2025

The 15th IACIP Annual Workshop

Sustainable and Smart Infrastructure Materials and Technologies

Date: Sunday Jan. 5, 2025
Time: 8:00 AM to 5:15 PM
Room: Gallaudet University (M1) / Marriott Marquis

The 15th IACIP Annual Workshop Program

Sustainable and Smart Infrastructure Materials and Technologies

Time	**Sunday Jan 5, 2025, from 8:00 AM to 5:15 PM**
Location	Room/Venue: Gallaudet University (M1) / Marriott Marquis, Washington, D.C.
8:00– 5:15	**Registration and Membership**
8:30– 8:40	**Conference Opening and Welcome Remarks** (Conference Co-chairs: Dr. Zhen Leng/ Dr. Shihui Shen; IACIP president: Dr. Lu Gao)
8:40 – 9:15	**Keynote Session I** (Moderator: Dr. Linbing Wang) • **Dr. Xudong Wang**, Research Institute of Highway (RIOH), Ministry of Transport, China, "RIOHTrack Accelerated Loading Test and Pavement Performance Verification after One Hundred Million ESALs"
9:15 – 10:20	**Session I: Advancement in Bituminous Pavement Materials** (Session Chairs: Dr. Haifang Wen and Dr. Yi Li) • **Dr. Geoffrey M. Rowe**, Abatech, Inc., "Moving the Asphalt Specifications – Options and BMD Implications" • **Dr. Yi Li**, Delft University of Technology, "Advancing Understanding of Blending and Interfacial Zones in Recycled Asphalt Materials: First Insights from BIZ-SRAMCS" • **Dr. Anand Sreeram**, University of Nottingham, "Enhancing Fatigue Resistance and Low-temperature Performance of Asphalt Pavements Using Antioxidant Additives" • **Dr. Shuai Yu**, Penn State, Altoona, "A Novel Method to Evaluate Asphalt Mixture Workability through Particle Kinematic Behaviors"
10:20 – 10:35	**Break**
10:35 - 12:00	**Session II: Sustainability & Resilience of Infrastructure** (Session Chairs: Dr. Shenghua Wu and Dr. Xijun Shi) • **Dr. Ghim Ping Raymond Ong**, National University of Singapore, Use of Waste Plastics on Roads with Environmental Considerations • **Dr. Changjiang Kou**, Yangzhou University/ University of Waterloo, "Combination Optimization of Mineral Filter Media for Pavement Runoff Pollution Treatment" • **Dr. Xijun Shi**, Texas State University, " Assessment of Waste Eggshell Powder as A Limestone Alternative in Portland Cement" • **Dr. Weibing Gong**, Missouri University of Science and Technology, "A Pseudo-3D Methodology for Regional-scale Back-analysis of Co-seismic Landslides" • **Dr. Junfeng Gao**, Chongqing Jiaotong University, "Research Progress of Bio-asphalt towards Green Pavement Development: Preparation, Properties, and Mechanism"
12:00 – 1:00	**Lunch Break**

1:00 – 2:10	**Keynote Session II** (Moderator: Dr. Zhen Leng and Dr. Shihui Shen) • **Dr. Imad Al-Qadi**, University of Illinois at Urbana-Champaign, "Flexible Pavements in 2050" • **Dr. Yujiang Zhang**, Federal Railroad Administration, US, "High-speed Trains in the U.S. - How Do They Get Qualified"
2:10– 3:15	**Session III: Infrastructure Maintenance & Management** (Session Chairs: Dr. Lu Gao and Dr. Zhe Han) • **Dr. Jiangmiao Yu**, South China University of Technology, "Key Technology of Ultra-Thin Friction Course and Challenges in Future" • **Dr. Kamal Hossain**, Carleton University, "A Smartphone APP for evaluating and Managing Low Volume Road Networks for Newfoundland, Canada" • **Dr. Miaomiao Zhang**, Massachusetts Institute of Technology, "Benchmarking and Reducing Life Cycle Greenhouse Gas Emissions in Pavement Networks" • **Dr. Jie Ji**, Beijing University of Civil Engineering and Architecture, "Application of Construction and Demolition Waste(C&DW) in Road Engineering"
3:15 – 3:30	**Break**
3:30 – 5:05	**Session IV: Infrastructure Condition Assessment and Performance Prediction** (Session Chairs: Dr. Xinbao Yu and Dr. Qing Lu) • **Dr. Yuqing Zhang**, Southeast University, "A Multiphysics Prediction of Field Aging and Fatigue Life for Viscoelastic Asphalt Pavements" • **Dr. Yihao Ren**, The University of North Carolina at Pembroke, "A Hybrid Local-Feature-Based Approach for Automated Rail Extraction from LiDAR Data" • **Dr. Junqing Zhu**, Southeast University, "Multi-Object Detection for Daily Road Maintenance Inspection with UAV Based on Improved YOLOv8" • **Dr. Zhenqiang Han**, Chang'an University, "Automated Approach to Measuring Asphalt Pavement Rut Depth Using Smartphone Photography Images" • **Dr. Zihang Weng**, The Hong Kong Polytechnic University, "Integrating Spatial and Channel Attention Mechanisms with Domain Knowledge in Convolutional Neural Networks for Friction Coefficient Prediction" • **Dr. Gang Liu**, University of Wisconsin-Madison, "Research Progress on Future Sustainable Road Pavements: Prefabricated Bridge Deck Pavement & Recycled Pavement System"
5:05 – 5:15	**Announcements and Workshop Adjourn** (Dr. Shihui Shen and Dr. Zhen Leng)
6:30 - 10:00	**Banquet** • Address: Tony Cheng's Seafood Restaurant (中国城海鲜大酒楼), 619 H Street NW, Washington, D.C. • Registration is required. More information is available at the end of this brochure.

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   - Banquet Ticket: $45 (Discounted)
   - Total: $145
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   - Banquet Ticket: $45 (Discounted)
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5. **Banquet Ticket Only:**
   - Banquet Ticket: $55

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* Membership is valid until December 31, 2025.

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KEYNOTE ABSTRACTS

RIOHTrack Accelerated Loading Test and Pavement Performance Verification after One Hundred Million ESALs

Xudong Wang, Ph.D.
Principal Investigator, Research Institute of Highway (RIOH), Ministry of Transport, China

ABSTRACT: Since the beginning of this century, extensive experimental research has been carried out on long-life asphalt pavement in China, and a large number of test sections and projects were put into practice, including semi-rigid base structure, flexible base structure, rigid base structure, inverted pavement structure, thick asphalt concrete structure and full-depth asphalt concrete structure. However, which of these pavement structures has a longer service life and meets the requirement of the technical and economic optimization in the whole life cycle needs to be verified by the equivalent load test. To this end, in 2014, a full-scale test track named RIOHTrack were built by the Research Institute of Highway Ministry of Transport (RIOH) to carry out accelerated loading test verification of various asphalt pavement structures. So far, the RIOHTrack has completed one hundred million equivalent single-axle load (ESALs) tests, which is equivalent to about forty-year service life according to relevant Chinese technical specifications. This paper mainly discusses the performance evolution of nineteen main structures in the RIOHTrack including deflection, rutting and cracking. The studies show that:1)Pavement service performance has a significant structural dependence, which does not depend on the name of the pavement structure, but the essential characteristics of the structure; 2) The load-environment coupling effect has significant influence on the evolution of deflection and rutting performance;3)There are some typical nonlinear response characteristics in the evolution of asphalt pavement performance, such as negative thixotropic effect of deflection response and duality of rutting and T-D (top-down) cracks.

Bio: Dr. Wang Xudong has been engaged in the research of asphalt pavement materials, structures and construction technologies for more than 30 years. He is the Principal Investigator of asphalt pavement at the Research Institute of Highway, Ministry of Transport and the executive director of the Road Engineering Branch of the China Highway & Transportation Society. He has successively carried out research on the reliability design of asphalt pavement structures, typical structures of asphalt pavements on high-grade highways (in China), dynamic parameters of asphalt pavement materials and moduli back-calculation of FWD deflection basin, design of asphalt pavement structures for heavy-duty traffic, long-term performance of asphalt pavements, and application technology of rubber asphalt and its mixtures. He has participated in more than 80 asphalt pavement engineering designs, constructions and scientific investigations. Since 2014, he has been responsible for the design and construction of China's first full-scale test track (RIOHTrack), and presided over the accelerated loading test and long-term observation of the track, and carried out the test verification of the service performance of long-life asphalt pavements of various structural forms such as semi-rigid base structure, composite pavement structure, inverted pavement structure, thick asphalt concrete structure and full-depth asphalt concrete structure throughout the life cycle, as well as the research on the construction and design technology of long-life asphalt pavements.

Flexible Pavements in 2050

Imad Al-Qadi, Ph.D.
Professor, University of Illinois at Urbana-Champaign

Abstract: A robust pavement infrastructure is essential for protecting the environment, supporting the economy, and benefiting society. Autonomous and connected vehicles, including trucks, have the potential to reduce energy consumption, emissions, and costs, while improving road safety. Therefore, the future vision for flexible pavements must be holistic, prioritizing safety, achieving net-zero emissions, enhancing resilience, and minimizing disruption to both travelers and freight. The evolution of traffic patterns, including truck platooning and electric freight, presents new challenges for flexible pavement performance. Addressing these challenges requires exploring optimization techniques that turn potential problems into opportunities, with the goal of achieving net-zero emissions by 2050— the focus of this presentation

Bio: Imad Al-Qadi, a renowned pavement scholar, is the Grainger Distinguished Chair in Engineering and the founding Director of the Illinois Center for Transportation (ICT). Prior to that, he was the Charles E. Via, Jr. Professor at Virginia Tech. He has led more than 180 research projects to completion, authored/co-authored more than 1000 publications, and advised more than 100 PhD students and postdocs. Professor Al-Qadi has received numerous national and international honors and awards, including the NSF Young Investigator Award, the IGS Award, ASCE James Laurie Prize, ARTBA Steinberg Award, ASCE Turner Award, TRR D. Grant Mickle Award and Woods Award, the ASCE Robert Horonjeff Airport Transportation Award, and the French Limoges Medal. He is an Emeritus Member of TRB and a Life member of AAPT. He served as the President of the ASCE T&DI Board of Governors and the Chair of the Academy of Pavement Science and Engineering Board of Directors and is the Editor-in-Chief of the *International Journal of Pavement Engineering.* In 2010, he was elected as an ASCE Distinguished Member and was the 2023 recipient of the TRB Roy W. Crumb Distinguished Service Award, the 2024 UIUC Executive Officer Distinguished Leadership Award, and the 2024 U of I President's Executive Leadership Program Fellow. He is also the recipient of the 2024 CUTC Lifetime Achievement Award for University Transportation Education and Research.

High-speed Trains in the U.S. - How Do They Get Qualified

Yujiang Zhang, Ph.D., P.E.
Staff Director, Federal Railroad Administration, US

ABSTRACT: High-speed rail has existed since the early 1660s. While China only began developing its high-speed rail network in the 2000s, it has quickly emerged as the global leader in this field. In contrast, the U.S. has lagged behind Europe and Asian countries in embracing high-speed rail systems. Compared to traditional rail, high-speed rail infrastructure requires more stringent standards for design, construction, maintenance, and safety. Sine high speed rail exclusively carries passengers, safety becomes paramount. Before any high-speed trains can transport passengers or any high-speed track can be commissioned for high-speed service, they must go through a series of qualification processes overseen by regulatory authorities. The Federal Railroad Administration (FRA) is the primary federal agency in the U.S. responsible for ensuring the safety of all railroad systems, including high-speed rail operations. Any rail vehicle operating at speeds above 90 mph (145 kmh) must comply with progressively stringent regulatory requirements. This presentation will provide an overview of vehicle and track system qualification under 49 CFR 213.345. The focus will be on the qualification of new vehicle types designed to operate above 125 mph (201 kph) and on curves where vehicles will experience unbalanced speeds corresponding to 5 inches (12.7 cm) or more of underbalanced superelevation. The scenario discussed here will entail the full-blown qualification process, including static testing, computer simulations, and dynamic testing using instrumented wheel sets and accelerometers.

Bio: Dr. Yujiang Zhang serves as the Staff Director for Track and Structures at the Federal Railroad Administration (FRA), where he leads a team of 110 professionals, including engineers, safety specialists, and safety inspectors. His team is responsible for overseeing federal regulations related to safety for track, bridge and structures, roadway maintenance machines, as well as safety for roadway workers, and bridge workers. From September 2023 to February 2024, Dr. Zhang also held the position of Acting Director for the Office of Program Management at the FRA. Before his promotion to Staff Director, Dr. Zhang was a civil engineer in the Track and Structures Division, focusing on the safety standards of high-speed track classes within 49 CFR Part 213. He has more than 42 years of professional experience. He holds a bachelor's degree in automotive engineering, a master's in civil engineering, and a Ph.D. in civil engineering. He is a licensed Professional Engineer in Virginia and has published numerous papers in international journals. Dr. Zhang is also a frequent speaker at international conferences. Before joining the FRA, Dr. Zhang was a staff scientist and project manager at ENSCO, Inc., where he led numerous research and development projects for both government and private clients. He is a recognized subject matter expert in rail track degradation, vehicle-track interactions, performance monitoring, instrumentation and data acquisition, and safety trend analysis.

TECHNICAL PROGRAM

Moving the Asphalt Specifications – Options and BMD Implications

Geoffrey M. Rowe, Ph.D., C.Eng., P.E.
President and CEO, Abatech

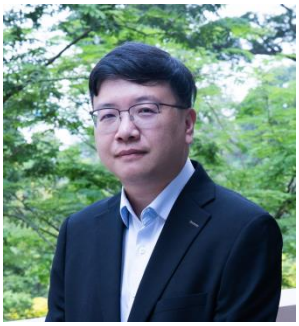
Abstract: Multiple parameters have been proposed by researchers in the asphalt industry to define cracking and durability properties of asphalt binders. Two critical needs exist for rheological evaluation in the high stiffness region exists, that is to define a shape and point parameter. The shape parameter defines the "rheological type" whereas the point parameter defines the hardness of a product. Cracking occurs when the binder has a relatively high stiffness, greater than 1MPa. In this high stiffness region, we need to define the shape of the master curve and the relative hardness. For the shape we have four proposals: 1) □Tc from BBR – proposed by NCHRP 9-60 workers; 2) R-value (Rheological index, NCHRP 9-59 proposed from BBR); 3) phase angle at constant modulus (Kris et al., 2020) and partly implemented to allow higher fatigue criteria loss stiffness (6,000kPa) for binders in ASTM & AASHTO; and 4) log Gc (log cross-over modulus) as originally proposed by WRI workers in 2008. Many states have implemented or are considering some form of implementation, particularly □Tc. However, the best measure of the shape of the master curve is most likely the phase angle at constant modulus. With regard to the hardness, we need a point parameter. Parameters that have been proposed to consider the relative hardness of the material include: 1) G*.sin□ at 10 radians/second at a defined temperature; 2) the cross over temperature (□=45°) measured at 10 radians/second and/or when the □=27°; 3) G-R parameter (Glover-Rowe) defined at a specified loading frequency and temperature; and 4) S(t) or G* - a value of modulus at a defined temperature and frequency. This presentation will discuss the best cracking parameters for both shape and point parameter, also, demonstrates how these parameters are measured and will demonstrate a practical path to implementation using existing test methods. The impact of these parameters on BMD tests such as the Ideal CT will be presented.

Bio: Dr. Geoffrey Rowe has been working with pavements since joining the industry 1976. Geoff is currently the president of Abatech, and provides consultancy services on projects around the world. His company, Abatech, has developed software packages for pavement and materials engineering. Geoff leads various research efforts on the performance of materials and the development of specifications. Geoff is a past president of the Association of Asphalt Paving Technologists and was member of the US Expert Task Group on asphalt binders until they ceased in December, 2018. He sits on many other groups advising research that has an impact of specifications in North America, Europe, Asia and Africa. He is a licensed Professional Engineer in New Jersey, Pennsylvania and Florida, and a Chartered Materials Engineer in the United Kingdom. Dr. Rowe has over 100- peer reviewed publications, many on advanced materials and performance evaluation.

Use of Waste Plastics on Roads with Environmental Considerations

Ghim Ping Raymond Ong, Ph.D.
Associate Professor, National University of Singapore

Abstract: With the rapid rise in the number of plastic products, recycling plastic waste has become a crucial challenge worldwide. Diverting plastic wastes to roads is one option to relieve pressure on landfill space. This study aims to ensure that plastics can be effectively used in asphalt roads and creating a circular economy. This include understanding the source of plastic wastes in consumer households and the industry, assessing whether recycling plastic in asphalt pavement using either the dry and/or wet process is a sustainable strategy. Engineering, environmental, and economic performances of various waste-plastic modified asphalt pavements are presented. Life cycle cost analysis (LCCA) performance of waste plastic-modified asphalt pavements and their impact on aquatic environmental pollution and pollutant emissions are discussed. Finally, the potential of recyclability (i.e. recycled asphalt pavements) for a full circular economy is presented. The implementation of waste plastics in asphalt roads in Singapore is discussed to demonstrate the translation aspect of this study.



Bio: Dr. Ghim Ping (Raymond) Ong is the Dean's Chair Associate Professor and Deputy Head (Research and Enterprise) at the Department of Civil and Environmental Engineering and Director (Operations) at the Coastal Protection and Flood Resilience Institute, National University of Singapore. His research interests include sustainable pavement materials and engineering and multimodal transport infrastructures. Dr. Ong is currently the Executive Vice President of the International Society of Maintenance and Rehabilitation of Transportation Infrastructures (iSMARTi), the Chair of the ASCE Transportation and Development Institute Economics and Finance Committee, and the Topic Group Chief (Highway Design and Maintenance) at the Eastern Asian Society for Transportation Studies (EASTS). He has attained various research recognitions including the ASCE Alfred Noble Prize, the International Association of Maritime Economists (IAME) Hanjin Prize, the Overseas Coastal Area Development Institute of Japan (OCDI) Takeuchi Yoshio Award, the iSMARTi Achievement Award and others.

Key Technology of Ultra-Thin Friction Course and Challenges in Future

Jiangmiao Yu, Ph.D.
Professor, South China University of Technology

Abstract: The key technologies of a new type of ultra-thin friction course are introduced. The thickness of this friction course can reduced to an extreme level of 8-12mm without comprising its mechanical performance. It also has improved functional performance such as better skidding resistance, reducing noise level, increased cracking resistacne, and higher durability as well. Compared with conventional friction course, the High-Toughness Ultra-Thin friction course has much less energy consumption, higher construction efficiency, lower construction cost, and less impacts to the residents. It can be furtherly processed and applied as surface course upgrading alternative of highway, urban road, bridge, and tunnel. The future challenges on developing and upgrading the current Ultra-Thin Friction Course will also be discussed in the presentation.

Bio: Dr. Jiangmiao Yu is a full professor in Pavement Engineering at the South China University of Technology (SCUT), and currently he is the vice dean of School of Civil Engineering and Transportation at SCUT. Dr. Yu received his PhD degree at the SCUT in 2005. In 2006 he started to work at the department of Pavement Engineering of SCUT as a faculty member. From April 2010 to October 2011, he worked as a visiting scholar at the Pavement Research Centre of University of California at Berkeley. His main research interests include pavement structure, pavement materials, pavement maintenance and management. He is also the principal/co-principal investigator of more than 100 research projects. He has published more than 60 international journal papers as first author and corresponding author. He is one of the main authors of Chinese national pavement design specification, which is “Specification for Design of Highway Asphalt Pavement” (JTG D50-2017). This mandatory specification is followed by all contactors registered in China and many researchers in asphalt industry. He has developed a High-toughness Ultra-thin Friction course, which has been applied in pavement maintenance projects for more than 30 million square meters in China.

A Multiphysics Prediction of Field Aging and Fatigue Life for Viscoelastic Asphalt Pavements

Yuqing Zhang, Ph.D.
Professor, Southeast University

Abstract: This study aims to predict asphalt pavement long-term field aging and its effect on the pavement remaining fatigue life prediction. The framework is proposed based on fundamental theories of Multiphysics modeling and viscoelastic damage mechanics instead of redundant empirical functions. Two road sections in Europe were selected to develop and validate the models. First, the pavement aging model was developed based on three physics (heat transfer, oxygen diffusion, and oxidative reaction) of pavement field ageing. The model was validated via the field measurements of pavement temperature and aging product. Then a viscoelastic-damage material model was developed and validated via the laboratory cyclic fatigue tests. After that, the coupled field aging-viscoelastic-damage pavement model was developed by coupling the two models via the time-temperature-aging shift model. The pavement model was validated via the falling weight deflectometer data at different pavement service years. Finally, the remaining fatigue life predictions with and without aging were conducted based on the integrated Multiphysics model. Results indicate that the proposed model can effectively obtain the temporal evolution and spatial distribution of pavement temperature and aging gradient. The aging-induced modulus gradient causes the localization of high von Mises stress near the road surface, which demonstrates that aging is highly associated with the pavement top-down and surface cracking. Based on the case study, field aging would shorten the pavement remaining fatigue life up to 1.6 years when only considering the effects of aging gradient.

Bio: Dr Yuqing Zhang is a Professor in Highway Engineering at Southeast University, China. Prior to that, he was a Senior Lecturer and the Director of the Aston Institute of Materials Research (AIMR) at Aston University in Birmingham, UK. He graduated from Texas A&M University, US. with a PhD degree in Civil Engineering. His research is focused on mechanics-based multiscale and multiphysics modelling of pavement materials and structures. He also works on renewable construction materials (e.g., bio-bitumen, waste plastic bitumen) for sustainable roads and intelligent evaluation technologies for future city infrastructures. As a principal investigator, Dr Zhang has led research projects from National Natural Science Foundation of China, EU's Horizon 2020, UK's Engineering and Physical Sciences Research Council (EPSRC), Royal Society, Royal Academy of Engineering, British Academy, British Council, and construction industries. He published over 100 technical papers on top academic journals. Dr Zhang serves as a journal editor of ASCE's Journal of Transportation Engineering, Part B: Pavements and the Journal of Construction and Building Materials. He is also sitting on the steering committee of the UK's National Asphalt Research Consortium (NARC) and is a member on CIHT, ISAP, TRB, EATA and RILEM technical committees. Dr Zhang is the Theodore von Kármán Fellowship (Germany) recipient and the proposal referees for the national research councils of six EU countries.

Advancing Understanding of Blending and Interfacial Zones in Recycled Asphalt Materials: First Insights from BIZ-SRAMCS

Yi Li, Ph.D.
Assistant Professor, Delft University of Technology

Abstract: Recycled Asphalt Materials (RAMs) are crucial for advancing sustainable road infrastructure, aligning with the European Green Deal and Circular Economy Action Plan. However, their application remains limited by unexpected cracking caused by incomplete blending of aged and fresh materials. This presentation showcases the first-phase findings of the "Interplay of Blending and Interfacial Zones in Sustainable Recycled Asphalt Materials: A Comprehensive Mechanical Characterization and Modeling Study" (BIZ-SRAMCS), which focuses on two critical zones: the Blending Zone (BZ) and the Interfacial Transition Zone (ITZ). Using an innovative combination of Environmental Scanning Electron Microscopy (ESEM) and Energy Dispersive X-ray Spectroscopy (EDS), the study identifies and quantifies the BZ, analyzing metrics such as blending degree and thickness in RAMs with varying Reclaimed Asphalt (RA) content and aging levels. An advanced pull-off test was also developed to evaluate the mechanical behavior of the ITZ, providing valuable insights into adhesion properties essential for enhancing RAM performance. The test results contribute to initial efforts to model ITZ mechanical behavior and fatigue response, highlighting the potential for accurate long-term performance prediction. This work addresses critical challenges in RAM design, offering insights to improve mechanical reliability and facilitate greater RA utilization without compromising durability. By sharing these findings, the study seeks to inspire collaboration and innovation in sustainable infrastructure materials.

Bio: Dr. Yi Li is an Assistant Professor in the Engineering Structures Department at Delft University of Technology, Faculty of Civil Engineering and Geosciences. She specializes in pavement engineering, focusing on sustainability and circularity in infrastructure. As a Marie Skłodowska-Curie Actions Fellow, Dr. Li leads the BIZ-SRAMCS project, which investigates the microstructural and mechanical properties of recycled asphalt materials to enable accurate durability predictions and promote sustainable road construction practices. Dr. Li brings a strong interdisciplinary background, combining expertise in civil engineering materials, microscopy, and mechanical modeling. Her research focuses on circular labeling of road materials, sustainable reuse and recycling technologies, and the development of multi-cycle-oriented decision-making systems. Her work emphasizes extending the lifecycle of road materials while ensuring environmentally responsible reintegration into infrastructure. Dr. Li also serves as the Dutch representative for the Forum of European National Highway Research Laboratories (FEHRL) Research Committee and is a member of the PFDM 2025 Scientific Committee.

Enhancing Fatigue Resistance and Low-temperature Performance of Asphalt Pavements Using Antioxidant Additives

Anand Sreeram, Ph.D.
Assistant Professor, University of Nottingham

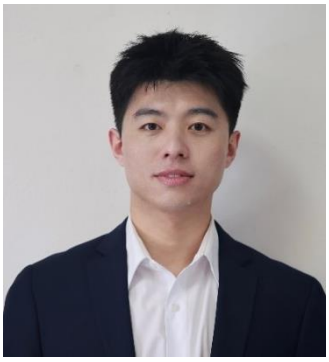
Abstract: Ageing results in significant performance deterioration of asphalt, especially in relation to its fatigue and low-temperature performance. This performance deterioration can theoretically be lowered by incorporating antioxidants in asphalt mixtures. Although there are several promising studies that have shown the potential efficacy of antioxidants such as zinc diethyldithiocarbamate (ZDC), no work has comprehensively evaluated its performance. In this regard, ZDC was employed to evaluate its effect as an antioxidant to slow down the ageing related performance deterioration of bitumen and asphalt mixtures. Both ZDC-modified (3% and 5%) and unmodified bitumen and asphalt mixtures were subjected to short-term and long-term ageing. Afterwards, linear amplitude sweep (LAS) tests and low-temperature frequency sweep tests were carried out on the bitumen samples using a dynamic shear rheometer (DSR). Four-point bending (4PB) fatigue tests were carried out at 25 ^{o}C, and indirect tensile asphalt cracking tests (IDEAL-CT) were carried out at 25 ^{o}C and -10 ^{o}C on the various asphalt mixtures. It was seen that properties of long-term aged bitumen and asphalt mixtures measured at low temperature and intermediate temperature could be improved by 13%-69% for mixtures and 1%-44% for bitumen with the addition of ZDC, compared to the unmodified samples. The ageing-mitigation efficiency of ZDC was more pronounced for the low-temperature performance-based metrics since its performance deterioration rate was significantly slowed. Overall, a comprehensive performance evaluation of the effectiveness of antioxidants at different scales provided robust evidence for the potential extension of this technology to field trials and application.

Bio: Dr. Anand Sreeram is an Assistant Professor in Transportation Engineering at the University of Nottingham, UK and the Nottingham Transportation Engineering Centre (NTEC). Formerly, he was a Marie Sklodowska Curie-Future Roads Research Fellow in the Department of Engineering at the University of Cambridge, UK. He completed his post-doctoral training at the Center for Transportation Research (CTR) at the University of Texas at Austin, USA and received his PhD in Civil and Environmental Engineering from the Hong Kong Polytechnic University, Hong Kong SAR. He has an internationally recognised track record of research and scholarship in the pavement and highway engineering field. His current research interests include sustainable infrastructural materials and technologies, advanced material characterisation, smart and resilient infrastructure, high performance materials for pavements and multiscale modelling. He is an elected member of the Chartered Institution of Highways and Transportation (CIHT) UK East Midlands committee and holds prominent leadership roles in several international committees related to pavement and highways engineering including the Transportation Research Board (TRB) subcommittee on the ageing and antiageing of binders, the RILEM Task Group (TC APS-TG2) on the recyclability of pavement materials, and the UK National Asphalt Research Consortium (NARC). Additionally, he serves as the guest editor for the theme of chemomechanics in the Journal of Road Materials and Pavement Design, the special issue editor for the ICE Journal of Infrastructure Asset Management and Journal of Cleaner Materials.

A Novel Method to Evaluate Asphalt Mixture Workability Through Particle Kinematic Behaviors

Shuai Yu, Ph.D.
Assistant Professor, Penn State, Altoona

Abstract: Workability is a critical parameter for assessing how effectively an asphalt mixture can be placed, spread, and compacted. With the increasing adoption of warm mix asphalt (WMA) technologies, recycled materials, and various additives, evaluating asphalt mixtures has become more complex and vital in both mixture design and pavement construction. However, for years, a standardized test method for assessing asphalt mixture workability has not been documented. To address this gap, our research developed a novel methodology using particle kinematic behaviors to evaluate the workability of asphalt mixtures. Utilizing the particle-sized Microelectromechanical System (MEMS) sensor, SmartKli, the compaction behaviors of individual particles can be effectively monitored. Our findings revealed a strong correlation between particle relative rotation and the density of asphalt mixtures during compaction. Based on this, two new parameters, Relative Rotation Capacity (RRC) and Average Residual Rotation (ARR), are proposed to quantify workability. This study investigated the effects of WMA additives (e.g., Evotherm), compaction temperature, low-density polyethylene (LDPE), and its processing techniques on workability. The results demonstrated that higher production temperatures and increased chemical additive dosages significantly enhanced particle rotation and, consequently, workability. However, the effects of temperature and WMA additives varied depending on baseline conditions, such as initial production temperature and additive usage. For LDPE-modified asphalt mixtures, the wet processing method proved to be more effective than dry methods under identical mix designs. Furthermore, for mixtures containing plastics, ensuring sufficient binder content was critical to maintaining workability. Overall, this methodology provides an effective mesoscale approach to evaluating the workability of asphalt mixtures. The proposed parameters and method have been standardized and published as an ASTM test method, offering a practical framework for designing various asphalt mixtures. This methodology also enables optimization of compaction conditions, ultimately enhancing the performance and durability of asphalt pavements.

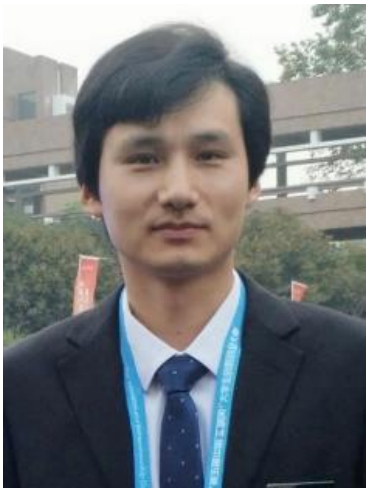


Bio: Dr. Yu an assistant professor of rail transportation engineering at Penn State, Altoona. He received his doctoral degree from Pennsylvania State University. Yu's research focus is primary on the automation in construction, application of sensor in civil engineering, and civil engineering materials. Yu has published multiple technical reports and papers in esteemed journals, like Automation in Construction, IEEE Transactions on Intelligent Transportation Systems, Journal of Cleaner Production, etc. He also actively served as a reviewer for several journals and research committees.

Combination Optimization of Mineral Filter Media for Pavement Runoff Pollution Treatment

Changjiang Kou, Ph.D.
Associate Professor/Visiting Scholar, Yangzhou University/ University of Waterloo

Abstract: Mineral filter media (MFM) serve as the cornerstone of low-impact development measures aimed at mitigating pavement runoff pollution. Nevertheless, a notable gap exists in the current publications pertaining to the combination optimization of MFM based on the purification efficiency for pavement runoff pollution. In this study, zeolite, ceramsite and diatomite were selected as MFM. Nine Filter column experiments of the single-layer with particle size gradation, single-layer with single particle size, double-layer with particle size gradation and Composite-layer with single particle size were designed to study the effect of types, gradations and combinations of MFM on the pollutant purification efficiency. Furthermore, microscopic tests were conducted to examine the microstructural and chemical properties of mineral filter media before and after purification experiments. Results indicate that the flow velocity, temperature and pollutant concentration of the pavement runoff have a significant effect on the purification efficiency of various MFM. The purification efficiency of MFM is ranked as zeolite, ceramsite and diatomite in terms of the pollutant removal rate. Zeolite has a better adsorption effect on heavy metals. Ceramsite has a better adsorption effect on total phosphorus and Zinc, and diatomite has a better adsorption effect on total nitrogen. A MFM layer with particle size gradation has a higher pollutant removal rate than that with a single particle size. Specifically, pollutant removal rates of zeolite, ceramsite, and diatomite layers are increased by 14.4%, 22.0%, and 9.6%, respectively after particle size gradation design. The double-layer with particle size gradation behave better purification efficiency than the single-layer with particle size gradation. Compared with the double-layer with particle size gradation, the triple-layer with particle size gradation has significant advantages in dealing with pavement runoff containing multiple pollutants. At the microscopic level, diatomite exhibits the greatest pore volume as 0.0744 mL·g-1.Ceramsite demonstrates the largest average pore size as 159.96 nm. Zeolite displays the highest ratio of transition pores to micropores in its pore composition and the greatest number of effective pores conducive to adsorption. The adsorption mechanism of zeolite for heavy metal cations is mainly based on electrostatic adsorption, while the adsorption process of ceramsite and diatomite for major pollutants is a physical adsorption process. Diatomite undergoes surface complexation adsorption with heavy metal ions. Based on the findings, the above MFM combinations were recommended for different runoff pollutant composition situations, providing reference for improving the material and structural design system of road water environment purification.



Bio: Dr. Changjiang Kou is an Associate Professor, Dean Assistant of Civil Science & Engineering at Yangzhou University, also a Visiting Scholar of Civil & Environmental Engineering at University of Waterloo. He was selected as an outstanding young teacher of Qing Lan Project by Jiangsu Province, Youth Science and Technology Talent by Jiangsu Association for Science and Technology, and High-level Talent by Yangzhou University. His research interests mainly include characterization of the behaviors of asphalt materials, optimization of the use of recycled materials in sustainable pavement, bio-mineral filter media for road low impact development. He has published more than 20 papers in his study field. His research projects have been funded by the National Natural Science Foundation of China, Ministry of Education of China, Jiangsu Department of Science and Technology, Jiangsu Department of Education.

Assessment of Waste Eggshell Powder as A Limestone Alternative in Portland Cement

Xijun Shi, Ph.D., P.E.
Assistant Professor, Texas State University

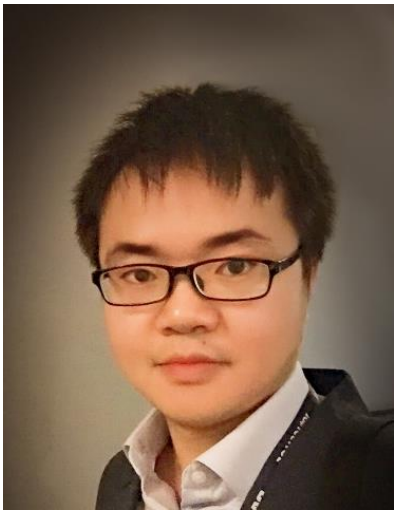
Abstract: The decarbonization of the concrete industry is an ongoing endeavor. One promising approach to achieving this goal is the incorporation of limestone powder into portland cement. Waste eggshells, with their high calcite content, present significant potential as an alternative calcite filler due to their compositional similarity to limestone. This study investigates the feasibility of replacing 15% and 35% of portland cement with ground eggshell in cement mortars. The hydration mechanisms of eggshell- and limestone-blended cements were compared through measurements of heat of hydration, phase assemblage, electrical resistivity, compressive strength, and shrinkage. Experimental results revealed that cement mortars incorporating ground eggshell achieved comparable compressive strengths to those with limestone. However, eggshell mixtures required additional mixing water due to the hydrophobic nature of the eggshell membrane. At a 15% replacement level, the high calcite content in both eggshell and limestone accelerated cement hydration. Conversely, at a 35% replacement level, ground eggshell retarded cement hydration, primarily due to the dominant effect of the membrane. Overall, eggshell waste is a viable and sustainable alternative to limestone powder for cement replacement at levels of up to 15%.

Bio: Dr. Xijun Shi, P.E., is an Assistant Professor of civil engineering at Texas State University (TXST). He received his PhD and MS degrees in Civil Engineering, both from Texas A&M University (TAMU). He graduated from the "Mao Yisheng" Honors Undergraduate Pavement Engineering Program at Southeast University in China. Since joining TXST in Fall 2020, Shi has secured over 20 internal and external research projects funded by NSF, NASA, NCHRP, USDOT, ACI Foundation, NMDOT, TxDOT, etc. as PI or Co-PI, totaling more than $13M. This includes him being a Co-PI of TXST's newly awarded USDOT Tier-1 University Transportation Center focused on infrastructure durability. Shi has more than 50 peer-reviewed publications in prestigious journals. Shi is a main member of TRB AKP 20 Standing Committee on Design and Rehabilitation of Concrete Pavements and a voting member of ACI 555 Concrete with Recycled Materials, ACI 565 Lunar Concrete, and ACI 221 Aggregates. Shi is Secretary of ACI 555 and chairs ACI 555-A. In 2022, Shi co-founded a startup company called Circle Concrete Tech Inc (https://buildwithcircle.com/), which is centered upon innovation that markedly reduces the tremendous environmental impacts of the concrete industry. Shi is a recipient of 2021 USDA E. Kika De La Garza Fellowship and a member of ACI Class of 2022 Emerging Leaders Alliance. In 2022, Shi guided the TXST CaerusCrete team to the first prize at the 2022 NASA MINDS Undergraduate Student Design competition with a lunar geopolymer project.

A Pseudo-3D Methodology for Regional-Scale Back-Analysis of Co-seismic Landslides

Weibing Gong, Ph.D.
Assistant Professor, Missouri University of Science and Technology

Abstract: Co-seismic landslides are a significant hazard in seismically active regions, threatening infrastructure and human safety. Existing methods for regional-scale back-analysis of such landslides face challenges in scalability and accuracy. This study presents a novel pseudo-three-dimensional (pseudo-3D) inversion methodology to address these limitations. The approach integrates seismic displacement models, geomorphic characteristics, and an inversion scheme to generate three-dimensional (3D) modeled landslides that closely match individual mapped landslides in both sizes and locations. It also derives strength parameters, enabling regional-scale evaluation of geotechnical properties without requiring prior assumptions. Validation against synthetic landslide datasets demonstrates strong consistency with 3D numerical methods, emphasizing the pseudo-3D approach's efficiency in estimating regional-scale strength parameters and uncovering spatial patterns of strength variability. Application to the 2015 Mw 6.4 Lefkada earthquake in Greece, which triggered over 700 landslides, highlights the methodology's capability to derive spatially-distributed strength parameters and support co-seismic landslide analysis. These findings demonstrate the potential of this approach to enhance seismic risk assessment and inform mitigation strategies in earthquake-prone regions.



Bio: Dr. Weibing Gong is an Assistant Professor of Geological (Geotechnical) Engineering in the Department of Earth Sciences and Engineering at Missouri University of Science and Technology. He earned his Ph.D. in Geosystems Engineering from UC Berkeley in 2023, following a Master's degree in Geotechnical Engineering from Tongji University (2018) and a Bachelor's degree in Civil Engineering from Central South University (2015). Dr. Gong's research focuses on addressing climate change and seismic hazards, enhancing infrastructure resilience to natural disasters, and leveraging remote sensing and AI technologies in geotechnical engineering. He is also actively involved in advancing carbon detection and capture solutions.

Research Progress of Bio-asphalt towards Green Pavement Development: Preparation, Properties, and Mechanism

Junfeng Gao , Ph.D.
Associate Professor, Chongqing Jiaotong University

Abstract: Bio-asphalt is a binder that is derived from bio-oil, which is extracted from fast pyrolysis or hydrothermal liquefaction of biomass and petroleum asphalt under specific conditions or by adding other external agents to bio-oil under defined conditions. Due to its renewable and eco-friendly characteristics, bio-asphalt has immense potential to substitute petroleum asphalt and reduce the environmental impact of road construction. This paper provides a comprehensive review of research progress on bio-asphalt, including the preparation and composition of bio-oil, the preparation process and properties of bio-asphalt, modified bio-asphalt, and its modification mechanisms. Future research directions for the development of bio-asphalt are also proposed. The review indicates that most types of bio-oil can improve the low-temperature and fatigue properties of virgin asphalt but may have adverse effects on the high-temperature performance and aging resistance. To improve the performance of bio-asphalt, modifiers such as polymers, rock asphalt, montmorillonite, and nano-clay materials are used to modify bio-asphalt. The majority of existing research is focused on physical modification, with relatively little attention given to chemical and composite modifications. Future studies should focus on the preparation process and classification of bio-oil, the development of efficient modifiers, and the mechanisms of composite-modified bio-asphalt to enhance its quality and increase its proportion of substitution for petroleum asphalt.

Bio: Dr. Junfeng Gao is an Associate Professor at Chongqing Jiaotong University. He is also the Young “Bayu Scholar” in Chongqing and the Young Top-notch Talent of Chongqing Jiaotong University. He earned his Ph.D. in Road and Railway Engineering from Chang’an University in 2020 and learnt as a joint PhD in the Department of Civil, Environmental, and Geospatial Engineering at Michigan Technological University. His main research interests are green and low-carbon road materials, bio-asphalt, and polyurethane modified asphalt. Dr. Gao serves as a principal researcher in the research projects from NSFC, NSCQ, CPSF and the Fundamental Research Foundation of the Central Universities. He also participated some research projects from Fundamental Research Project of the Ministry of Transport, MnDOT, DEQ, and EGLE - State of Michigan. Dr. Gao has published over 40 papers in peer reviewed journals. These publications include prestigious journals such as the ASCE Journal of Materials in Civil Engineering, Journal of Cleaner Production, and Construction and Building Materials. Dr. Gao is an active member in the professional community. He is currently a member of the editorial board of Advances in Civil Engineering (SCI), a guest editor of Applied Sciences-Basel (SCI), Coatings (SCI), buildings (SCI), and a young editorial board member of Materials Engineering, Journal of Chang'an University (Natural Science Edition), Journal of Northeast Petroleum University, Journal of Changsha University of Science and Technology (Natural Science Edition), Chinese and Foreign Highway, and Municipal Technology. He is also a member of the American Society of Civil Engineers (ASCE), American Society for Testing and Materials (ASTM), international Society for Maintenance and Rehabilitation of Transport infrastructures (iSMRTi). He was invited to participate in over 20 international or domestic academic conferences such as TRB, SATC, WTC, and ASCE academic annual meeting. He has also reviewed technical papers for over 40 international journals. Dr. Gao has won the Second Prize of Chongqing Science and Technology Progress Award (2/10), the National Scholarship for Doctoral Students, the Scholarship for Study Abroad by the China Scholarship Council, and the Best Poster Award by the International Association of Chinese Infrastructure Professionals (IACIP).

A Smartphone APP for Evaluating and Managing Low Volume Road Networks for Newfoundland, Canada

Kamal Hossain, Ph.D.
Associate Professor, Carleton University

Abstract: Assessing roadway conditions is essential for efficient road management, requiring leadership, equipment, skilled personnel, and funding. In Canada, Newfoundland and Labrador's 13,500 lane-kilometer network include 7,700 kilometers managed by local jurisdictions, where municipalities often face challenges like limited resources, funding, and public expectations. While agencies rely on the Transportation Association of Canada's guidelines, municipal roads require tailored approaches. This presentation introduces a cost-effective alternative using road users' feedback. A survey of residents from 108 municipalities provided data on roadway conditions, which was analyzed to develop a distress-based pavement performance model. To support practical implementation, a smartphone (MUNPave) application is introduced, offering local agencies an accessible tool for evaluating and managing road networks

Bio: Dr. Kamal Hossain is an Associate Professor of Civil Engineering at Carleton University in Ottawa. Dr. Hossain has over 15 years of experience in academia and industry in the areas of civil, transportation and construction engineering. His research includes Highway Pavement Performance and Sustainability, Climate Change Impact Assessment on Transportation Infrastructure, Pavement Design, Civil Infrastructure Management, Highway Maintenance and Preservation, Infrastructure Resiliency, Cold Region Pavement Engineering and Highway De-icing and Anti-icing. Previously, Dr. Hossain served as an Assistant Professor of Civil Engineering at Memorial University of Newfoundland, and as a postdoctoral researcher in pavement and transportation engineering research groups at University of Illinois at Urbana-Champaign (UIUC) in USA and University of Waterloo in Canada. He holds a PhD in Transportation Engineering from University of Waterloo. He has supervised over 20 Master's/PhD thesis projects and authored/co-authored over 100 technical publications. Dr. Hossain is a member of the standing committees of US Transportation Research Board (TRB) on pavement maintenance (AKT40) and binder for flexible pavements (AKM20).

Benchmarking and Reducing Life Cycle Greenhouse Gas Emissions in Pavement Networks

Miaomiao Zhang, Ph.D.
Post-doctoral fellow, Massachusetts Institute of Technology

Abstract: To support global sustainability efforts and meet ambitious GHG reduction goals set by various Departments of Transportation (DOTs), a comprehensive evaluation of greenhouse gas (GHG) emissions and effective mitigation strategies for pavement networks is essential. This study develops a two-stage bottom-up (TSBU) network analysis framework that integrates life cycle assessment (LCA) and life cycle cost analysis (LCCA) methodologies, along with dynamic updates and feedback mechanisms, to evaluate baseline GHG emissions, economic impacts, and the long-term effectiveness of GHG mitigation strategies. The framework was applied to Colorado arterial road networks for a 50-year baseline GHG emissions evaluation from 2021 to 2070. Annual network life cycle GHG (LC-GHG) emissions were estimated at 270 kt CO2eq in 2021, primarily from pavement-vehicle interaction (PVI) emissions, followed by embodied emissions, fuel cycle emissions, and albedo emissions. Network LC-GHG emissions are projected to increase to 370 kt CO2eq by 2070, mainly due to traffic growth. Network life cycle costs (LCCs) are expected to rise from $100 million to $160 million over the 50-year period, with agency costs and PVI costs increasing over time. Implementing treatment optimization enhances overall network performance and sustainability, resulting in an 18% reduction in GHG emissions and a 3% reduction in LCCs compared to the decision tree approach. Increasing the network budget by 10% further leads to a 6% reduction in GHG emissions, with increased agency costs offset by reduced user costs, resulting in no overall increase in network LCCs.

Bio: Dr. Miaomiao Zhang holds BS and MS degrees in Transportation Engineering from Dalian University of Technology and a PhD in Civil Engineering from the University of Tennessee. She is currently a Postdoctoral Associate at the Massachusetts Institute of Technology. Dr. Zhang's research focuses on developing rapid pavement structural condition assessment technologies, intelligent assessment and prediction of pavement performance, and infrastructure carbon accounting and low-carbon decision-making. Her research interests include low-carbon materials, pavement mechanics, and artificial intelligence, integrating life cycle assessment and cost analysis to advance sustainable practices in transportation engineering.

Application of Construction and Demolition Waste (C&DW) in Road Engineering

Jie Ji, Ph.D.
Professor, Beijing University of Civil Engineering and Architecture

Abstract: Recycling Construction and Demolition Waste (C&DW) is an environmentally friendly approach to reusing limited resources effectively. Once processed into aggregates of varying sizes, C&DW can be stabilized with inorganic binders such as cement, lime, and fly ash to form a new semi-rigid mixture suitable for base layers in road construction. This study analyzes the physical and chemical properties of C&DW aggregates, outlines the design methodology, and evaluates the performance of the resulting mixture. A test section utilizing this mixture has been in service for three years. Comprehensive tracking and evaluation over this period assessed its mechanical properties, dynamic and static modulus, and fatigue performance, with comparisons to conventional semi-rigid mixtures. Results demonstrate that the new mixture performs exceptionally well and has significant potential for large-scale application in road base layers.

Bio: Dr. Ji is a full professor at the School of Civil Engineering and Transportation, Beijing University of Civil Engineering and Architecture (BUCEA). She leads the “Resilient Infrastructure of Future Cities” initiative, part of Beijing's high-level innovative teams. She has been recognized as a National May 1st Female Pacesetter in China and one of Beijing's "Most Beautiful Scientific and Technological Workers." Dr. Ji earned her Ph.D. in Transportation Engineering from Tongji University. Her research focuses on the performance of pavement materials and structures, as well as the recycling and utilization of solid wastes. She has published over 150 technical papers, authored 5 books, and held more than 50 authorized patents. Dr. Ji has led over 40 research projects funded by the National Natural Science Foundation of China, the Ministry of Science and Technology, and other organizations. She serves as an Editorial Board Member of the China Journal of Highway and Transport and as Secretary-General of the Construction and Demolition Waste Recycling and Management Committee under the China Urban Sanitation and Environmental Association.

A Hybrid Local-Feature-Based Approach for Automated Rail Extraction from LiDAR Data

Yihao Ren, Ph.D.
Assistant Professor, the University of North Carolina at Pembroke

Abstract: Constructing 3D rail models from observed LiDAR point clouds gains growing interest in the railroad industry to 1) create digital twins of their infrastructure asset inventory and 2) continuously monitor their infrastructure health conditions. Performance of the existing threshold-based and rule-based extraction methods not only heavily depends on feature-specific properties such as retro-intensity, geometric design rules, and defined feature shapes but also relies on data quality and prior knowledge such as data resolution, scanning angle, and feature orientation. This research proposes a hybrid approach, combining both data-driven filtering algorithms and artificial intelligence (AI) model-based classification approaches for automatically generating 3D rail models. The main objective is to develop an automatic and computationally-efficient procedure for rail 3D model reconstruction in a massive, noisy, and unevenly distributed railroad scene with high accuracy but without requiring 1) prior knowledge, 2) high-density point data clouds, and 3) feature-specific global features. In this paper, we developed and compared three hybrid procedures by using data collected by the Federal Railroad Administration (FRA) with a point density of 293 pt/m2. Both pointwise and lengthwise evaluations were used to evaluate the robustness of the proposed methods. The pointwise evaluation shows an average precision, recall, f1, and IoU of 0.989, 0.747, 0.852, and 0.741, respectively. The lengthwise evaluation shows average correctness, completeness, and quality of 99.32%, 94.69%, and 94.06%, respectively. The proposed automated, configuration-independent, and global-feature-free method shows its efficient and effective rail extraction capabilities with low-density point clouds for complicated railroad terrains.

Bio: Dr. Yihao Ren is currently an Assistant Professor of Supply Chain at the University of North Carolina at Pembroke (UNCP). He earned his Ph.D. in Transportation and Logistics from North Dakota State University and his M.S. in Construction Management from the University of Houston. His research interests focus on developing computational models and artificial intelligence algorithms, as well as leveraging sensing technologies to address real-world challenges in areas such as supply chain and transportation asset management, roadway and railway safety, pavement preservation and maintenance, autonomous vehicles, freight mobility, and other critical transportation and supply chain applications.

Multi-Object Detection for Daily Road Maintenance Inspection With UAV Based on Improved YOLOv8

Junqing Zhu, Ph.D.
Associate Professor, Southeast University

Abstract: Daily road maintenance is essential to road safety and serviceability, particularly to highways. In daily road maintenance inspection tasks, the objectives include a variety of targets, such as pavement cracks, foreign objects, guardrail damages etc. There is a lack of rapid detection methods that allow for the uniform identification of multiple targets for road maintenance. This paper proposes an automatic multi-object detection method for road daily maintenance inspection assisted by unmanned aerial vehicles (UAV). A dataset of multiple roadway anomalies (UAVROAD) for daily road maintenance needs was constructed. UM-YOLO, an improved algorithm based on the YOLOv8n algorithm was created to better extract the features of multiple targets, as well as fuse features and reduce computation while maintaining accuracy. The improvements include adding EMA (Efficient multiscale Attention Module) in the C2f module in the backbone, employing Bi-FPN fusion mechanism in the neck and using GSConv, a lightweight convolutional network, for the convolution operation. Compared with the YOLOv8n, the proposed UM-YOLO improved mean average precision(mAP) by 4.6% and reduced the model computation by 14%.

Bio: Dr. Junqing Zhu received the B.S. degree from Jilin University, Changchun, China, and the M.S. and Ph.D. degrees from Ohio University, Athens, OH, USA. He is currently an Associate Professor with the School of Transportation, Southeast University, Nanjing, China. His current research interests include pavement distress analytical methods, multi-sensor fusion and distress detection, uav-based infrastructure inspection methods. He has authored over 40 journal articles and 10 conference papers. He is the PI of over 10 projects, including national natural science foundation, national key research and development program project and provincial projects. He has received several awards including first place in China Highway & Transportation Society Science and Technology Award. He is the young academic editor of Journal of Road Engineering and committee member of technical committee GL0601 - Pavement Testing, Evaluation, and Maintenance of World Transportation Convention.

Automated Approach to Measuring Asphalt Pavement Rut Depth Using Smartphone Photography Images

Zhenqiang Han, Ph.D.
Associate Professor, Chang'an University

Abstract: To address issues of low efficiency or high costs associated with existing pavement rut depth (RD) measurement methods, this study proposed an approach to identify and measure RD using smartphone photography images and neural network prediction models. Accelerated pavement tests (APTs) were conducted on 4 types of asphalt pavements to obtain measured data and smartphone photographs of the rutting evolution history. By utilizing image grayscale conversion and Fourier transform algorithms, the study identified the rutting related frequency range in the frequency domain spectrum of grayscale images. The grayscale rut curves corresponding to actual rut cross-sections were obtained after Fourier filtering process. A backpropagation neural network was designed to establish a multivariate nonlinear mapping model between the grayscale and actual RD. The proposed method illustrated desirable accuracy and generalization capability, providing a viable alternative for the efficient and accurate RD measurement in APT and filed highway pavement service condition evaluation.

Bio: Dr. Zhenqiang Han is an associate professor and master supervisor at Chang'an University. His research focuses on numerical simulation and performance optimization of road materials and structures, intelligent detection and operation of roads based on multi-source data fusion, planning and design of energy integration systems for highway transportation. He was selected into the Young Talent Program of Association for Science and Technology in Xi'an of China, and serves as the principal investigator for the projects of National Natural Science Foundation of China Youth Science Foundation (52108393), National Key R&D Program of China (2021YFB260130201), Technology R&D Project of Henan Provincial Department of Transportation (202253). He has published 15 academic papers and granted 4 national invention patents. He works as the young editorial board member for the Journal of Road Engineering, serving as the reviewer for Journal of Transportation Engineering, Engineering Fracture Mechanics, Journal of the Transportation Research Record, Journal of Testing & Evaluation, etc.

Integrating Spatial and Channel Attention Mechanisms with Domain Knowledge in Convolutional Neural Networks for Friction Coefficient Prediction

Zihang Weng, Ph. D.
Post-doctoral fellow, the Hong Kong Polytechnic University

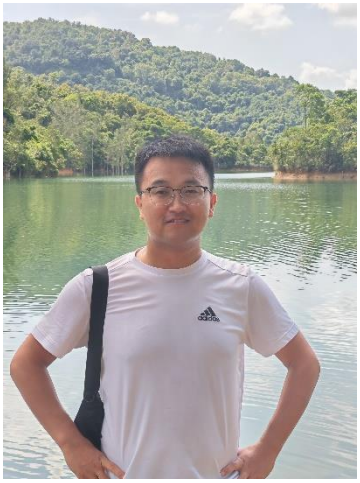
Abstract: The pavement skid resistance is crucial for ensuring driving safety. However, the reproducibility and comparability of field measurements are constrained by various influencing factors. One solution to these constraints is utilizing laser-based 3D pavement data, which is notably stable and can be employed to estimate pavement skid resistance indirectly. However, the integration of tire-road friction mechanisms and deep neural networks has not been fully studied. The paper employed spatial-channel attention mechanisms to integrate frictional domain knowledge and convolutional neural networks (CNN) that predict the friction coefficient as the output. The models' inputs include 3D texture data, corresponding finite element (FE) simulation outcomes, and 2D wavelet decomposition outcomes. An additional spatial attention (ASA) mechanism guided the CNNs to focus on the tire-road contact region, using tire-road contact stress from FE simulation as domain knowledge. Multi-scale channel attention (MSCA) mechanisms enabled the CNNs to learn the channel weights of 2D-wavelet-based multi-scale inputs, thereby assessing the contribution of different texture scales to tire-road friction. A multi-attention and feature fusion mechanism was designed, and the performances of various combinations were compared. The results showed that the fusion of ASA and MSCA achieved the best performance, with a regression R2 of 0.8470, which was a 20.25% improvement over the baseline model.

Bio: Dr. Zihang Weng is currently a post-doctoral fellow of Prof. Zhen Leng's Group in the Department of Civil and Environmental Engineering, the Hong Kong Polytechnic University, Hong Kong, China. He received his Ph.D. degree in transportation engineering (Supervised by Prof. Yuchuan Du) in July 2024, and a bachelor's degree in civil engineering in July 2018 from Tongji University, Shanghai, China. From Oct 2022 to Oct 2023, he served as an academic guest (Supervised by Prof. Bryan Adey) in the Institute of Construction & Infrastructure Management at ETH Zurich, Switzerland. He has authored a total of 17 academic journal articles, including 9 SCI publications in prestigious journals such as Automation in Construction, Computer-Aided Civil and Infrastructure Engineering, Construction and Building Materials, Case Studies in Construction Materials and International Journal of Pavement Engineering. His research interests lie in the field of computer-aided pavement condition assessment using emerging sensing technologies, with a focus on the evaluation of pavement surface characteristics using 3D laser scanning data.

Research progress on future sustainable road pavements: prefabricated bridge deck pavement & recycled pavement system

Gang Liu, Ph.D.
Post-doctoral fellow, University of Wisconsin-Madison

Abstract: Prefabrication and recycling are effective means to achieve sustainable development of transportation infrastructure. In this presentation, the author will share his research progress on future sustainable road pavement technologies. The first one is prefabricated bridge deck pavement (BDP) and the other one is recycled pavement system. The prefabricated BDP technology comprises the development of self-leveling paving materials, multi-objective optimization integrated design method for structure system, and precast assembly process, which could promote the industrialization level of future roads and bridges. The recycled pavement system adopts closed-loop and open-loop material circularity strategies according to the specifications of pavement systems in Hong Kong, which can maximize the reutilisation of locally available resources and sustainable materials to help decarbonize the road pavement of Hong Kong.



Bio: Dr. Gang Liu works as a Research Associate at University of Wisconsin-Madison in US. Previously, he served as a Postdoc Fellow at City University of Hong Kong. He received PhD degree in Transportation Engineering from Southeast University in 2023 and joined into National University of Singapore as a joint PhD student in 2022. Before that, He received master degree in Transportation Engineering from Southeast University in 2020 and bachelor degree in Road & Highway Engineering from Chang'an University in 2017. His research interests mainly include low-carbon and resilient road infrastructures materials, intelligent construction and maintenance of road infrastructures, smart pavement and autonomous driving technology. He has been the principal investigator or the major contributor to some research projects, such as Hong Kong Green Tech Fund Project, National Natural Science Foundation of China, National Key Research & Development Program of China and Postgraduate Research & Practice Innovation Program of Jiangsu Province. He has published more than 30 high-quality international journal papers, 15 international conference presentations, and 4 patents. He also won some prestigious academic awards, such as World Transportation Convention Excellent Paper Award, Excellent Reviewer Award from Journal of Traffic and Transportation Engineering (English Edition), National Scholarship for Doctoral Students, etc. He also serves as a young editor for 5 academic peer-reviewed journals, reviewer for more than 20 peer-reviewed journals and conferences, and member of ASCE, RILEM, IACIP, etc.

2025 IACIP ANNUAL Workshop BANQUET

Seats are limited and tickets are required for the banquet.
Tickets can be purchased at the IACIP Annual Meeting Site.

January 5, 2025
6:30 p.m. to 10:00 p.m.

Tony Cheng's Seafood Restaurant
中国城海鲜大酒楼

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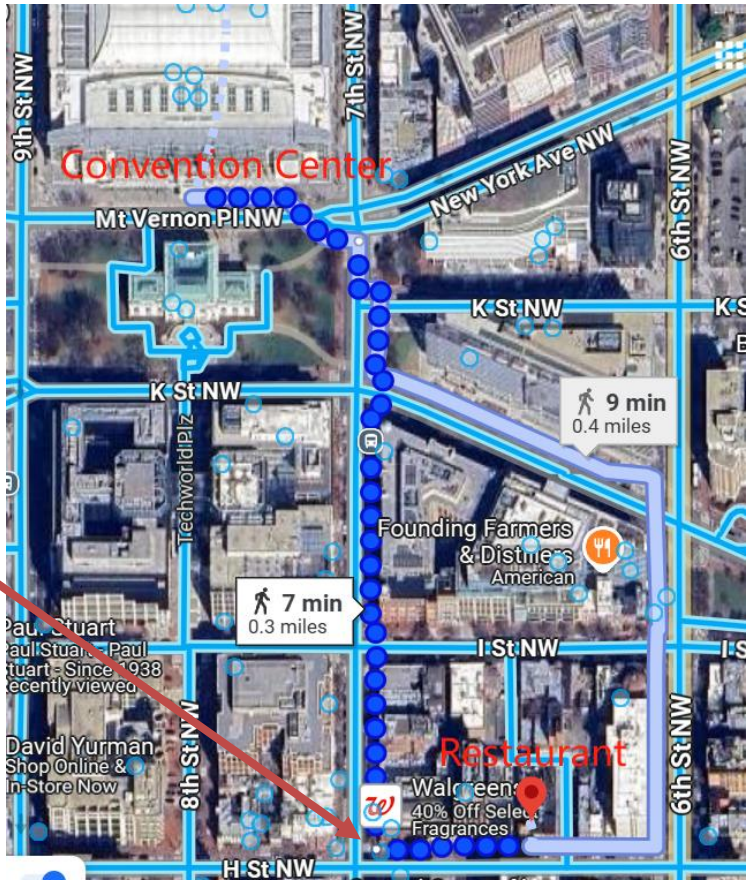

Directions:

The restaurant is conveniently located in the Washington DC China Town, about 8-10 minutes working distance from the Convention Center.

If take DC Metro:

1. Take the subway redline towards DC Downtown

乘坐前往**DC**市中心的地铁-红线

2. The fourth (4th) stop is Gallery Pl/Chinatown

坐四站下车，到达中国城站**Gallery Pl/Chinatown**

3. Take the 7th St./H St. Exit

从**7th St./H St.**出口出站

4. Cross the street to the right

出站后过街**(H St.)**右拐，步行一百米到达饭店