory Alloy Fibers.
2. Roberto Gomez, Associate Professor, National Autonomous University of Mexico, Mexico.
   Raul Sanchez, Assistant Professor, National Autonomous University of Mexico, Mexico.
   Title: Dynamic Characteristics of Wind Flow in a Wind Tunnel.
3. Marcell Knolmar, Assistant Professor, Budapest University of Technology and Economics, Hungary.
   Title: Two-Dimensional Hydrodynamic Simulations in Urban Water Systems.
4. Vusumzi Funda, Lecturer, University of Fort Hare, South Africa.
   Title: Understanding Student Insights on AI Adoption in Learning: Exploring Value, Ease of Use, and Benefits.

14:00-14:45 Session 10- A Public Lecture on "The Influence of AI and Machine Learning"

Speaker: Timothy M. Young, *Head, Agriculture Unit, Athens Institute, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.*

14:45-15:30 Lunch

16:45-20:00 Session 11
Old and New-An Educational Urban Walk

The urban walk ticket is not included as part of your registration fee. It includes professional tour guide and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappeion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by the Athens Institute exclusively for the conference participants.

20:30-22:30
An Ancient Athenian Symposium: Continuous Dialogues, Timeless Flavors (featuring authentic ancient Athenian dishes, local wine, and sweet delicacies from ancient Athens)

Wednesday 25 June 2025
An Educational Visit to Selected Islands
or Nafplio & Mycenae Visit

Thursday 26 June 2025
Visiting the Oracle of Delphi

Friday 27 June 2025
Visiting the Ancient Corinth and Cape Sounion

A. Zafer Acar
Professor, Dean, Faculty of Applied Sciences, İstanbul Bilgi University, Türkiye
Serkan Karakaş
Professor, İstanbul Bilgi University, Türkiye
&
Kenan Dinç
Head, Department of Logistics Management, İstanbul Bilgi University, Türkiye

The Impact of Blockchain on Transforming to Sustainable Transportation

Organizations increasingly recognize the importance of integrating sustainable practices in business. This increases the interest in emerging technologies that have the potential to accelerate the environmentally and socially sustainable transformation of supply chains. The traceability and transparency opportunities offered by the current technologies can provide consumers with information about all the processes, from production to the delivery of the products and services they prefer. This opportunity allows consumers to choose producers and distributors that comply with sustainability principles in the products they prefer. In this direction, Blockchain Technology (BT) offers several benefits, such as increasing efficiency in operational processes and monitoring carbon footprints. However, there are challenges to adopting this new technology in transportation operations to transform them into sustainable sector. Thus, this study aims to investigate the potential and adoption challenges of BT in sustainability in transport and distribution.

Incorporating UN sustainable development goals 12 and 13 into the research framework, this study employs an integrated qualitative research design comprising a literature review and two case study analyses. The literature review investigates the opportunities and challenges of BT adoption in sustainable transportation operations. The case studies investigate successful (CargoX) and unsuccessful (TradeLens) implementation attempts. The findings from case studies are evaluated using a comparative approach and supported by the insights from the literature review. The theoretical discussion of the study is based on resource orchestration theory.

Successful implementation of BT in examined case study supported that BT has benefits such as tracing a product's history, lowering costs for all parties, providing security and transparency, resistance to fraud with cryptography and ensuring its compliance with environmental and

ethical standards in sustainable supply chains. However, there are challenges to the widespread adoption of new technology, including limited participation of stakeholders, inability to understand basic concepts related to technology and inability to create a common language in this sense as demonstrated by the TradeLens case. Therefore, when investing in emerging technology, it is important to design effective strategies to foster a collaborative business environment to facilitate stakeholder participation.

By addressing the challenges associated with BT adoption, organizations can leverage its benefits to improve supply chain transparency, efficiency and sustainability. Understanding the factors that contribute to both successful and unsuccessful BT implementations can guide businesses in making informed strategic decisions.

This paper advances both academic and practical knowledge of BT adoption in sustainable transportation by providing instances of successful and failed real-world applications. Moreover, it provides a comparable analysis of given cases and discusses findings within a theoretical framework. By doing so, the study provides valuable insights for academia, businesses, and policymakers regarding technology adoption into sustainable transportation and distribution management.

Jacob Adedeji
Lecturer, Durban University of Technology & PhD Student, Central University of Technology, South Africa

Road Marking Maintenance in Nigeria: Adapting South African Best Practices for Road Safety

Road traffic safety is a growing global concern, with annual road traffic fatalities projected to exceed 1.3 million worldwide by 2020, however, in 2023, it is reported to have fallen slightly to 1.19 million which is still unacceptable. Various factors contribute to this issue, including road user behavior, vehicle conditions, environmental factors, and road infrastructure. Among these, the maintenance of road markings and signs under road infrastructure plays a critical role in guiding drivers and reducing accidents. However, Nigeria faces significant challenges in maintaining its road infrastructure, particularly road markings and signs, which deteriorate rapidly due to poor maintenance culture, funding constraints, and institutional inefficiencies. This study examines the maintenance strategies employed in South Africa, a country known for its systematic approach to road safety in the global south, and explores how such strategies can be adapted to address Nigeria's unique challenges. South Africa's success in implementing sustainable maintenance frameworks provides valuable lessons, particularly in urban road environments where proper markings enhance visibility, reduce lane violations, and improve overall traffic discipline. The research adopts a comparative methodology, case studies, and maintenance techniques from South Africa. The study focuses on urban and major highways, where the impact of inadequate road markings is most pronounced. By bridging the knowledge gap between successful practices in South Africa and Nigeria's infrastructural needs, this study aims to propose actionable recommendations to improve the maintenance culture for road markings.

Emre Bayraktar
Professor & Director, The University of Southern Mississippi, USA
&
Kemit Spears
Instructor, The University of Southern Mississippi, USA

Exploring the Role of Career Fairs in Early Construction Education: A Text-Based Analysis of Student Reflections

Industry engagement plays a vital role in civil engineering and construction education, particularly in helping students connect academic learning with professional pathways. At the University of Southern Mississippi's School of Construction and Design, a Construction and Design Career Fair is organized every semester to introduce students to employers, internships, and the broader industry landscape. While the fair is designed to support students at all levels, this study focuses on its potential influence on first- and second-year students who participate early in their academic journey.

To explore how such early exposure may contribute to student retention, motivation, and understanding of the construction industry, this study analyzes short reflective essays written by lower-level students as part of an assignment related to their first internship experience. Using qualitative analysis and word cloud visualization, the study examines recurring language, themes, and expressions in the essays to identify the ways students perceive and internalize their early interactions with industry.

This paper will discuss the study design, analytical approach, and the potential of structured, recurring career fair events to strengthen students' professional awareness from the start of their education. The paper also reflects on how structured reflection assignments can serve as a feedback mechanism for academic programs seeking to understand and enhance the early student experience.

Glen Bright
Academic Member, Athens Institute & Professor and Dean of the School of Engineering, University of KwaZulu-Natal, South Africa

Project Based Learning for Undergraduate Engineering Students of the Future

The Fourth Industrial Revolution (4IR) has highlighted the potential of UAVs to assume tasks previously performed by humans or other less efficient production systems. This research explores the potential of UAVs in industrial, disaster management and humanitarian aid applications, specifically for transporting medical supplies and essential items. The research developed a two-axis, roll-pitch, Inertial Stabilization Platform (ISP) compatible with the DJI Matrice 300 (DM300) UAV. The research aimed to aid existing strategies in time-sensitive scenarios where access is limited or obstructed. The ISP was designed to repetitively stabilize fragile cargo such as vaccines and blood samples. Given the DM300's 2.7kg payload capacity, the ISP needed to be lightweight. As such, Fused Deposition Modelling (FDM) was chosen for fabrication.

The study optimized FDM parameters to create structurally resilient, lightweight, components. The resulting ISP assembly contained 19 FDM-fabricated parts with a combined mass of 329.7g. The final design assembly featured an Arduino Nano microcontroller, an Adafruit BNO055 Inertial Measurement Unit (IMU), two DC servo motors, and two lithium-ion batteries, achieving a total assembly mass of 709.86g and a payload capacity of 1900g. Experimental testing procedure findings validated the prototypes functionality, with acceptable stabilisation capabilities being exhibited in both axes. Fully loaded roll and pitch settling times of 1.89s and 1.92s were observed. These findings indicated that the ISP supported UAV operations attempting to aid industrial, disaster management and humanitarian aid efforts.

Eunsoo Choi
Professor, Hongik University, South Korea

Estimation of Self-Centering Capacity of Mortar Beams due to Activated Shape Memory Alloy Fibers

This paper investigates prestressing and self-centering effect of mortar beams reinforced by crimped NiTi shape memory alloy (SMA) fibers with considering fiber's aspect ratios and volumetric ratios. To this end, rectangular mortar beams with a length of 300 mm and a cross section of 50 mm x 50 mm (BxH) are prepared with one and two reinforcing bars at the top and bottom, respectively. The SMA fibers with a diameter of 0.8 mm made from cold-drawn SMA wires and three types of fibers with 20, 30, and 40 mm in length. Thus, their aspect ratios are 25, 37.5, and 50. The considered volumetric ratios are 0.75, 1.0, and 1.25%. Thus, nine types of mortar beams are prepared. Each beam first is heated by electric resistance wires embedded in the beam to induce the presressing effect and, then, the beam is exposed to a cyclic bending test for capturing self-centering capacity. Although the SMA fibers are discontinuously distributed in the beam, they induce the prestressing effect resulting in obtaining upward deflection in the beam. The prestressing effect increases cracking flexural resistance in the beam while it does not effect on the ultimate flexural resistance. Moreover, the SMA fibers provide additional self-centering capacity in the beam. It is observed that the 3 mm fiber with 0.75% and 1.0% volumetric ratio provide the most effective prestressing and self-centering effect.

Govind Sharan Dangayach
Professor, Malaviya National Institute of Technology Jaipur, India
&
Alok Bihari Singh
Research Scholar, Malaviya National Institute of Technology Jaipur, India

Evaluating the Impact of Energy-Efficient Practices on Hospitality Industry Performance: A Sustainability Perspective

Sustainability and its constituent practices are a rising concern for the worldwide hospitality industry. The current study explores the integration of energy-efficient processes in 4 and 5-star hotels in India and its potential effect on overall performance. The study aims to assess the current status of these practices and their subsequent impact on operational and financial performance. A total of 144 responses were collected from a diverse range of hotels within this segment, focusing on key areas such as energy consumption, energy-efficient installations, energy audits, cost savings, and guest satisfaction. The collected data is further analyzed as per the objective of the study. The analysis highlights the extent to which sustainable practices have been implemented and evaluates their effectiveness in enhancing operational efficiency. Findings indicate a significant positive correlation between the adoption of energy-efficient measures and improvements in energy use reduction, cost efficiency, and guest experience. This paper contributes to the growing body of literature on sustainable practices in the hospitality industry, offering insights into best practices and providing a framework for further research. The results underscore the importance of sustainability in achieving long-term competitive advantage and operational excellence in the hospitality sector.

Mareen Derda
Vice Dean for Studies, Teaching and Equal Opportunities, Technical University Berlin, Germany
&
Marco Wedel
Senior Researcher, Technical University Berlin, Germany

Educating Future Engineers to be Responsible Citizens

The university's task is to enable students to face technological change and its social impact with a creative ability, a sense of responsibility and a high level of professional qualification. Prospective engineers should be taught the skills and competences that they will need in their later professional and social lives and prepare them for lifelong learning. In addition to technical competences, this also includes more and more socially relevant skills. Prospective engineers should be able to reflect on their own actions and assess their consequences as well as react appropriately to changing social conditions. To this end, topics such s sustainability and ethics must be integrated into the curriculum. Furthermore, the topics of digitalization, artificial intelligence and data literacy are of particular importance both now and increasingly in the future. Future engineers will play a key role in our future society. This makes it all the more important not only to equip them with a high level of professional qualification, such as the methodological and scientific foundations of their subject, but also to train them to become responsible citizens of our society. Technology assessment and reflective competence as well as critical, analytical, interdisciplinary and interdisciplinary thinking must more than ever take their place in the curriculum of today's engineering degree programs. Students must learn to place their knowledge and actions in an overarching historical, social and cultural context and to consider the ethical consequences of their actions. A number of universities around the world have already recognized the importance of training these skills for future engineers. TU Berlin is also working on redesigning its degree programs and giving the promotion of socially relevant skills its rightful place in the curricula. This article would like to present the steps taken so far in curriculum development and invite discussion on which steps are necessary and which methods are suitable for developing a curriculum which, in addition to technical competences, also trains students to become responsible participants in our society. In addition to the course of the actions of the last five years on this path, starting with the definition of framework conditions in a mission statement for teaching in 2018, developed concepts are

presented, such as possible formats for integrating socially relevant topics into the degree programs. Building on this, we present our future planned steps and would also like to address previous obstacles and lessons learned.

Vusumzi Funda
Lecturer, University of Fort Hare, South Africa

Understanding Student Insights on AI Adoption in Learning: Exploring Value, Ease of Use, and Benefits

This study explores student perceptions of Artificial Intelligence (AI) in education, with a focus on its potential to enhance learning experiences and academic performance. Using the Value-Based Adoption Model (VBAM) as a theoretical framework, the research explores how perceived value, ease of use, and benefits influence students' acceptance of AI technologies. A case study research design will be employed, focusing on a South African university to provide in-depth insights within a specific educational context. Data will be collected through a structured questionnaire distributed to a purposive sample of undergraduate and postgraduate students, selected based on their exposure to AI-enabled tools in learning. This approach ensures the inclusion of diverse perspectives regarding AI adoption in education. The findings aim to uncover key factors shaping students' acceptance of AI, offering insights into its role in achieving learning objectives and addressing barriers to adoption. By bridging technological gaps and improving learning outcomes, the study contributes data-driven recommendations for AI integration in higher education and supporting instructional efficiency.

Roberto Gomez
Associate Professor, National Autonomous University of Mexico, Mexico
&
Raul Sanchez
Assistant Professor, National Autonomous University of Mexico, Mexico

Dynamic Characteristics of Wind Flow in a Wind Tunnel

When solving engineering problems to estimate wind loads on civil structures, the possible interaction between the wind and structures, the effect of wind on pedestrians, dispersion of air pollutants, etc., it is necessary to simulate the atmospheric boundary layer (ABL) and carry out experiments in a boundary layer wind tunnel.

When using the wind tunnel, the proper estimation of the aerodynamic characteristics of the rough surface (zero displacement plane d_0, and aerodynamic roughness length z_0) is required for the study of the vertical wind speed and turbulence profiles to be simulated. Consequently, it is required to have design methodologies for simulator devices that generate the turbulent wind characteristics (e.g., boundary layer height and turbulence levels) for different wind engineering problems.

In this paper, the flow over a rough surface in the wind tunnel and the relation between these parameters is presented, followed by a description of the influence of different roughness, along the same fetch, on the shape and height of the ABL. Theoretical and experimental methods to describe the ABL are reviewed and a morphometric method is selected to apply in an experimental study carried out in a new wind tunnel using different densities of roughness elements; profiles of mean wind speeds are fitted and compared to those obtained theoretically. In addition, plots of the longitudinal turbulence intensity for the different roughness density cases are presented.

Clara Guttenberger
Tunnel Project Engineer, MSc Graduate, FOM University of Applied Sciences, Germany
&
Joachim Berlak
Professor, FOM University of Applied Sciences, Germany

A Systematic Methodology for CO_2 Accounting and Sustainability Assessment in Mechanized Tunnel Construction

Tunnel projects are central elements of modern transportation infrastructure, whose ecological sustainability is increasingly coming into focus. Against the backdrop of global climate protection goals and rising regulatory requirements, the systematic recording and optimization of CO_2 emissions is becoming a critical success factor for infrastructure projects. This paper presents a comprehensive methodology for the sustainability assessment of tunnel construction projects, with a particular focus on mechanized tunneling using tunnel boring machines (TBMs). The proposed methodology combines elements of Life Cycle Assessment (LCA) with the Greenhouse Gas Protocol and is specifically tailored to the project-specific requirements of mechanized tunneling. At its core is a structured calculation approach that systematically captures relevant emission sources and integrates them into a modular calculation scheme. This includes material production (especially concrete and steel), the operation of the tunnel boring machine, cooling and ventilation systems, as well as upstream and downstream transport processes. Based on findings from an empirical expert survey and an extensive literature review, the methodology addresses existing deficiencies in CO_2 accounting for tunnel construction projects. Its practical applicability is validated using an exemplary tunnel project consisting of two tunnel tubes, each approximately 3 km long, with cross passages at intervals of 60 meters. The results show that material production accounts for over 90% of total emissions, while transport, logistics, and machine operation together contribute only about 8%. These insights enable targeted identification of optimization potential, particularly using CO_2-reduced cements and steels, as well as resource-efficient segmental lining designs. The developed methodology provides project planners, construction companies, and public clients with a practical tool for the ecological assessment and optimization of tunnel construction projects. It can be flexibly adapted to project-specific requirements and forms the basis for well-founded decisions on emission reduction in early planning phases. Despite the

complexity of data collection and the need for standardized, tunneling-specific emission values, the methodology shows high potential for transferability to other infrastructure projects. The presented CO_2 accounting methodology could serve as a guideline for designing sustainable infrastructure and contributing to sustainable development.

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Supply Chain Management in Automotive Industries: Overcoming the Barriers

Cladding, buttering and surfacing are the techniques used for imparting a protective layer on the subtract to enable it to withstand in the various environmental conditions. Imparting a layer of stainless steel on mild steel is crucial technique used by many industries, to improve its applicable properties without disturbing its fundamental characteristics. This study deals with the investigation of the process parameters of advanced gas metal arc welding process, which comprises the water-cooled torch having preheating and nozzle cooling capabilities. The primary aim of this study is to assess the effects of process parameters on the various responses and to evaluate the effectiveness of the proposed process in decreasing the peak temperature and reduction in power consumption while maintain the overall quality of cladded samples. It has been deduced that the problems like distortion, residual stress and excessive heat input that can be generated via conventional process can be eliminated or reduced by using advance process. Additionally, use of the auxiliary power source for wire preheating can increase the energy efficiency, as because of preheating of wire the requirement of energy for melting the filler wire will decrease resulting in lower peak temperature and constant arcing. Sixteen experiments for each process were carried out in controlled environment. Setup consists of imparting ss layer over mild steel plate, only difference in both the processes is utilization of advanced torch. The responses like peak temperature, power consumption, corrosion resistance and wear resistance were calculated and analyzed. The decrement in the power consumption can be attributed to the decrement in resistance in the nozzle material because water cooling, as cooled material will result in less resistance. The cladded samples were subjected to electrochemical impedance spectroscopy for corrosion testing and pin on disc apparatus for finding wear resistance of the samples. The results shows that the cladded samples through advance process displayed more resistance toward corrosion as well as wear and tear. The deduction of these results could be uniform and finer grain size, low heat affected zone and decreased residual stress. Scanning electron microscopy was used for examination of microstructure of cladded samples as well as corrosion and wear sample after tests. Digital surface profile projector was also

used for corrosion and wear samples after test to check the surface properties and unevenness. This research shows that advance process has capabilities to enhance the cladding technique via decreasing maximum temperature, lower power consumption and improved resistance towards corrosion and wear environments.

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Experimental and Numerical Investigation on the Seismic Performance of Proposed Steel-Concrete Composite Joints

This study evaluates two newly developed beam-to-column joint systems through a common experimental-numerical program that combines full-scale cyclic tests, detailed LS-DYNA simulation, and parametric sensitivity analysis. In each program, two geometrically identical specimens were fabricated from the same materials; only the beam-to-column connection method differed. Cyclic loading histories, identical instrumentation layouts, and a unified verification procedure were applied across all specimens to ensure consistent comparison, while the validated finite-element models were subsequently employed for parametric studies on material strength and steel-plate thickness.

For the concrete-filled steel tube (CFST) beam–to–steel column joints, the welded specimen (SC-W) and the column-tree bolted specimen (SC-B) exhibited nearly the same initial stiffness, peak strength, and energy-dissipation capacity. Likewise, for the precast H-shaped steel-reinforced concrete beam–to–reinforced concrete column joints, the fully welded specimen (PC-W) and the flange-weld/web-bolted specimen (PC-B) achieved comparable global responses. In both joint systems, finite-element predictions closely matched the measured hysteretic curves, confirming the models' suitability for design-oriented parametric studies. Sensitivity analyses demonstrated that increasing steel tensile strength produced a more pronounced enhancement in load-carrying capacity than increasing plate thickness, indicating that material grade selection is a more efficient parameter for joint optimisation.

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The Usage Behavior and Perception of Public on-Demand Transport Based on three Examples in the Province of Salzburg

Based on the previous work of the Institute of Transport Studies at the University Bodenkultur (BMK Endowed Chair for Digitalisation and Automation in Transport and Mobility Systems) on the topic of demand-responsive transport, the question was raised together with representatives of the Austrian province of Salzburg: How are these services used and perceived in the region? This includes both users and non-users of the service, who in turn are made up of locals, commuters, tourists and visitors to the region. This question was investigated on the basis of three case studies, which are embedded in different framework conditions, and the results will be summarised in this presentation. All three case studies are located in different regions in the Austrian province of Salzburg (W3 shuttle, Walsie bus and Loigom shuttle). In principle, there are some differences in the type of service and the framework conditions between the case studies. The most obvious difference is that one service runs according to a timetable, whereas the other shuttles have a flexible timetable based on demand indications.

The survey showed that the services are well established in the region, so the majority of non-users are also aware of the service and the majority of respondents think the service is good (78% W3 shuttle, 66% Walsie bus and 80% Loigom shuttle). The shuttle is primarily used for leisure purposes, 42% for the Loigom shuttle, 22% for the Walsie bus and 48% for the W3 shuttle. About every second journey was made by occasional users, which is the proportion of users travelling with a single ticket. The survey confirmed, the contribution of the W3 shuttle to tourists' choice of transport both at site and for arrival is remarkable. The local traffic effect is also noticeable. For example, 54% of Loigum-Shuttle users, 42% of W3-Shuttle users and 34% of Walsie Bus users stated that

they would have made their last journey by on-demand bus by car if the service had not existed.

The investigation of the three successful services showed success factors for on-demand transport, which are: (1) the clear (also financial) commitment of the municipalities; (2) the operation of the service by a professional operator from the taxi/bus sector; (3) the use of vehicles with a capacity of up to 8 passengers, including flexible increases in the number of vehicles in the event of peaks in demand; (4) the exclusion of school transport; (5) the recognition of transport association tickets and other regional network tickets; (6) the coordination and connection of the service to the superordinate transport system; (7) the complete integration of on-demand transport into route planning systems (beyond the shuttle's service area) and (8) operation on all days of the week. The delineation of the service area is an important planning decision and has an influence on the minimum time between the ordering process and the execution of the journey. Municipal boundaries are less important than the necessary journey times within the service area and connection points to the superordinate public transport network. These should therefore not be longer than a pre-order time of 60 minutes (preferably 30 minutes) allows. The division into several areas/zones is certainly an option and is used on the W3 shuttle and Walsie bus. In operation, every effort must be made to ensure that (potential) passengers have the confidence that their journey request will be fulfilled. This is the only way to create a regular clientele (also indirectly, by recommending existing users or multipliers such as accommodation providers for their guests) that can justify operation in the long term.

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Two-Dimensional Hydrodynamic Simulations in Urban Water Systems

In the studies presented here, we demonstrate the latest simulation capabilities of two-dimensional (2D) free-surface flow modeling through specific case studies. In hydrodynamic investigations, it is often necessary to use coupled one-dimensional (1D) and two-dimensional (2D) modeling of open-channel flows. This is because in closed conduits or smaller watercourses, flow variations predominantly occur along the channel (1D), while in shallow impounded areas or surface flooding scenarios, the flow characteristics can vary significantly in the lateral direction as well (2D). During high-flow flood events, gradually varied, unsteady flow conditions develop. The spatial resolution of a hydrological model lumped to a 1D hydrodynamic model is often insufficient to obtain more accurate spatial results.

For the unsteady 1D–2D hydrodynamic, hydrological, and geospatial tasks at hand, we employed the widely accepted HEC-RAS (Hydrologic Engineering Center's River Analysis System) and HEC-HMS (Hydrologic Modeling System) simulation software.

In one case study, a one-kilometer urban reach of a stream flowing through the outskirts of a major city was analyzed in connection with plans to improve water quality in recreationally impounded lakes. The hydrodynamic assessment of the planned lake conditions was carried out using 2D modeling. The spatial resolution of the model enabled the identification of potential sediment deposition zones and the verification of the proper operation of the weir and outlet structures.

In another case, we analyzed surface runoff generated by precipitation falling on the site of a planned solar power plant located within a small riverside town. The results helped assess the need for and potential design of a stormwater drainage system. The spatial resolution of the 2D model allowed for an accurate determination of both the quantity and extent of surface runoff accumulation.

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Study on CO_2 Carbon Sequestration in Recycled Concrete

This study explores CO_2 sequestration in recycled concrete by fabricating cylindrical specimens incorporating 10% baking soda and quicklime by cement weight. Waste concrete aggregate partially replaced fine aggregate, while air -cooled blast furnace slag partially replaced coarse aggregate. Accelerated carbonation curing was applied under different curing durations and pressures. Two carbonation strategies were tested: carbonation curing after demolding and pre-carbonation of the waste concrete aggregate. Compressive strength and elastic modulus tests were conducted. Results showed that carbonation duration and pressure significantly influenced CO_2 absorption, with the highest sequestration rate of 6.08% achieved at 6 hours of carbonation and 4.08 bar pressure. The optimal mix proportion was 2% baking soda, 5% quicklime, 50% waste concrete aggregate, and 50% air-cooled blast furnace slag. Carbonation curing had little effect on the elastic modulus, which was mainly influenced by the type of concrete used. The results highlight the importance of carbonation duration and pressure on CO_2 absorption, with significant implications for improving the carbon footprint of concrete production. Additionally, the study provides valuable insights into the optimal mix proportions for achieving the highest carbon sequestration rates while maintaining concrete's structural integrity. This research adds to the growing body of knowledge on carbon sequestration in concrete and could pave the way for more environmentally sustainable construction practices. Future work could explore further optimization of these additives, as well as real -world applications of such materials in large-scale concrete production.

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Climate Change Effects on Roads Infrastructure and Adaptive Strategies in KwaZulu-Natal South Africa

The increasing threats posed by climate change, alongside the demand for sustainable infrastructure development, have raised serious concerns among government officials and stakeholders. The devastating floods of April 2022, which claimed over 400 lives and caused economic losses worth billions of rands, underscore the urgent need for resilient infrastructure and improved urban planning. This study aims to assess the impact of climate change on KwaZulu-Natal's roads infrastructure, mitigate its effects, and develop adaptive measures to enhance resilience. The specific objectives are to analyse historical climate trends in the province, evaluate the extent and patterns of damage to highway infrastructure, and propose a multidimensional framework for mitigation and adaptation strategies. The study utilizes secondary data from sources such as the KwaZulu-Natal Department of Transport (KZNDoT), the South African Weather Service (SAWS), academic literature, government reports, and existing roads design standards. Data analysis employs data mining techniques for events classification, risk assessment, and predictive modelling of extreme weather return periods and intensities. The findings will inform policy recommendations to enhance infrastructure resilience and ensure sustainable development in the region.

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Ontology-based System for Generating Information Security Policy

In any kind of organization, information security is indispensable for properly guaranteeing not only confidentiality but also integrity and availability while keeping them in balance. Although establishing an information security policy is effective as a means for that purpose, it is still a high hurdle especially for SMEs without neither personnel nor financial leeway. Thus, we have proposed a framework of a system for automatically generating an information security policy and tried to implement it in application programs, with the help of which the organization generate information security policies properly adjust to each organization. We have implemented the creation process of the basic policy by presenting the template reflecting the organizational profile. We have also proposed methods for the reflection of the characteristics of the organization obtained from its profile not only to the basic policy but also to the selection of countermeasures.

The system was proposed referencing an information security ontology corresponding to the industry based on the input organizational characteristics and reflecting them in a template. However, the specific ontology is incomplete, and no algorithm for reflecting it has been created. In this research, we aim to actually create an ontology for each organizational characteristic and implement a trial algorithm in an application program.

Paper will be organized as follows. After describing the general definition of information security policy and reviewing suitable for information security issues, trial ontologies for generating the proper information security policy are presented according to the type of organization, then the ontology-based query system in SPARQL is described. Last part just before the conclusion, we will show some results obtained from simulations with several types of organization.

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Application of Content and Language Integrated Learning (CLIL) on the Example of Functional Safety Study Programme in English

Safety Engineering has become a demanding and rewarding career path in the age of rapid technological and scientific advances. In the field of Safety Engineering, university graduates often have to work in international teams, which requires knowledge of a specialist foreign language.

The aim of this presentation is to show how successful cooperation between professionals in the field of Functional Safety, and experienced foreign language teachers can enhance students' motivation and encourage them to face the social and professional needs of changing business environments.

We have tried to prove that a tailor-made course provides students with efficient information on the subject matter, source materials and terminology of Safety Engineering. It also enables students to apply their knowledge to respond to hazards and accidents. It teaches them to take independent decisions in emergency situations and prepares them to function confidently in the global business world.

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Analysis and Prioritization of Traffic Crash Hotspot Intervention Sites

Traffic crashes remain a major cause of preventable loss of life and injury. Many policy and intervention efforts aim to reduce the number and severity of collisions. Of these, the most direct is the identification and correction of hotspots of severe crashes. We present data from the 20 largest cities in Israel, spanning a decade, showing that clusters of light crashes have a risk of a severe crash in the following year that is comparable to that of clusters of severe crashes. This has immediate policy implications, as we should rethink the intervention strategy that currently predominantly considers severe hotspots. Next, we apply machine learning to model the probability of having a future severe event at a cluster, given the known characteristics of the location and the previous accidents that occurred there. The quality of the model is shown to differ between types of clusters, such as severe vs. minor, and intersection vs. non-intersection, etc. Finally, the problem facing a decision maker is how to use a given budget and prioritize clusters for intervention, based on the risk scores provided by the model and their type-dependant uncertainties, as well as the type-dependant cost of intervention. The overall aim of the policy is assumed to be maximization of the total reduction of expected future severe crashes, but extensions that consider fair spread of resources are also considered.

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A Hybrid Explainable Machine Learning (XML)-Supported Fuzzy AHP Framework for Resilient Circular Supply Chains in Construction

The construction industry faces challenges due to urbanization, and sustainability standards. Furthermore, due to recent modernization and technological advancements, community needs have increased which directly influences construction operations. This has increased Supply chain delays, particularly in circular supply chains (CSC), impacting project schedules, financial targets, and sustainability programs. Challenges include supplier dependability, logistical efficiencies, policy and regulations, and market stability. However, current frameworks fail to address disruptions and therefore stress to incorporation of predictive analytics, highlighting the need for innovative approaches to increase CSC resilience and flexibility. The aim of the research is to design a hybrid framework that combines the Fuzzy Analytic Hierarchy Process (Fuzzy AHP) and explainable machine learning (XML) to handle important disruption causes in circular supply chains. The objective is to establish a single decision-making and forecasting tool that merges expert judgment with data-driven insights to manage disruptions and boost operational efficiency.

Fuzzy AHP was utilized to identify and prioritize significant disruption causes, allocating the greatest weight to “logistics and operational efficiency”, followed by “supplier and material reliability”. Among sub-criteria, “financial stability” scored as the most crucial aspect, followed by “transportation reliability” and “warehouse efficiency and inventory management”. These findings were included in a machine learning model developed with XML algorithms which are gradient boosting (GB), decision trees (DT), and random forest (RF). The comparative analysis of the GB, DT, and RF models against the fuzzy AHP methodology gives a valuable understanding of their efficacy in anticipating supply chain disruptions. Each model's findings reveal distinct strengths and limits in terms of precision, recall, F1-score, and alignment with fuzzy AHP global weights, finally indicating the best acceptable approach to data-driven

MCDM. The GB model emerged as the most robust, obtaining a high AUC of 0.91 and improved performance across accuracy, recall, and F1-score criteria. Its capacity to handle unbalanced datasets and complicated non-linear interactions allows it to recognize trends in both disruption and non-disruption instances efficiently. The DT model, although interpretable, displayed a modest AUC of 0.50 and failed to reliably predict disruption instances, as evidenced by its lower recall (33%) and F1-score (35%) for the "Disruption" class. The RF model fared marginally better than the DT, obtaining an AUC of 0.55, but its performance remained worse than GB, notably in recall for the "Disruption" class, demonstrating limited capabilities in recognizing disruptions reliably.

This study is crucial since existing CSC frameworks typically fail to incorporate qualitative and quantitative methodologies, limiting their capacity to proactively detect and manage disturbances. By integrating Fuzzy AHP's interpretability with XML's predictive capacity, the hybrid framework overcomes this gap, delivering a solid, explainable strategy for decision-making. The results indicate that addressing supplier financial stability, streamlining logistics, and matching regulatory procedures are crucial for strengthening supply chain resilience and promoting circular economy objectives. In conclusion, this research adds to the literature by presenting a unique hybrid framework that combines Fuzzy AHP and XML to increase decision-making and prediction capacities in CSC. The findings illustrate the need to connect expert-driven goals with data-driven insights for sustainable supply chain management. Future studies must concentrate on adding real-time data, extending the framework to incorporate developing risk variables and verifying the technique across sectors and in different geographies.

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Identify Communication Methods for Severely Intoxicated Drivers to Develop Effective Engineering Countermeasures for Wrong-Way Driving

This paper presents research efforts sponsored by Caltrans to understand the cognitive abilities of severely intoxicated drivers and to evaluate the effectiveness of engineering countermeasures to prevent wrong-way entry onto freeways via exit ramps. The study tested 30 human subjects in a driving simulator with scenarios depicting various combinations of traditional and novel wrong-way-related traffic control devices (signs or pavement markings). Each subject participated in three separate simulator sessions: an initial training session, a session including all scenarios while sober, and a session including all scenarios while intoxicated to a target blood alcohol level of 0.12. The researchers recorded all the subjects' input into the driving simulator and the area of the simulator screen in which the subjects were looking through eye-tracking devices. The analysis reveals which wrong-way warning methods proved the more effective based on the observed virtual driving behavior. Some key findings are summarized as follows:

- Alcohol-impaired drivers tend to look less toward the far roadway horizon and more toward the pavement area in front of the vehicle.
- Based on the number of WWD events, it can be concluded that signs worked better than pavement markings. The combination with Wrong-Way flashing signs had the potential to keep alcohol-impaired drivers from Wrong-Way Driving.
- The total fixation durations for each Traffic Control Device (TCD) revealed that normal drivers will spend more time on TCD(s) than alcohol-impaired drivers.
- According to the results of the average fixation duration for single TCDs, drivers typically have longer average fixation durations under alcohol-impaired conditions than normal conditions, which indicates that drunk drivers may need more time to understand those single TCDs.

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Evaluating the Effectiveness of a Smartphone App Intervention for Improving Driving Safety in Novice Teen Drivers: A Randomized Controlled Trial

Purpose: Traffic crashes are the leading cause of death among teens aged 15–17 years, with the national death rate for teen drivers increasing by 26% from 2019 to 2022 in the United States. Limited research has explored the role of supervised driver training and technology interventions in improving safety for novice teen drivers. We conducted a randomized controlled trial to test the effectiveness of a smartphone app designed to help novice teen drivers learn driving skills and improve driving safety.

Methods: We recruited 90 teen-parent dyads in Ohio during the learner permit phase and randomized them into three groups: app-only, app + parent engagement, and control. The app uses phone sensors to monitor each driving trip, scoring five key areas—cornering, acceleration, braking, speeding, and phone usage—on a 100-point scale. These scores are combined to create a comprehensive driving safety score. Weekly summaries of driving performance, individualized feedback, educational materials on driving errors, and gamification elements (e.g., badges) are provided to motivate teens to improve their safety scores. The app + parent engagement group included additional situational supervised driving practice, while the control group received a modified version of the app that only tracked performance and provided passive information on car maintenance. A linear mixed-effects model with a random intercept for participants and a random slope for time was used to compare driving safety scores across three groups.

Results: Over six months, the driving safety score increased by 2.6 points in the app-only group and 2.5 points in the app + parent engagement group compared to the control group; however, these differences were not statistically significant due to the small sample size. The intervention groups showed notable trends in reducing risky driving behaviors, including a 24% reduction in cornering events in the app-only group (Rate Ratio [RR]: 0.76, 95% Confidence Interval [CI]: 0.41, 1.41) and a 16% reduction in the app + parent engagement group (RR: 0.84, 95% CI: 0.46, 1.54). Speeding decreased by 17% in the intervention groups, with an

average speeding percentage (speeding distance/total distance traveled * 100%) of 2.67% (95% CI: 1.26%, 4.08%) for the intervention groups, relative to 3.21% (95% CI: 1.67%, 4.76%) in the control group. Additionally, phone usage during driving decreased by 20% in the app + parent engagement group (1.89% [95% CI: 1.05%, 2.74%]) and by 8% in the app-only group (2.16% [95% CI: 1.24%, 3.08%]), compared to controls (2.35% [95% CI: 1.41%, 3.30%]).

Conclusions: This smartphone app-based intervention demonstrated potential in enhancing teen driving skills and reducing risky driving behaviors. Further research with a larger sample size is needed to conclusively determine the effectiveness of this intervention in improving driving safety among novice teen drivers.

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