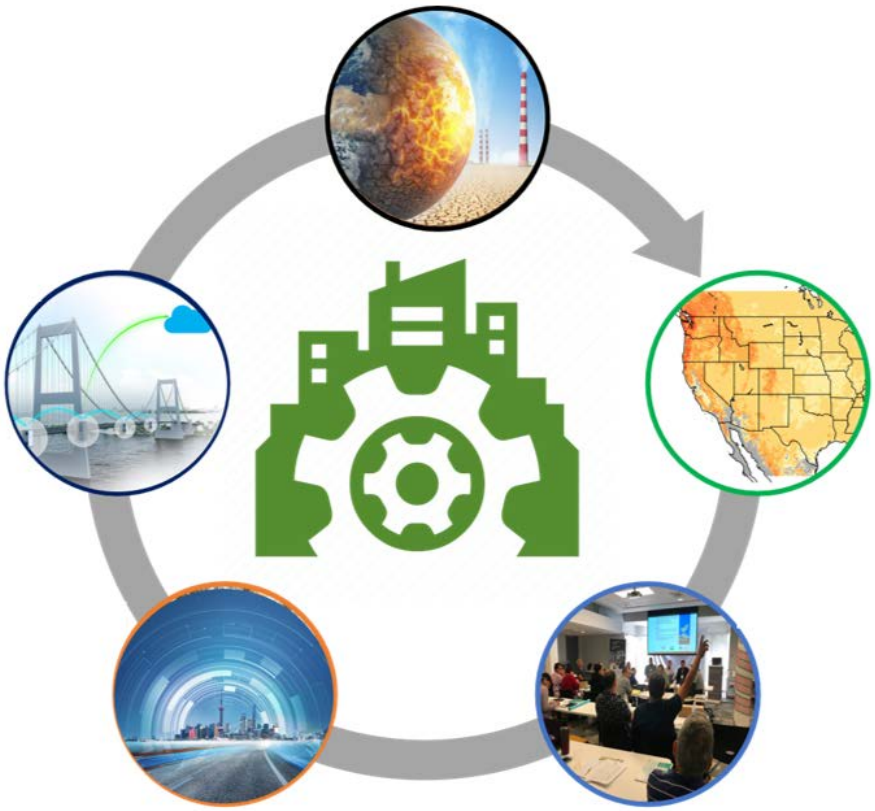
IACIP

International Association of Chinese Infrastructure Professionals

国际华人基础设施工作者协会

2023

The 13th IACIP Annual Meeting



Session I

US EST: 7 pm to 11 pm
Saturday, Jan 14, 2023

北京时间：早 8 点到中午，
2023 年 1 月 15 日周日

Session II

US EST: 8 am to 12 pm
Sunday, Jan 15, 2023

北京时间： 晚 9 点到 1 点，
2023 年 1 月 15 日周日

Adaptive Infrastructure under Climate Change

气候变化下的适应性基础设施

Zoom Webinar Link

https://wsu.zoom.us/j/98056352055?pwd=VlZzWG5EUHhoUHV4M1JURDBzVVRyZz09

(Passcode: 096309)

The 13th IACIP Annual Meeting Program

Adaptive Infrastructure under Climate Change

Session I

US EST Time	**US EST: 7 pm – 11 pm, Saturday, January 14th, 2023** **北京时间： 早 8 点到中午，2023 年 1 月 15 日周日**
Platform	Zoom Webinar Link to Login: https://wsu.zoom.us/j/98056352055?pwd=VlZzWG5EUHhoUHV4M1JURDBzVVRyZz09 Passcode: 096309
7:00 – 7:05 pm	**Conference Opening by Dr. Haifang Wen and Dr. Shenghua Wu, Co-Chairs** • Welcome
7:05 – 7:10 pm	**Remarks from IACIP Presidents** • Dr. Hao Wang, Current President of IACIP • Dr. Jenny Liu, New President of IACIP
7:10 – 7:50 pm	**IACIP Keynote Speech** (Moderators: Dr. Haifang Wen, Dr. Shenghua Wu) • **Dr. Pizhong Qiao**, Shanghai Jiaotong University, Fracture and Durability of Shotcrete-Concrete Interface Bonds
7:50 – 9:20 pm	**Presentation** (Moderators: Dr. Xiaojun Li and Dr. Yaning Qiao) • 7:50 to 8:20 pm: Dr. Jie Wang (East Transport Co. Ltd), The Total Solution and Application of Smart Construction Site • 8:20 to 8:50 pm: Dr. Yinghao Miao (University of Science and Technology Beijing), Impact of Climate Change On Asphalt Pavement and Its Adaptation Strategies • 8:50 to 9:20 pm: Dr. Kamal Hossain (Carleton University, Canada), Climate Change Impact and Adaptation for Highway Asphalt Pavements: A Canadian Study
9:20 – 9:30 pm	**Invited Poster Presentation** (Moderators: Drs. Jinnan Chen, Fangyuan Gong, Kai Yao, Meng Guo, Dongdong Ge, and Fang Liu)
9:30 – 11:00 pm	**Presentation** (Moderators: Dr. Lei Zhu and Dr. Jingan Wang) • 9:30 to 10 pm: Dr. Chengwei Xing (Chang'an University), Analysis of Base Bitumen Chemical Composition and Aging Behaviors via Atomic Force Microscopy-based Infrared Spectroscopy • 10 to 10:30 pm: Dr. Kai Yang (Hebei University of Technology), Effect of Laboratory Oxidative Aging on Dynamic Shear Rheometer Measures of Asphalt Binder Fatigue Cracking Resistance • 10:30 to 11 pm: Dr. Punyaslok Rath (University of Missouri-Columbia), Ground Tire Rubber and Waste Plastics Recycling in Asphalt Mixtures

The 13th IACIP Annual Meeting Program

Adaptive Infrastructure under Climate Change

Session II

US EST Time	**US EST: 8 am – noon, Sunday, January 15th, 2023** **北京时间： 晚 9 点到早 1 点，2023 年 1 月 15 日周日**
Platform	Zoom Webinar Link to Login: https://wsu.zoom.us/j/98056352055?pwd=VlZzWG5EUHhoUHV4M1JURDBzVVRyZz09 Passcode: 096309
8:00 – 8:05 am	**Conference Opening by Dr. Haifang Wen and Dr. Shenghua Wu, Co-Chairs** • Welcome
8:05 – 8:10 am	**Remarks from IACIP Presidents** • Dr. Hao Wang, Current President of IACIP • Dr. Jenny Liu, New President of IACIP
8:10 – 8:50 am	**IACIP Keynote Speech** (Moderators: Dr. Haifang Wen, Dr. Shenghua Wu) • **Dr. Randy West**, National Center for Asphalt Technology (NCAT), Auburn University, Strategies Toward Zero Emission Pavements
8:50 – 10:20 am	**Presentation** (Moderators: Dr. Yue Hou and Dr. Yue Huang) • 8:50 to 9:20 am: Dr. Chen Chen (Auburn University), Impact of Polymer Modification on IDEAL-CT and I-FIT for Balanced Mix Design • 9:20 am to 9:50 am: Mr. Yongping Hu (University of Nottingham, UK), Evaluating the Ageing Degrees of Asphalt Binders • 9:50 am to 10:20 am: Dr. Di Wang (Aalto University, Finland), Fabrication and Low Temperature Characterization of Multiphase Bituminous Materials
10:20 – 10:30 am	**Invited Poster Presentation** (Moderators: Drs. Jinnan Chen, Fangyuan Gong, Kai Yao, Meng Guo, Dongdong Ge, and Fang Liu)
10:30 – 12:00 pm	**Presentation** (Moderators: Dr. Jun Zhang and Dr. Hongyu Zhou) • 10:30 to 11 am: Dr. Yangming Gao (Delft University of Technology), Role of Surface Roughness in Surface Energy Calculation of Aggregate Minerals • 11:00 am to 11:30 am: Dr. Lei Wang (University of Cincinnati), Robust Design of Stabilizing Piles for Slopes in the Face of Uncertainty • 11:30 am to 12 pm: Dr. Jialai Wang (University of Alabama): Bio-molecule Mediated Carbonation (Biocarb) of Concrete And Calcium Rich Minerals
12:00 - 12:05	**IACIP Outstanding Student Award** (Moderator: Dr. Zhanping You)
12:05 - 12:10	**IACIP Poster Awards** (Moderator: Dr. Jinnan Chen, Fangyuan Gong)
12:10 - 12:15	**Adjoin** (Moderators: Dr. Haifang Wen, Dr. Shenghua Wu)

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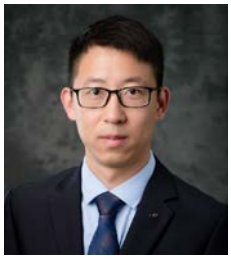

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IACIP KEYNOTE SPEECHES

Fracture and Durability of Shotcrete-Concrete Interface Bonds

Pizhong Qiao, "Zhiyuan" Chair Professor
Shanghai Jiao Tong University, Shanghai, China (Email: qiao@sjtu.edu.cn)

Abstract

Shotcrete is popular with vertical and overhead construction where conventional formworks and repairs are difficult to be implemented. However, this method could reduce the life expectancy of structures if the shotcrete-concrete interface bond is not adequately formed due to the lack of cleanliness and soundness in substrate surface. In addition, the long-term freeze-thaw weathering in northern states also weakens such bonds, leading to debonding and rebar corrosion.

A fracture mechanics approach is adopted to characterize short- and long-term performance of shotcrete-concrete interface bonds with different concrete substrate surface preparation techniques. A unique double-edge butterfly-shaped specimen primarily for mode-II fracture of quasi-brittle to quasi-brittle interface bond is proposed, designed, experimentally evaluated and analyzed. In addition, a parametric study is conducted using a combined concrete damage plasticity and cohesive zone model in ABAQUS to identify failure mechanisms at the bond interface. In summary, the best surface preparation method for shotcrete-concrete interface bonds is identified, a new mode-II fracture mechanics-based test method for the effective hybrid brittle material interface is developed, and the short- and long-term shotcrete-concrete interface bond properties are evaluated. Furthermore, a probabilistic damage model based on a Weibull distribution is presented to predict the service life of shotcrete-concrete interface bonds. The fracture properties acquired in this study can better guide engineering practices in shotcrete applications to concrete substrates, while the mode-II fracture test method of double-edge butterfly-shaped specimen developed can be effectively used to characterize and screen the quality of quasi-brittle to quasi-brittle material interface bonds.

Bio: Pizhong Qiao, currently "Zhiyuan" Chair Professor, Shanghai Jiao Tong University (SJTU). Before joining SJTU in 2021, He was Professor of Civil and Environmental Engineering, Washington State University (2006-2021). Dr. Qiao has been extensively working in development, research and application of advanced and high performance materials (smart materials, polymer composites, and sustainable concrete) in civil and aerospace engineering. His research interest includes Analytical and Applied Mechanics, Smart and Composite Materials, Interface Mechanics and Fracture, Impact Mechanics and High Energy Absorption Materials, Structural Health Monitoring, Integrated Intelligent Structural Systems, Materials Characterization, and Sustainable Concrete. He has published more than 250 peer-reviewed journal articles of international circulation. He is one of the top 150 Most Cited Researchers in the subject of Civil Engineering by Elsevier and Shanghai Ranking in 2016. He is also one of the Stanford University's Top 2% Scientists (both Career-long Impact and Single Recent Year Impact).

IACIP KEYNOTE SPEECHES

Strategies Toward Zero Emission Pavements

Dr. Randy West
National Center for Asphalt Technology (NCAT), Auburn University, USA

Abstract:
The Intergovernmental Panel on Climate Change calls for limiting human-induced global warming activities and requires reaching net zero GHG emissions as soon as possible. Accordingly, the US DOT has adopted a net zero goal for transportation which emphasizes the need to reduce the embodied carbon in the manufacture and construction of pavements. Four challenges to achieve zero emission asphalt pavements include: (1) drastically reducing emissions associated with asphalt pavement materials production, (2) making asphalt pavements a circular economy, (3) using data and practical environmental accounting to guide net zero efforts, and (4) informing stakeholders of the opportunities and engaging them to take actions necessary to achieve the net zero goal. Research at NCAT is exploring strategies for longer lasting asphalt pavements including implementing Balanced Mix Design as a means to design asphalt mixtures with high recycled materials contents and achieve much more durable asphalt pavements, supporting the advancement of cold recycled asphalt mixtures, utilization of perpetual pavement design to eliminate distresses in lower pavement layers, and promoting other practices to extend pavement life and reduce the life-cycle carbon footprint of pavements.

Bio:

Dr. Randy West is the Director at the National Center for Asphalt Technology (NCAT) and a Research Professor at Auburn University. He has worked in the asphalt pavement industry for 32 years, beginning his career as a bituminous research engineer with the Florida Department of Transportation from 1988 to 1995. He was the Director of Materials Services for APAC Inc. from 1995 to 2003. His expertise is asphalt pavement materials, construction, and quality assurance. He is a member of ASTM, the International Society for Asphalt Pavements, TRB Committee AKC-60, and the Association of Asphalt Paving Technologists, serving as its President in 2016. He is currently the Executive Director of the Consortium for Asphalt Pavement Research & Implementation. He received his Ph.D. from the University of Florida in 1995 and is a registered professional engineer in Alabama, Florida, and Georgia.

PRESENTATIONS

The Total Solution and Application of Smart Construction Site

Dr. Jie Wang
EASTTRANS, China

Abstract:
Smart construction technology has integrated smart technologies in all aspects of the construction period, making it possible to intelligently control the whole process of project construction. This report introduces the total solution of smart construction site based on digital twin technology, focusing on the requirements of the country with strong transportation network and digital transportation development planning outline. The report discussed how to achieve collaborative management, reduce hidden security risk, save costs and improve quality and efficiency for project, and shared the construction experiences and achievements of Jiangsu provincial smart construction site demonstration project, with a view to provide some reference for the innovation and promotion of smart construction technology.

Bio:

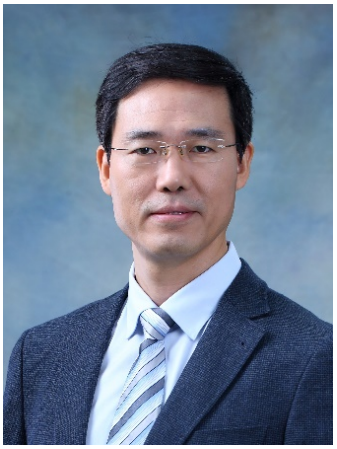
王捷，毕业于东南大学道路与铁道工程专业，博士学位，研究员级高级工程师，入选江苏省交通运输行业高层次领军人才（第一层次）、江苏省交通行业“100 人才工程”和江苏省“333 高层次人才培养工程”培养对象，现任交通运输部自动化作业技术行业研发中心主任、教育部道路基础设施数字化研究华东分中心主任，江苏东交智控科技集团股份有限公司董事长兼总经理。

长期从事工程建设数字化、智能施工技术、工程质量管控等智慧交通相关技术研发与产业化工作，在无人化施工、公路水运智慧工地建设方面成绩斐然。在国际会议和有关专业期刊公开发表论文 30 多篇，并担任 20 多项重点课题研究项目的负责人，研究成果多次荣获省部级科技进步奖项。

Impact of Climate Change On Asphalt Pavement and Its Adaptation Strategies

Dr. Yinghao Miao
National Center for Materials Service Safety, University of Science and Technology Beijing, China

Abstract: There is a lot of evidence showing that the climate is changing at an alarming rate. Asphalt pavement is one of the major types of road pavement, the performance of which is significantly influenced by climate conditions. Climate change has brought severe challenges to asphalt pavement. The increase of temperature in summer can lead to more extreme high temperature events, which could aggravate the rutting disease. The increase of temperature in winter can lead to more freeze-thaw cycles in seasonal frozen area, which could increase the risk of frost heaving of asphalt pavement. What is the current status of the impact of climate change on asphalt pavement? How will the global warming of 1.5 °C or 2.0 °C affect asphalt pavement in the future? These urgent questions will be addressed in this speech. And the adaptation strategies will also be discussed.



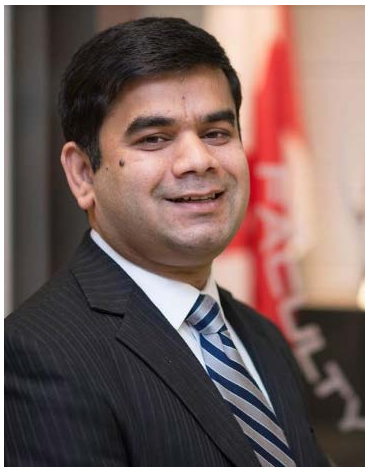
Bio: Dr. Miao is a Professor in the National Center for Materials Service Safety (NCMS), University of Science and Technology Beijing (USTB). He earned his B.S. degree in highway and urban road engineering from Chang'an University in 1997 and entered Hebei Highway & Waterway Engineering Consulting Co., Ltd. After working on the field for 3 years, he returned to Chang'an University to continue his studies and earned his Master's degree and Ph.D. degree in road and railway engineering in 2003 and 2006 respectively. After received his doctoral degree, he joined the faculty of Beijing University of Technology in 2006. Funded by the China Scholarship Council, he visited Virginia Tech from March 2013 to March 2014. In April 2018, he joined the faculty of NCMS, USTB. He is currently a member of the Technical Committee on Climate Change and Resilience of Road Network (TC 1.4) of the World Road Association (PIARC), and an editorial board member of the Journal of Infrastructure Preservation and Resilience. As PI, Co-PI, and major contributor, he has finished a number of national major projects. As organizing committee chair, he organized 3 international seminars. His current research interests include pavement service environment and performance, resilient roads and climate change adaptation, smart roads.

Climate Change Impact and Adaptation for Highway Asphalt Pavements: A Canadian Study

Dr. Kamal Hossain
Carleton University, Canada

Abstract:
This study aims to quantify the impact of climate change on pavement performance, including revising pavement design and materials for Canadian asphalt pavements. To achieve this, the temperature and precipitation data were extracted from ten statistically downscaled climate change models, which were gathered from the pacific Canada Climate database. Also, the pavement materials, traffic, and structural data were collected from the Long-term Pavement Performance (LTPP) database. All these data were used in the Pavement Mechanistic-Empirical (ME) software to determine the pavement performance for both baseline and future climate. Various adaptation strategies such as upgrading asphalt binder grade, increasing the thickness of asphalt concrete layer, increasing the base layer thickness, and using stabilized base layers were analyzed to mitigate the climate change impact and to extend the service life of the pavement. All of these adaptation strategies are based on climate change data and its effect on pavement performance. It is also evident that selecting a climate-appropriate asphalt binder is essential in ensuring the longevity of pavement surfaces. A new pavement temperature model was also developed for Canadian climatic conditions to determine the appropriate asphalt binder grade for future climate that addresses the issues in LTPP and SHRP pavement temperature models. In addition, Life Cycle Assessment (LCA) and Life Cycle Cost Analysis (LCCA) were also carried out for all the alternatives to determine the CO2 contributions to Canadian environment and changes in life cycle cost of Canadian pavement surfaces.

Bio:

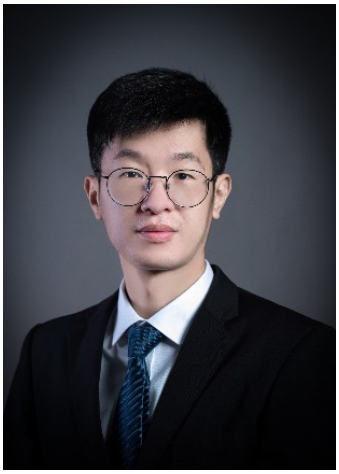


Dr. Kamal Hossain is an Associate Professor in Civil Engineering at Carleton University. His current research includes Pavement Performance and Sustainability, Climate Change Impact Assessment on Transportation Infrastructure, Pavement Design for Autonomous and Connected Vehicles, Civil Infrastructure Management, Highway Maintenance and Preservation, Transportation Infrastructure Resiliency, Cold Region Pavement Engineering and Highway Deicing and Anti-icing. Previously, Dr. Hossain was a postdoctoral researcher in pavement and transportation engineering research groups at University of Illinois at Urbana-Champaign (UIUC) in USA and University of Waterloo. Dr. Hossain holds a PhD in Transportation Engineering from University of Waterloo. He has supervised over 15 Master's/PhD thesis projects in transportation infrastructure engineering and management areas and authored over 100 technical publications.

Analysis of Base Bitumen Chemical Composition and Aging Behaviors via Atomic Force Microscopy-based Infrared Spectroscopy

Dr. Chengwei Xing
Chang'an University, China

Abstract: Conventional atomic force microscopy (AFM) can only capture the surface microstructure and nanomechanical properties of bitumen. As such, AFM cannot directly analyze chemical composition and changes of the surface at the nanoscale. However, state-of-the-art characterization technology has combined AFM with infrared spectroscopy (AFM-IR) to facilitate the analysis of chemical composition on the surface of bitumen at the nanoscale. The present work adopts AFM-IR to collect topography maps, phase maps, functional group distribution maps, and infrared spectra of base bitumen samples before and after aging. Analysis of the topography maps indicates that the bee structures on the surface undergo no apparent change with aging. For surface functional group distributions, the sulfoxide and carbonyl concentrations of each phase on the bitumen surface vary with aging. The present work also proposes a quantitative AFM-IR analysis method based on Fourier transform infrared (FT-IR) spectroscopy. The resultant sulfoxide and carbonyl indices measured by AFM-IR and FT-IR spectroscopy exhibit an excellent linear correlation, but the concentrations of carbonyl groups on the surface are greater than that in the bulk material. Finally, the IR spectra and functional group indices of each nanoscale phase on the bitumen surface before and after aging are compared with those obtained for the four fractions of bulk bitumen to investigate the proportions of the four fractions included in each nanoscale phase. The results strongly suggest that the chemical fractions of each phase on the bitumen surface are quite similar and have a higher polarity than that of the bulk material.



Bio: Dr. Chengwei Xing now works in the school of highway of Chang'an University. He received his doctoral degrees from Tongji University. Dr. Xing's research areas include bitumen aging and reclamation of recycled bitumen pavement. He is selected into the Young Talent Program of Association for Science and Technology in Shaanxi of China, and serves as the principal investigator for the project of National Natural Science Foundation of China. He has published nearly 20 peer-reviewed journal or conference articles, and served as the reviewer for some international journals and conferences. He has received several awards including the 3rd National Excellent Doctoral Dissertation Award on Transportation Engineering, Excellent Doctoral Dissertation Award of Tongji University in 2020, the First Prize of the 3rd Jiangxi Highway Science and Technology Progress, etc.

Effect of Laboratory Oxidative Aging on Dynamic Shear Rheometer Measures of Asphalt Binder Fatigue Cracking Resistance

Dr. Kai Yang
Hebei University of Technology, China

Abstract: Long-term aging can significantly affect the fatigue property of asphalt pavements. The influence of aging on fatigue resistance of asphalt binder has not been fully understood and unified conclusions are lacking. In this work, the effect of laboratory oxidative aging on fatigue damage resistance and linear viscoelastic (LVE) parameters of asphalt binder is studied. Tests included the temperature-frequency sweep, linear amplitude sweep (LAS) testing and time sweep from the output of dynamic shear rheometer (DSR). Different undamaged parameters (e.g., Glover-Rowe parameter (GRP), dynamic shear modulus |G*| at 64°C, |G*|·sinδ (δ is the phase angle)) have been proposed as the indicators of aging sensitivity of the asphalt binder and are discussed. The fatigue test results are interpreted under different aging levels by using Simplified viscoelastic continuum damage (S-VECD) analysis. The trends of LVE parameters with increasing aging levels are very intuitive and show a tendency to increase in value with aging. The number of cycles to failure (Nf) shows a less intuitive trend than the LVE parameters. The existing failure criteria GR works well for the Nf prediction for highly aged materials. From the results of measured and predicted Nf from time sweep and LAS tests, fatigue damage resistance appears to increase with long-term aging at low strain levels (less than 7% strain levels in this work). When the aging level continues increasing, the fatigue resistance eventually declined in most cases evaluated. The objective of this study is to evaluate the fatigue resistance of asphalt binder under different aging levels by using various parameters and failure criteria.

Bio: Kai Yang, got a doctorate degree from Chang'an University in 2022. He was a visiting scholar in North Carolina State University in United States from 2019 to 2021. Now he is a lecturer in the School of Civil Engineering and Transportation of Hebei University of Technology. He is interested in multi-scale characterization of fatigue resistance and interlayer mechanical properties of asphalt materials. His research is focused on utilizing multi-scale fatigue characterization to develop a fundamental understanding of asphalt binders and their interaction with asphalt mixtures. Additionally, he investigates the use of innovative damage model and asphalt modification technology for improving pavement sustainability.

Ground Tire Rubber and Waste Plastics Recycling in Asphalt Mixtures

Dr. Punyaslok Rath
University of Missouri, Columbia, USA

Abstract:
Recently, there has been a significant push towards adopting circular materials to make the pavement infrastructure more sustainable and resilient. This has resulted in an increase in the use of sustainable materials such as recycled ground tire rubber (GTR) and post-consumer recycled plastics (PCR-P) in asphalt mixtures. This presentation will cover various aspects of the use of GTR and PCR-P in asphalt mixtures. Since rubber modified asphalt (RMA) mixtures have been used in the US for decades, a summarized current state of knowledge will be presented including the recent developments in dry process rubber modifier technologies which has been key in opening up the markets for RMA adoption. On the other hand, PCR-P modification of asphalt mixtures is a relatively recent occurrence in the US and currently, a number of demonstration projects are underway to showcase its field performance. Experience from one such recent demonstration project will be presented including mixture design, production and early field performance data.

Bio:
Dr. Punyaslok Rath works as a Research Scientist in the Department of Civil and Environmental Engineering at the University of Missouri, Columbia. He got his PhD from Mizzou and Masters from University of Illinois, Urbana-Champaign. His research focus is on asphalt materials and their characterization. Dr. Rath has worked in collaboration with many industry entities to promote sustainability through use of recycled materials in asphalt mixtures.

Impact of Polymer Modification on IDEAL-CT and I-FIT for Balanced Mix Design

Dr. Chen Chen
Auburn University, USA

Abstract: Existing studies with the IDEAL-CT and I-FIT testing have shown that PMA mixtures do not always show better cracking resistance than unmodified mixtures, which contradicts their existing field performance. Two hypotheses were proposed to explain this unexpected trend; one was related to the lack of binder content optimization for Superpave mixtures and the other was due to limitations associated with the test procedures. The objective of this study is to evaluate the impact of polymer modification on the IDEAL-CT and I-FIT results through testing the two proposed hypotheses. Two Superpave mixture designs were tested with IDEAL-CT and I-FIT at three binder contents and six virgin binders, which included two unmodified binders and four PMA binders with SBS or RET modification. Both tests were conducted at 25°C and an equivalent modulus temperature (T=G*) determined based on the Torsion Bar Modulus test. Preliminary results showed that for both mixture designs, the PMA mixtures didn't have significantly better cracking resistance than the unmodified mixtures at different binder contents and test temperatures. This demonstrates that the lack of discrimination in the IDEAL-CT and I-FIT results between PMA and unmodified mixtures could not be addressed by solely adjusting the binder content or the test temperature.

Bio:

Dr. Chen Chen is a research engineer at NCAT. He earned his Ph.D. degree from Auburn University in 2020, focusing on the loose mixture aging and validation of cracking tests for Balanced Mix Design. After graduation, he works at Colas Solutions as a research engineer, and provides technical support, product development, and applied research for Colas companies, especially on pavements, pavement material and preservation. By now, Dr. Chen has served as Co-PI or key research engineer on 20 research projects regarding BMD, OGFC, SMA, polymer, additives, and various recycled materials. Dr. Chen has published over 20 journal papers and technical reports on materials and asphalt pavements and has made over 10 presentations at national and international conferences. He is a reviewer for a variety of academic journals.

Evaluating the Ageing Degrees of Asphalt Binders

Yongping Hu, Haopeng Wang, Lu Zhou and Airey Gordon
Nottingham Transportation Engineering Centre (NTEC), Department of Civil Engineering, University of Nottingham, Nottingham, UK

Abstract: Climate change is a growing concern of the public. A variety of human activities contribute to the climate change, including the construction and maintenance of infrastructure. Asphalt pavement is a crucial part of infrastructure. Owing to ageing, over 750 million tons of pavement arisings will be generated per year worldwide. If the aged materials, especially the asphalt binders, which occupies more than 70% of the costs of the materials could be reused, considerable economic and environmental benefits could be harvested. For reusing the waste materials, it is necessary to understand the ageing mechanism and behaviour of asphalt binders. Motivated by the current gap between the ageing and rejuvenation, this research investigated the evolution of the performance of asphalt binders in terms of its low-, intermediate and high-temperature properties. Firstly, six types of asphalt binders with different penetration grades and chemical components were aged by RTFOT, then subjected to PAV for 15 hours, 20 hours, 30 hours, and 40 hours. Finally, all binders with different ageing levels were tested by BBR and DSR with MSCR, LAS (as per TP101 and T391), Binder yield energy (BYE), frequency sweep modes. The low/fatigue and high -temperature ageing indices were proposed thereby to characterise the ageing levels of asphalt binders quantitatively and accurately. It was found that the delta Tc, nonrecoverable compliance and G-R parameter could be employed to evaluate the ageing degrees of asphalt binders, however, two versions of LAS standards have their own limitations in characterising the fatigue performance of binders in terms of ageing.

Bio: Mr. Yongping Hu currently is a full-time Ph.D. student at the Nottingham Transportation Engineering Centre (NTEC) of University of Nottingham. Mr. Hu graduated from Highway School of Chang'an University in China, where he obtained his BSc and MSc degrees in 2018 and 2021, respectively. After that, he went to the UK and started his Ph.D. study under the supervision of Prof. Gordon Airey. His research interests include the ageing and rejuvenation of bitumen, the adhesion and cohesion failure mechanism between bitumen and minerals, the advanced functional materials used in pavement, the modelling of bitumen and asphalt mixture et al. Within the past 3 years, Mr. Hu has published 9 SCI indexed papers in Fuel, International Journal of Pavement Engineering, Construction and Building Materials et al. as first author and/or corresponding author or co-author. As project leader and the main participant, he was engaged in several grants and research projects, also has won several awards in the competitions such as Traffic Technology Competition, Pitch Perfect et al.

Fabrication and Low Temperature Characterization of Multiphase Bituminous Materials

Dr. Di Wang
Aalto University, Finland

Abstract:
In this study, the low temperature strength properties were experimentally characterized for multiphase bituminous materials: binder, mastic, Fine Aggregate Matrix (FAM), and mixture. First, the mix design of mastic and FAM were calculated based on the reference mixture AC 22 TS. The mathematic adaptation to the boundary sieve (DFAIB) method was applied to calculate the gradation and binder content of FAM. Next, a fabricated method was proposed to replicate the Fine Aggregate Matrix (FAM) in a laboratory environment. Finally, three-point bending (3PB) test on the multiphase bituminous specimens with different dimensions at -6 °C, -12 °C, and -18 °C with a modified Bending Beam Rheometer (BBR) device and dynamic loading machine, respectively. Results indicate that the creep stiffness in FAM was close to mixtures and much higher than the one observed in binder and mastic. The fabricating method proposed could simulate the FAM phase that exists in the mixture, and the air voids can be easily adjusted during the slab compaction procedure.

Bio:
Dr. Wang is a Postdoc researcher at the Department of Civil Engineering at Aalto University, Finland. Before he joined Aalto University, he worked as a Post-doc researcher at the Technical University of Braunschweig, Germany, and he obtained the doctoral degree in civil engineering at the same university. In 2022, he gained the national scientific qualification to function as Associate Professor in Italian Universities. He has more than eight years of experience in the areas of asphalt pavement, particularly to the characterization and modeling of asphalt binders at low temperatures as well as the incorporation of circular and sustainable materials in asphalt roadways. He participated in several European, Nordic, German, Finland, and RILEM projects in the past six years. He also has rich experience in teaching and supervising. He is currently serving in several sector associations, such as the CEN Task Group, RILEM, NRS, COTA and IACIP. As a results, he published more than 60 contributions in scientific journals, conference proceedings, and technical reports with multi collaborators in the area of infrastructure and waste management. He is very active in professional activities, including conference organization member, scientific committee, and session chair in more than 10 international conferences world widely in the areas of pavement and waste management. Currently, he is serving as editorial board members and scientific reviewers in more than 50 scientific journals, such as *Road Materials and Pavement Design, Construction and Building Materials, Journal of Infrastructure Preservation and Resilience, Journal of Materials in Civil*

Engineering, and *Materials and Structures*, among others.

Role of Surface Roughness in Surface Energy Calculation of Aggregate Minerals

Dr. Yangming Gao
Delft University of Technology, Netherlands

Abstract: Surface energy is a key material property and can work as a crucial parameter in various mechanical models to predict the moisture sensitivity and fatigue damage of asphalt mixtures. The calculated surface energy values of the aggregate minerals strongly depend on their surface roughness. This study aims to investigate the relationship between surface roughness and surface energy of aggregate minerals. Two minerals, quartz and calcite, were used for this study. The surfaces of the mineral specimens were treated to achieve four levels of roughness. Their surface roughness was described by three roughness parameters. Based on the sessile drop (SD) method, an optical tensiometer with a 3D topography module was employed to measure the contact angle and the surface energy of the minerals with different roughness. The influences of surface roughness on the contact angle and the surface energy were then analyzed. The results showed that the contact angle for both quartz and calcite decreases with the increasing surface roughness when it's less than 90° and increases when it's greater than 90°. Wenzel equation can remove the effect of surface roughness on the contact angles of the minerals. The surface energy of quartz and calcite in the presence of roughness at the microscale would be underestimated when using the measured (apparent) contact angle. The corrected surface energy based on the Wenzel equation must be applied to represent the real surface energy of the minerals.

Bio: Dr. Yangming Gao is currently a Marie Sklodowska-Curie Individual Fellow in the Section of Pavement Engineering of the Delft University of Technology, The Netherlands. He received his PhD degree in Civil Engineering from Aston University in the UK in March 2020. His research interests include Mechanics of Asphalt Materials, Multiscale Computational Modelling, Bio-Based Materials and Sustainability, and Sensing and Healing of Road Materials. Dr. Gao has an internationally recognised track record of publications in the field of pavement engineering. He now serves as a Young Academic Editor for Journal of Traffic and Transportation Engineering (English Edition) and a Guest Editor of MDPI Journal of Materials. He also serves on the technical committee (278-CHA, Crack-Healing of Asphalt Pavement Materials) of the RILEM and is an active member on Transportation Research Board (TRB), Academy of Pavement Science and Engineering (APSE), and International Society for Asphalt Pavements (ISAP). Dr. Gao is a recipient of 2020 Marie Sklodowska-Curie Actions (MSCA) Individual Fellowships, 2020 Chinese Government Award for Outstanding Self-Financed Students Abroad and 2019 ARMOURERS & BRASIERS' Prize.

Robust Design of Stabilizing Piles for Slopes in the Face of Uncertainty

Lei Wang, Ph.D., P.E.
University of Cincinnati, USA

Abstract:
Stabilizing piles are widely used in slope engineering practice to mitigate the risk of landslide and slope failure. However, the design of such slope stabilizing systems is a challenging soil–structure interaction problem. Specifically, the installation of stabilizing piles can alter the behavior of the slope; and the deterministic uncoupled stability analysis of reinforced slope dominates the design of stabilizing piles in the current practice. This paper presents a robust design approach for optimizing slope-stabilizing piles in the face of various uncertainties. This framework explicitly considers the coupling between the stabilizing piles and the slope and the robustness of the stability of the reinforced slope against the spatial variability of the geotechnical parameters. The proposed design framework is implemented as a multi-objective optimization problem considering the design robustness as an objective, in addition to safety and cost efficiency, two objectives considered in the conventional design approaches. The design of stabilizing piles in an earth slope is studied as an example to illustrate the effectiveness of this new design framework. A comparison study is also undertaken to demonstrate the superiority of this new framework over the conventional design approaches.

Bio:
Dr. Lei Wang is an Assistant Professor of Civil Engineering at the University of Cincinnati. Prior to his current position, he served as an Assistant/Associate Professor at the University of the District of Columbia. He received his Ph.D. in civil engineering from Clemson University and is a licensed Professional Engineer in California. He has an extensive research experience in geotechnical engineering, including geotechnical risk and reliability, risk and resilience assessment of civil infrastructure, underground excavation and tunneling, soil/rock-structure interaction, numerical and centrifuge modeling, earth slopes and levees, foundation engineering, and geotechnical earthquake engineering. He has published over 70 refereed journal and conference papers. His research has been supported by NSF, NASA, USDA, USGS, and NIST. He serves on the Editorial Board of Engineering Geology, Bulletin of Engineering Geology and the Environment, and Marine Georesources & Geotechnology. He was a recipient of many honors and awards, including the Best Paper Award by Taiwan Geotechnical Society.

Bio-molecule Mediated Carbonation (Biocarb) of Concrete and Calcium Rich Minerals

Dr. Jialai Wang
University of Alabama, USA

Abstract:
Concrete can serve as a CO_2 sink through mineralization processes, in which CO_2 react with calcium-rich minerals in concrete to produce $CaCO_3$ and permanently store CO_2. However, key challenges including diffusion barriers and marginal strength improvement impede existing technologies to reach full potential of concrete for CO_2 sequestration. To fully unlock this potential, we propose a biomolecule regulated carbonation process (Biocarb) to maximize CO_2 uptake while in-situ produce nanoscale performance enhancers before concrete hardens. This is achieved by using a biomolecule as small-dose additive, which regulates the carbonation process of calcium-rich minerals through: i) chelating with calcium to facilitate the carbonation of the minerals, ii) controlling the crystal nucleation, orientation, size, and polymorph of calcium carbonate, and iii) enabling uniform dispersion-of the produced $CaCO_3$ nano- and micro-particles. As a result, much more CO_2 can be absorbed by concrete directly without compromising performance. More importantly, the metastable $CaCO_3$ produced through BioCarb can react with the cement to form new minerals or dissolve and re-precipitate to function as a binding phase in concrete. As a result, a novel calcium silicate hydrate- $CaCO_3$ hybrid binder can form in the concrete, leading to improved mechanical strength, volumetric stability, and durability.

Bio:

Dr. Jialai Wang, P.E., is a professor of Department of Civil, Construction, and Environmental Engineering (CEEE) at the University of Alabama. Dr. Wang has vast experience in infrastructure materials with a focus on low carbon cementitious materials and CO_2 sequestration with construction materials, and a strong record of producing research results which have not only advanced the state of knowledge, but also been transferred effectively to practice. His research focuses on reducing both operational and embodied carbon of buildings and construction materials. He has been granted five US patents, one of which has been successfully licensed to CarbonCure Technologies for field applications in many ready-mix and precast concrete plants. He has served as PI for many research projects sponsored by National Science Foundation (NSF), Department of Energy, NASA, and Alabama DOT.

LIST OF STUDENT POSTERS

All posters and videos are posted on IACIP Website: https://www.iacip.net/poster-session

Group A: Asphalt Materials and Innovation

A-1 Title: Fatigue performance analysis and life prediction of wood tar-based rejuvenated asphalt
Presenter: Wang Luyue
Email: 20211200526@csuft.edu.cn
University: Central South University of Forestry & Technology
Advisor: Liu Kefei

A-2 Title: Study on the Freeze-thaw Cycle Durability of Bamboo Fiber Asphalt Mixture
Presenter: Wang Luyue
Email: 20211200526@csuft.edu.cn
University: Central South University of Forestry & Technology
Advisor: Liu Kefei

A-3 Title: Recovery effect of adhesion-targeted regenerator on aged high-viscosity asphalt and its regeneration mechanism
Presenter: Wenxuan Zhang
Email: zhangwenxuan@njfu.edu.cn
University: Nanjing Forestry University
Advisor: Qiang Li

A-4 Title: 3D printed rubber modified asphalt in pavement maintenance
Presenter: Xuejiao Cheng
Email: 202031604003@stu.hebut.edu.cn
University: Hebei University of Technology
Advisor: Fangyuan Gong

A-5 Title: Evaluating the ageing degrees of Asphalt Binders
Presenter: Yongping Hu
Email: Yongping.hu@nottingham.ac.uk
University: University of Nottingham
Advisor: Gordon Airey and Haopeng Wang

A-6 Title: Laboratory Performance Comparison of Conventional, Rubber Modified, Tire Fiber and Rubber Modified Asphalt Mixtures
Presenter: Dongzhao Jin
Email: zyou@mtu.edu
University: Michigan Technological University
Advisor: Zhanping You

A-7 Title: Analysis of rheological behavior and anti-aging properties of SBS modified asphalt incorporating naphthenic oil (NPO) and UV absorbent
Presenter: Chongxin Zhu
Email: zhuchongxin@chd.edu.cn
University: Chan'an University
Advisor: Feng Ma

A-8 Title: Evaluation of Thermal and Rheological Properties of Phase Change Material-incorporated Asphalt Mastic with Porous Fillers

Presenter: Farshad Saberi K
Email: farshad@mst.edu
University: Missouri University of Science and Technology
Advisor: Yizhuang David Wang, Jenny Liu, and Hongyan Ma

A-9 Title: Study on preparation and performance of ultra-thin overlay asphalt mixture with dual phase change materials
Presenter: Rui Zhang
Email: ZR@emails.bjut.edu.cn
University: Beijing University of Technology
Advisor: Meng Guo

A-10 Title: Rheological evaluation and temperature regulation capacity of asphalt binders containing tetradecane / octanoic acid microcapsules
Presenter: Yingjie Hou
Email: yingjiehou@chd.edu.cn
University: Chang'an university
Advisor: Feng Ma

A-11 Title: Rutting Deformation Monitoring of Asphalt Mixture Based on Distributed Optical Fiber Shape Sensing Technology
Presenter: Jiwen Zhang
Email: zhangjiwenhit@163.com
University: Harbin institute of Technology
Advisor: Zejiao Dong and Xianyong Ma

A-12 Title: Research on Rheology and Road Performance of Color Durable Clear Asphalt
Presenter: Xinye Jiang
Email: jiangxinye@chd.edu.cn
University: Chan'an University
Advisor: Feng Ma

Group B: Aggregate, Concrete and Advanced Materials

B-1 Title: Active ecological protection technology of slope by mesh-bolt-spraying vegetation concrete
Presenter: Shun Wan
Email: 2022010084@stu.cdut.edu.cn
University: Chengdu University of Technology
Advisor: Hua Xu

B-2 Title: Stone Beams Strengthened with Prefabricated Prestressed CFRP-reinforced Plates
Presenter: Song Han
Email: 410800384@qq.com
University: Huaqiao University
Advisor: Ye Yong

B-3 Title: Evaluation of interfacial property of biocarbon and guaifenesin treated RAP in hot mixed asphalt
Presenter: Xiaotong Du
Email: mailhukui@haut.edu.cn
University: Henan University of Technology
Advisor: Kui Hu

B-4 Title: Study of bonding characteristics of recycled concrete aggregate-asphalt interface with molecular dynamics study
Presenter: Jiawang Zhou
Email: mailhukui@haut.edu.cn
University: Henan University of Technology
Advisor: Kui Hu

B-5 Title: Meta-Analysis on PET Plastic as Concrete Aggregate using Response Surface Methodology and Regression Analysis
Presenter: Beng Wei Chong
Email: hdn31@txstate.edu
University: Texas State University
Advisor: Xijun Shi

B-6 Title: Photocatalyst for Microorganism Inhibition
Presenter: Samuel Ojo
Email: sto25@case.edu
University: Case Western Reserve University
Advisor: Xiong (Bill) Yu

B-7 Title: Effect of Granite Powder and Marble Powder on Multiscale Properties of Cementitious Materials: A Critical Review
Presenter: Qiao Zhang
Email: zhangqiao@stu.hqu.edu.cn
University: Huaqiao University
Advisor: Zhibin Zhuang

B-8 Title: Performance evaluation of asphalt mixtures incorporating with salt-storage aggregates
Presenter: Yujie Wang
Email: wangyujie@chd.edu.cn
University: Chang'an University
Advisor: Xili Yan

B-9 Title: Thermal Performance Analysis of Hollow Cellular Concrete Block Air Convection Embankment for Cold Regions
Presenter: Hanli Wu
Email: hwvfn@mst.edu
University: Missouri University of Science and Technology
Advisor: Jenny Liu and Xiong Zhang

B-10 Title: Modeling of Asphalt Concrete's Tension-Compression Asymmetry Effects on Pavement Response
Presenter: Zhifei Tan
Email: zhi-fei.tan@connect.polyu.hk
University: The Hong Kong Polytechnic University
Advisor: Zhen Leng and Denis Jelagin

Group C: Pavement Design, Construction and Performance

C-1 Title: The Characteristics of Expressway Reconstruction and Extension Engineering in China
Presenter: Wenhao Dong
Email: 245451068@qq.com

University: Chang'an University
Advisor: Feng Ma

C-2 Title: Wireless Power Transfer Tuning Model of Electric Vehicles with Pavement Materials as Transmission Media for Energy Conservation
Presenter: Yanjie Li
Email: yanjieli@buaa.edu.cn
University: Beihang University
Advisor: Feng Li

C-3 Title: Implementing the LWD for MoDOT Construction Acceptance of Unbound Material Layers
Presenter: Chuanjun Liu
Email: cl8b7@mst.edu
University: Missouri University of Science and Technology
Advisor: Jenny Liu

C-4 Title: Performance zoning method of asphalt pavement in cold regions based on climate indexes: a case study of Inner Mongolia, China
Presenter: Kaiwen Zhao
Email: 21b932006@stu.hit.edu.cn
University: Harbin Institute of Technology
Advisor: Zejiao Dong

C-5 Title: Wide Base Tire (WBT) load's impact on fatigue cracking of flexible pavement - Based on the Michigan Mechanistic-Empirical (ME) design method
Presenter: Lei Yin
Email: leiyin@mtu.edu
University: Michigan Technological University
Advisor: Zhanping You and Jacob E. Hiller

C-6 Title: Analysis of skid resistance and braking distance of aircraft tire landing on grooved runway pavement
Presenter: Junyu Qian
Email: jq102@scarletmail.rutgers.edu
University: Rutgers, The State University of New Jersey
Advisor: Hao Wang

C-7 Title: Improvement of pile type based on the bearing characteristics of cement mixing piles in highway composite foundation treatment
Presenter: Yuhe Zhang
Email: 202235471@mail.sdu.edu.cn
University: Shandong University
Advisor: Kai Yao

C-8 Title: Multi-scale evolution of road surface texture under traffic and climate conditions on RIOH track
Presenter: Xiao Shen-qing
Email: 19904638828@163.com
University: Harbin institute of Technology
Advisor: Tan Yi-qiu

C-9 Title: Investigation of the Road Performance and Enhancement Mechanism of Biomass Fiber-Modified Asphalt Mixture
Presenter: Yukang Xiong
Email: xiongyuakang@njfu.edu.cn
University: Nanjing Forestry University
Advisor: Qiang Li

C-10 Title: Coupled Field Ageing-Viscoelastic Mechanical Responses of Asphalt Pavements
Presenter: Hanyu Zhang
Email: hanyu.zhang@nottingham.ac.uk
University: University of Nottingham
Advisor: Gordon Airey and Yuqing Zhang

C-11 Title: Monitoring the Compaction Condition of Asphalt Pavement Based on Particle Kinematic Behaviors
Presenter: Shuai Yu
Email: sqy5325@psu.edu
University: Pennsylvania State University
Advisor: Shihui Shen

C-12 Title: Carboxylated styrene-butadiene latex (XSB) in asphalt modification towards cleaner production and enhanced performance of pavement in cold regions
Presenter: Jiaqiu Xu
Email: jiaqiu.xu@connect.polyu.hk
University: The Hong Kong Polytechnic University
Advisor: Dawei Wang and Zhen Leng

Group D: Advanced Testing and Evaluation Techniques

D-1 Title: Climate Adaptive Management of Solid Waste Disposal Facilities using Drone-based Sensing Technology for Decision Making
Presenter: Syed Zohaib Hassan
Email: zohaib@knights.ucf.edu
University: University of Central Florida
Advisor: Peng Sun and Jiannan Chen

D-2 Title: Performance Assessment of Post-Flood Pavement with FWD Testing for Decision Making of Roadway Operation
Presenter: Xiao Chen
Email: xc299@scarletmail.rutgers.edu
University: Rutgers, the State University of New Jersey
Advisor: Hao Wang

D-3 Title: Sand-containing Fog Sealing Layer Road Performance and Temperature Change Performance Study
Presenter: Bo Weng
Email: wengbo@njfu.edu.cn
University: Nanjing Forestry University
Advisor: Qiang Li

D-4 Title: Investigation of the solution effects on asphalt binder and mastic through molecular dynamics simulations

Presenter: Chen Li
Email: 2018121140@chd.edu.cn
University: Chan'an University
Advisor: Feng Ma

D-5 Title: Evolution of tire-pavement friction with the regular surface macro-texture characteristics and environmental factors using three-dimensional (3D) printing technology
Presenter: Fucheng Guo
Email: fcguo@chd.edu.cn
University: The Hong Kong Polytechnic University
Advisor: Jianzhong Pei and Augusto Cannone Falchetto

D-6 Title: Pore Structure & Mechanical Properties of FRCC in the Freeze–thaw Environment: A Review
Presenter: Weizhe Wu
Email: 21014086094@stu.hqu.edu.cn
University: Huaqiao University
Advisor: Yixin Zhang

D-7 Title: Evaluation on contribution rate of various natural environmental factors on bitumen aging in cold-arid region
Presenter: Meichen Liang
Email: Lmc@emails.bjut.edu.cn
University: Beijing University of Technology
Advisor: Meng Guo

D-8 Title: Optimization of site investigation program for reliability assessment of undrained slope using Spearman rank correlation coefficient
Presenter: Liang Zhang
Email: wang4li@ucmail.uc.edu
University: University of Cincinnati
Advisor: Lei Wang

D-9 Title: Laboratory Investigation of the Low-temperature Crack Resistance of Wood Tar-based Rejuvenated Asphalt Mixture Based on the Semi-circular Bend and Trabecular Bending Test
Presenter: Wang Luyue
Email: 20211200526@csuft.edu.cn
University: Central South University of Forestry & Technology
Advisor: Liu Kefei

D-10 Title: Properties of polyphosphoric acid and styrene-butadiene rubber modified asphalt based on molecular dynamics simulation and experimental analysis
Presenter: Yujie Tang
Email: yujietang2022@chd.edu.cn
University: Chang'an university
Advisor: Zhen Fu

D-11 Title: Investigating the storage stability of asphalt binder modified with treated high-density polyethylene (HDPE) using Fourier-transform infrared spectroscopy (FTIR)
Presenter: Anyou Zhu
Email: az53r@umsystem.edu
University: Missouri University of Science and Technology
Advisor: Jenny Liu