2017

# The 7th IACIP Annual Workshop

## Advances in Smart, Sustainable and Resilient Transportation Infrastructure

Date: Sunday Jan. 8, 2017
Time: 8:00 AM to 5:30 PM
Room: Shaw (M3) / Marriott Marquis

# The 7th IACIP Annual Workshop Program

## Advances in Smart, Sustainable and Resilient Transportation Infrastructure

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| **Date** | **Sunday Jan 8, 2017 from 8:00 AM to 5:30 PM** |
| **Location** | Shaw (M3) / Marriott Marquis, near the Convention Center at 901 Massachusetts Avenue, Washington, D.C. |
| **8:00 – 8:20** | **Registration, Posters (Moderators: Dr. Zhen Liu and Dr. Shenghua Wu)**<br>Assisted by: Gang Xu, Mehdi Honarvarnazari, Siyu Chen |
| **8:20 – 8:30** | **Conference Opening by Dr. Xianming Shi, Chair of IACIP Annual Workshop**<br>• Welcome everyone<br>• Acknowledge the sponsors of the annual workshop<br>• Introduction of Dr. Jie Han, President of IACIP |
| **8:30 – 8:40** | **Dr. Jie Han, President of IACIP**<br>• Welcome everyone<br>• Summary of his term<br>• Introduction of Dr. Chung Wu, new President of IACIP |
| **8:40 – 8:50** | **Dr. Chung Wu, new President of IACIP**<br>• Plan for the new Board of IACIP<br>• Introduction of Dr. Kelvin Wang, President of ASCE T&DI |
| **8:50 – 8:55** | **Dr. Kelvin Wang, President of ASCE T&DI**<br>• Introduction of ASCE T&DI |
| **8:55 – 9:20** | **Keynote Speaker** (Moderator: Dr. Chung Wu)<br>Dr. Zhanmin Zhang, The University of Texas at Austin, "An Innovative Approach to Cross-asset Resource Allocation for Transportation Asset Management" |
| **9:20 – 9:45** | **Posters Session** (Moderators: Dr. Qingli Dai and Dr. Shihui Shen) |
| **9:45 – 10:55** | **Session I: Behavior, Durability and Recycling of Asphalt Pavement**<br>(Moderators: Dr. Shenghua Wu and Dr. Zhen Leng)<br>• Dr. Qingli (Barbara) Dai, Michigan Technological University, "Multiscale and Multiphysical Behaviors of Designed Asphalt Materials"<br>• Dr. Nanxiang Zheng, Chang'An University, "Rutting Prediction Model of Semi Rigid Asphalt Pavement Based on Accelerated Loading Test"<br>• Dr. Jenny Liu, University of Alaska, Fairbanks, "Critical Low Temperature, from Asphalt Binder to Mixture"<br>• Dr. Jinhai Yan, JSTI Group, "Early-age strength and long-term performance of asphalt emulsion cold recycled mixes with various cement contents" |

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| **10:55-12:20** | **Session II: Sustainable Asphalt Pavements** (Moderators: Dr. Xianming Shi and Dr. Feipeng Xiao)<br>• Dr. Wei Zhou, JSTI Group, "Study on the void reduction behavior of porous asphalt pavement based on discrete element method"<br>• Dr. Hainian Wang, Chang'An University, "Comprehensive Performance Evaluation of SBS Modified Bio-asphalt Binders and Mixtures"<br>• Dr. Zejiao Dong, Harbin Institute of Technology, "Comprehensive Performance Evaluation and Improvement Comparison of Asphalt Binder Blended with Multi-Source Bio-Asphalt"<br>• Dr. Kun Zhang, Washington State University, "Numerical Investigation of Dry and Wet Mixing Processes to Improve the Performance of RAP Mixtures"<br>• Dr. Shihui Shen, Pennsylvania State University, "Long-term Field Aging of Warm Mix and Hot Mix Asphalt Binders" |
| **12:20 – 1:35** | **Lunch Break** |
| **1:35 – 2:05** | **Keynote Speaker** (Moderator: Dr. Xianming Shi)<br>• Dr. Jason Weiss, Oregon State University, "Toward Performance Specifications for Concrete Durability" |
| **2:05 – 2:35** | **Keynote Speaker** (Moderator: Dr. Xianming Shi)<br>• Dr. Markus Oeser, RWTH Aachen University, Germany, "Advanced Characterization and Modelling of Pavement Surface Texture and Skid Resistance: A Comprehensive Approach Considering Chassis-, Tire- and Pavement Dynamics" |
| **2:35 – 3:25** | **Session III: Sustainable and Resilient Transportation Infrastructure** (Moderators: Dr. Penkun Hou and Dr. Yudong Dang)<br>• Dr. George Wang, East Carolina University, "Construct Sustainable Transportation Infrastructure -Materials and Methods Aspects"<br>• Dr. Xiaochao Tang, Widener University, "Developing Low-Cost Sensor Units for Transportation Infrastructure Monitoring"<br>• Dr. Renguo Gu, South China University of Technology, "Multiscale problems of soil mechanics and multiscale analysis of geological hazard" |
| **3:25 – 3:55** | **Posters Session** (Moderators: Dr. Xinyu Gu and Dr. Yingwu Fang) |

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| **3:55 – 5:25** | **Session IV: Planning, Preservation and Operations of Transportation Infrastructure** (Moderators: Dr. Xiong Yu and Dr. Junliang Tao)<br>• Dr. Shaozhi Hong, Tongji University, "Collaboration Management Model of Large Airport Terminal Rehabilitation & Expansion Project without Suspending Air Flights: Based on Shanghai Practice"<br>• Dr. Feipeng Xiao, Tongji University, "Functional Layer Material Designation of Combined Chip Seal and Slurry Seal in Airport Pavement"<br>• Dr. Qiao Dong, The University of Tennessee, "Influence of Materials and Construction Practices on the Performance of Slurry Seals in the LTPP Database"<br>• Dr. Joshua Q. Li, Oklahoma State University, "Pavement surface safety analysis with data from different devices"<br>• Dr. Zhongren Wang, California Department of Transportation, "Development of the 2017 Ten-Year Pavement Management Plan using PaveM" |
| **5:25-5:30** | **Workshop Adjoin**: Dr. Chung Wu |

## BANQUET

**7th IACIP Annual Banquet (More info. at the end of this brochure)**

**Sunday Jan. 8, 2017 from 7:00 PM to 9:00 PM**

**Chinatown Garden (龙之味), 618 H Street, N.W., Washington, D.C.**

## REGISTRATION

1. Professionals with IACIP membership registration only (attending the workshop only and not attending the banquet): $20
2. Students with IACIP membership registration for workshop only: $5
3. Professionals with IACIP membership registration and banquet ticket: $30
4. Students with IACIP membership registration and banquet ticket: $15
5. Banquet ticket only/separately (at workshop or restaurant): $25
6. Complimentary workshop registration and banquet for speakers, representative from sponsors, one student or young professional for each poster, and organizing committees (including student members).

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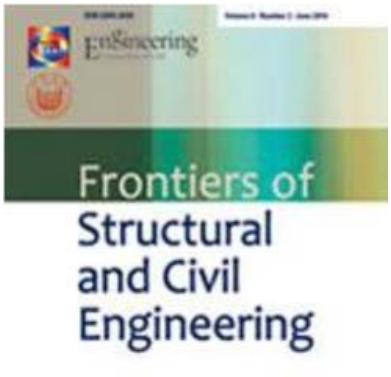


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**FSCE Journal (Frontiers of Structural and Civil Engineering, Transaction of Chinese Academic Engineering):** http://www.springer.com/engineering/civil+engineering/journal/11709

- Publishes peer-reviewed articles of original contributions on all aspects of structural and civil engineering
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- *Frontiers of Structural and Civil Engineering* is an international journal that publishes original research papers, review articles and case studies related to civil and structural engineering. Topics include but are not limited to the latest developments in building and bridge structures, geotechnical engineering, hydraulic engineering, coastal engineering, and transport engineering. Case studies that demonstrate the successful applications of cutting-edge research technologies are welcome. The journal also promotes and publishes interdisciplinary research and applications connecting civil engineering and other disciplines, such as bio-, info-, nano- and social sciences and technology. Manuscripts submitted for publication will be subject to a stringent peer review.
  Originally established in 2007 as *Frontiers of Architecture and Civil Engineering in China*, the journal was renamed *Frontiers of Structural and Civil Engineering* in 2011.The journal is supported by the Chinese Academy of Engineering.

**FAHE Roadway Technology & Equipment**: http://www.fahe-qs.com/

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- **法赫中国成立于**2001**年，是新一代**桥梁隧道养 护工程技术公司，已广泛服务于铁道、公路、高速、市**政、**轨道交通等交通系统领域十多年。
- **法赫主要**产品与服务有检测仪器及养护机具配套、道桥养护一体机的多功能应用、桥隧预防性养护工程工程材料技术与应用、中国桥梁隧道养护网及培训班养护租赁服务**等，旨在提供全方位的**桥隧养护解决方案。
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## KEYNOTE ABSTRACT

### An Innovative Approach to Cross-asset Resource Allocation for Transportation Asset Management

Zhanmin Zhang, Ph.D.
The University of Texas at Austin
z.zhang@mail.utexas.edu

Resource allocation mechanisms have become a major issue for transportation agencies in the U.S. and around the world. One of the main concerns with the transportation asset management framework and its implementation is the absence of an organized process for cross-asset resource allocations. This presentation discusses an innovative methodological framework for cross-asset resource allocations, highlighting a data-oriented approach to enhancing transportation asset management. To demonstrate the applicability of the proposed methodological framework, a case study was conducted using two asset groups, pavements and bridges, from a roadway network in Texas. Results from the case study show that the proposed methodological framework has great potential as a tool to support highway agencies in performing cross-asset resource allocations at the network level.

**Dr. Zhanmin ZHANG** is Professor and holds the Clyde E. Lee Endowed Professorship in Transportation Engineering at The University of Texas at Austin, where he also serves as Director of the Center for Resilient Infrastructure and Smart Cities (CRISC). His current research interests include: large-scale infrastructure systems simulation, robust maintenance policies, optimal resource allocations, innovative financing mechanisms, and infrastructure resilience. As a Principal Investigator or Co-Principal Investigator, Dr. Zhang has conducted major research projects totaling more than $16.4 million sponsored by federal, state, and local government agencies and private industry. Dr. Zhang has been playing an active leadership role in his professional community. Among other professional services, he is currently Council Chair of the Mode Spanning Council, American Society of Civil Engineering (ASCE), overseeing four technical committees. Dr. Zhang is an author or co-author of more than 180 technical papers, reports, and articles and has delivered more than 130 oral presentations nationally and internationally. Dr. Zhang was selected to receive the Best Paper Award at both the 8th and 9th International Conference on Managing Pavement Assets in 2011 and 2015, respectively. In addition, Dr. Zhang was selected to receive one of the most prestigious national awards, the 2012 ASCE James Laurie Prize.

## KEYNOTE ABSTRACT

### Toward Performance Specifications for Concrete Durability

Jason Weiss, Ph.D.
Oregon State University
Jason.Weiss@oregonstate.edu

This presentation discusses the development of a conceptual framework for the specification for concrete durability using performance modeling concepts. Specifically, the approach will relate acceptance tests, material properties, degradation models, limit states, and reliability. When implemented, this approach can be used for a variety of distress mechanisms; examples are provided for three specific distresses. In the first example, the formation factor is used to describe the transport of chloride ions that indicate the onset of depassivation and corrosion in a reinforced concrete element. In the second example, a sorption based model is presented to describe performance of concrete in a freeze-thaw environment. The third describes new approaches to reduce a concretes risk to deicing salt damage. The approach described is an attempt to relate concrete durability performance to measurable properties. While it is likely that the test methods will need to be refined and models will require further calibration based on rigorous evaluation and improvement in the coming years, this framework has great potential to directly relate measured concrete properties to the long term durability performance of concrete structures.

**Dr. Jason WEISS** is the Miles Lowell and Margaret Watt Edwards Distinguished Chair in Engineering and the Director of the Kiewit Center for Infrastructure and Transportation Research. Before joining Oregon State as the head of the school of civil and construction engineering he was a faculty member at Purdue University for 16 years where he held the position of the Jack and Kay Hockema Professor of Civil Engineering and Director of the Pankow Materials Laboratory. He earned a B.A.E. from the Pennsylvania State University and a MS and PhD from Northwestern University in 1997 and 1999 respectively. He is actively involved in research on cement and concrete materials specifically focused on early age property development, cracking, transport in concrete, and concrete durability. Specifically, he is known for research in the areas of shrinkage and cracking reduction, the use of the ring and dual ring test, use of electrical resistivity and the formation factor, use of internally cured concrete, and concrete pavement durability.

Dr. Weiss is a member of the American Concrete Institute (Past Chair of ACI 123), American Society of Civil Engineers, RILEM (Bureau Member, Past TAC member, TC CCD chair), Transportation Research Board (AFN 040 Chair), and American Society for Testing and Materials. He is the editor of the ASTM journal Advances in Civil Engineering Materials, is past editor in chief of the RILEM Materials and Structures Journal and is a member of the editorial board of Cement and Concrete Research.

Dr. Weiss has authored over 350 publications with over 165 peer-reviewed journal articles. He is a recipient of the NSF Career Award, the RILEM L'Hermite Medal, the ACI W. P. Moore, ACI Young Member, and ACI Wason Awards, the ESCSI Erskine Award, the TRB Burgraff and Mather Awards for outstanding research and publications, and the ASCE Huber Award. He is a fellow of ACI and is also the recipient of the Wansik, Munson, Buck, and Burke awards for outstanding teaching/advising in the school of civil engineering, has received the Potter award for outstanding teaching in the college of engineering, has received the university Murphy award for undergraduate teaching, and has been inducted into the Purdue Teaching Academy.

## KEYNOTE ABSTRACT

# Advanced Characterization and Modelling of Pavement Surface Texture and Skid Resistance: A Comprehensive Approach Considering Chassis-, Tire- and Pavement Dynamics

Markus Oeser, Prof. Dr.-Ing. habil.
RWTH Aachen University
oeser@isac.rwth-aachen.de

Over the past decades a wide range of routine measurement devices has been developed, all of them measuring the friction force between a rubber wheel and the (wetted) road surface. At the same time many efforts have been undertaken to predict skid resistance solely from texture measurements. This presentation discusses a concept of contactless skid resistance measurement which is based on optical texture measurement and consists of two components: 1) measurement of the pavement texture by means of an optical measuring system and 2) calculation of skid resistance based on the measured texture by means of a rubber friction model. The basic assumptions and equations underlying the theoretical approach are presented. Wehner/Schulze (W/S) machine was chosen to prove the theoretical approach: The results are very promising: A close relation between measured and predicted friction coefficients could be found. Thus, a strong indication can be provided that skid resistance could be measured without contact in the future.

**Dr. Markus OESER** received his Ph.D. degree with the topic of "Numerical Simulation of the Nonlinear Behaviour of Multi-layered Pavement Structures," from the Dresden University of Technology in 2004. In 2010, he finished his Professorial-Thesis (Habilitation) with the topic of "Non-Linear Numerical Simulation Models for Pavements under Consideration of Mechanical, Thermal and Hydraulic Influences". From 2011, he has been the Chair-Professor of Pavement Engineering and Director of the Institute for Pavement Engineering and from 2016, he has been the dean of Faculty of Civil Engineering at the RWTH Aachen University. His research and teaching focuses on numerical methods (FEM, FSAFEM, BEM) and constitutive models (elsto-visco-plastic models, hypo-elastic models, critical state concept) and so on. He is an active member at the International Conference on Asphalt Pavements. His work has been published in more than 30 peer reviewed journal papers including the International Journal of Pavement Engineering, International Journal of Numerical Methods in Engineering, Construction and Building Materials, Wear, and others.

## PRESENTATION ABSTRACTS

### Multiscale and Multiphysical Behaviors of Designed Asphalt Materials

Qingli Dai, Michigan Technological University, qingdai@mtu.edu

This presentation will discuss an integrated computational-experimental approach for evaluating healing performance of designed asphalt mixture. The conductive carbon fiber or steel fibers were added into asphalt mixtures for induction healing by functioning as heating elements. The superior graphite powders were also incorporated into mixtures for infrared light-healing or microwave-healing of micro-cracks inside asphalt mixtures. The computational analysis were conducted to predict the recovered fracture strength of healed samples. The molecular dynamics analysis methods were also adapted to simulate the common three-component asphalt model and to predict the physical properties of designed asphalt materials.

**Bio of the Presenter**

Dr. Qingli DAI is an associate professor in the Department of Civil and Environmental Engineering at Michigan Tech. Dr. Dai's primary professional and scholarly contributions have dealt with material design, characterization, test and analysis for sustainable civil infrastructure applications, especially on self-healing abilities, damage mechanism diagnosis and multi-physical interactions in asphalt mixtures or concrete. She has published over 100 technical papers including 56 journal articles and other 40+ conference papers. Dr. Dai has been a Principle Investigator of several research projects funded by National Science Foundation and Michigan Department of Environmental Quality. Other sponsors of her research program include State Department of Transportation and Michigan Space Grant Consortium. Dr. Dai is an associate editor for ASCE Journal of Materials in Civil Engineering since November 2011. She is a member of ASCE granular material committee, bitumen committee, pavement committee, and geophysics committee. She is a member of ACI committee 201,130 and 228. She regularly reviews technical papers for Elsevier and ASCE journals as well as other journals. She has served on NSF review panels for four different programs. She has also served as ASCE Engineering Mechanics and US National Congress on Theoretical and Applied Mechanics conference session chairs.

# Rutting Prediction Model of Semi Rigid Asphalt Pavement Based on Accelerated Loading Test

Nanxiang Zheng, Chang'An University, znx@163.com
Xinquan Xu, Chang'An University
Xiaoping Ji, Chang'An University
Zhuohong Cong, Chang'An University
Shutao Meng, Highway Science Research Institute, Ministry of Communications, China
Quanliang Xu, Highway Science Research Institute, Ministry of Communications, China

The obvious difference of the structure and material of the semi-rigid pavement and flexible pavement will lead to the particularity of the rutting development. Therefore, the establishment of rutting prediction model which is suitable for semi-rigid base asphalt pavement is very important to the material and structure design of semi-rigid asphalt pavement. In this study, in view of the structure and material characteristics of semi rigid asphalt pavement in Northwest China, several factors, such as the application environment (temperature and vehicle speed), service life (traffic volume), pavement structure, and mixture performance, were characterized, and the dynamic stability, the shear stress of pavement structure, axle loading repetitions, and pavement temperature were introduced, so that the basic form of rutting prediction in exponential form was determined. Three different semi-rigid asphalt pavement structures were analyzed through accelerated pavement rutting tests with an accelerated loading facility and through shear stress calculation. Besides, the pavement temperature of the testing pavement was collected, and combining mechanical analysis, a rutting prediction model with a reference speed of 20 km/h was established. The SPT creep test was conducted, and combined with time hardening function creep model and loading time function, the relationship between pavement rut and driving speed was determined. The final rutting prediction model was established through adjustment of vehicle speed in the simplified rutting prediction model. In addition, model form and forecast precision of the rutting prediction model were compared with the AASHTO model and SHELL model.

## Bio of the Presenter

郑南翔**教授**，长安大学公路学院道路系教授，工学博士。1982**年**毕业于原西安公路学院公路工程专业，现任道路与养护技术国际合作研究中心主任、**中国公路**协会道路养护分会理事，历任长安大学公路学院道路研究所、道路系副主任、长安大学道路新技术研究所所长、长安大学公路工程检测中心主任等职。

**主要研究方向**为：1.**耐久性路面**结构与路面材料；2.**公路路面养**护技术、养护材料及方法；3.**路面**环保型及再生技术等。

郑南翔教授主编参编论著四部，培养硕士、博士研究生100**多名**，**主持了**40**余**项**国家**级、陕西、甘肃、宁夏、四川、广东、江西等省的科研项目，主持和参与了**多条高速公路的科研**、设计**咨**询**等技**术工作。**曾**获国家科学技术进步二等奖、国家教育委员会科技进步一等奖，并获得**多**项**省**、**部**级科技进步奖。

## Critical Low Temperature, from Asphalt Binder to Mixture

Jenny Liu, University of Alaska, Fairbanks
Jliu6@alaska.edu

Low temperature cracking, or thermal cracking, is seen as one of the most prevalent asphalt pavement distresses in northern states and countries. The low temperature limit of the asphalt mixture to address the thermal cracking, also named the critical temperature, can be determined at the intersection of the tensile strength vs. temperature curve with the thermal stress vs. temperature curve, both obtained from the indirect tension (IDT) test. However, this mixture critical temperature is not considered in the pavement mix design process in which only low temperature grade of asphalt binder is specified. The critical temperature of asphalt binder, in addition, can be calculated at the intersection between the strength master curve obtained from direct tension tester (DTT) and the thermal stress curve obtained from the bending beam rheometer (BBR) creep stiffness data. Therefore, it is desirable to reveal the relation between the specified asphalt binder's critical temperature and resulting asphalt mixture's critical temperature. This research presents such a study by including several local Alaskan asphalt binders and their resulting mixtures. Binder type, material source, and aging method were investigated as influence factors. The thermal stress analysis routine (TSAR) software was used as an additional method to process BBR and DTT data to calculate binder critical temperature. The asphalt binder cracking device (ABCD) was used to as a direct method to obtain the binder critical temperature in addition to BBR and DTT data for comparison.

### Bio of the Presenter

Dr. Jenny LIU received her M.S. and Ph.D. degrees in Civil Engineering from Texas A&M University, and her B.S. degree in Materials Science and Engineering from Tongji University, Shanghai, China. She is the Director of Center for Environmentally Sustainable Transportation in Cold Climates (CESTiCC). She is currently serving as an Associate Editor for ASCE Journal of Materials in Civil Engineering, Chair of ASCE Bituminous Materials Committee, Director of ACI Alaska Chapter, and members of three TRB committees and two ASCE committees. She is a registered Professional Engineer in Alaska and certified examiner for ACI Certifications of aggregate and concrete testing technicians.

# Early-age strength and long-term performance of asphalt emulsion cold recycled mixes with various cement contents

Jinhai Yan, JSTI Group, jason.yan1@gmail.com
Zhen Leng, The Hong Kong Polytechnic University
Feng Li, JSTI Group
Haoran Zhu, JSTI Group

Cold recycling with asphalt emulsion is an economical and environment-friendly technology for asphalt pavement maintenance and rehabilitation. This study aims to investigate the early-age strength and long-term performance of the asphalt emulsion cold recycled mixes with various cement contents, as well as the correlation between the early-strength and long-term performance. To achieve this objective, three research tasks were conducted, including: 1)quantifying the early-age strength of four types of asphalt emulsion cold recycled mixes by measuring their cohesive forces and raveling loss rates through the Hveem cohesion test and raveling test, respectively; 2)characterizing their long-term performance properties, including moisture stability, high-temperature stability, and low-temperature cracking resistance; and 3) developing the correlation models between the early-age strength and long-term performance of asphalt emulsion cold recycled mixes through regression analysis. It was concluded that adding cement in cold recycled mixes played positive effects on both its early-age strength and long-term performance. In addition, strong linear correlation was found between the early-age strength and long-term performance of asphalt emulsion cold recycled mixes.

## Bio of the Presenter

Dr. Jinhai YAN is Deputy Chief Engineer at Division of Pavement & Materials, Jiangsu Transportation Institute Group. He received his PhD degree from Southeast University on June 2011. Prior to his current position, he worked as an Assistant Engineer in China Highway Engineering Consulting Corporation in 2006 and a Technical Engineer in MeadWestvaco in 2008. He visited NCAT as a scholar visitor in 2016. His research area is focused on asphalt pavement maintenance and rehabilitation, solid waste recycling and new asphalt materials development, etc. Dr. Yan has in charge of and in cooperation with 18 research projects in previous ten years. He has published 12 peer-reviewed journal papers and received 3 Chinese patents.

# Study on the void reduction behavior of porous asphalt pavement based on discrete element method

Wei Zhou, JSTI Group, zw665@jsti.com
Xiaoming Huang, Southeast University, China
Linbing Wang, Virginia Polytechnic Institute and State University
Rongji Cao, JSTI Group

The objective of this study was to analyze the void reduction behavior of porous asphalt mixture under load. A three-dimensional discrete element model of porous asphalt mixture based on aggregate gradation and void gradation was built in PFC3D software. The parameter of the model was obtained from creep test. The rutting test was simulated using this discrete element model. And a new method was developed to obtain and analyze the void structure in discrete element model. The simulation results were compared with one of the laboratory test. The comparative analysis indicates that, the discrete element method can be used to simulate the creep response and void reduction behavior of porous asphalt mixture. Further research shows that porosity, effective porosity, number of connected components and section pores have a good correlation with strain of porous asphalt mixture. With the increase in strain, the proportion of section pores with diameter less than 2 mm increases. In the initial stage of loading, the void reduction is the main reason for rut increment of porous asphalt mixture. In the later stage, the void structure is almost incompressible; the lateral deformation of mixture becomes the domination factor.

## Bio of the Presenter

Dr. Wei ZHOU received his Ph.D. degree in Communication and Transportation Engineering from Southeast University in 2015. His supervisor was Prof. Huang Xiaoming. He has worked as an engineer and researcher in JSTI GROUP since 2014. He main research interests include porous asphalt pavement and pavement maintenance. He has done some research in reduction behavior of void structure and drainage performance of porous asphalt pavement, intelligent maintenance technology, etc. Main research results were published in International journal of pavement engineering, China Journal of Highway and Transport, etc.

# Comprehensive Performance Evaluation of SBS Modified Bio-asphalt Binders and Mixtures

Hainian Wang, Chang'An University
wanghainian@aliyun.com

Developing new sustainable materials such as bio-asphalt has become a new research trend in recent years. In this study, SBS modified bio-asphalt was investigated to research whether it can replace petroleum asphalt of 50# in technical and road performances. A series of laboratory tests were carried out to evaluate the performance of styrene-butadiene-styrene block copolymer(SBS) modified bio-asphalt binders and mixtures, including penetration, softening point, ductility, rutting, moisture susceptibility, and low temperature cracking. SBS modified bio-asphalt was prepared with different contents of bio-oil, 0%, 5%, 10%, 15% and 20%, respectively. Moreover, a comprehensive evaluation was applied on all types of asphalt and a recommended selection of asphalt was provided. The research showed that technical performances of SBS modified bio-asphalt can satisfy the specification requirements to 50# base binder when bio-oil concentration was less than 15%. High temperature stability of SBS bio-asphalt mixture was worse than that of 50# base binder mixture to some degree, but can still satisfy the specification requirements. SBS modified bio-asphalt mixture had a better low temperature crack resistance and water stability than 50# base binder mixture. Meanwhile, the SBS modified bio-asphalt mixture had higher low temperature adhesion than that of the 50# base binder mixture, which reached its maximum with aggregates sink ratio of 4.33% when the bio-oil content was 10%. SBS modified bio-asphalt with 10%-15% bio-oil were recommended according to the performance evaluation.

## Bio of the Presenter

Dr. Hainian WANG is a professor and associate dean of School of Highway, Chang'An University. He has been actively conducting research in assessment of design of pavement structure, optimization, testing and characterization on the sustainable pavement materials. He has an in-depth study on the developing bio-asphalt binder, characterization and simulation of the material microstructure, and cold region pavement, etc. As the Principal Investigator, Dr. Wang has been leading more than 10 influential research programs, from NSFC, National DOT and Shanxi Province. Dr. Wang has published more than 100 academic papers in high-level national and international journals.

**Comprehensive Performance Evaluation and Improvement Comparison of Asphalt Binder Blended with Multi-Source Bio-Asphalt**

Zejiao Dong, Harbin Institute of Technology, hitdzj@hit.edu.cn

This presentation will cover the performance evaluation, Physical and Chemical modification, experimental pavement establishment of asphalt binder blended with multi-source bio-asphalt. As a sustainable pavement material, bio-asphalt could replace conventional petroleum based asphalt partially or even fully and lead to vast environmental and economic benefits. This study was undertaken to investigate the effects on asphalt binder by adding multi-source bio-asphalt made from corn or other plants in Northeastern China. The proportions of bio-asphalt were 10% and 15%. The Rotational Viscometer (RV) test shows that the addition of bio-asphalt increased the viscosity of asphalt binder while decreased the temperature susceptibility, the Dynamic Shear Rheometer (DSR) test indicates that high temperature performance was improved while the Bending Beam Rheometer (BBR) test points out that the low temperature cracking resistance was decreased slightly. Then, a typical mixture gradation of AC-20 was chosen to evaluate the service performance of asphalt mixture. The related tests present that the addition of bio-asphalt improved the rutting resistance while sacrificed the low temperature cracking resistance slightly, and the moisture damage resistance decreased evidently. As a result, Elemental analysis, Gas Chromatography-Mass Spectroscopy (GC-MS), Fourier Transform Infrared Spectroscopy (FT-IR) and Four Components Analytical Method (SARA) were utilized to analyze chemical composition of certain bio-asphalt, for the sake of clarifying the performance variation mechanism due to the mentioned bio-asphalt addition. The analysis results illustrate that a certain amount of light and soluble components were existed in one certain proposed bio-asphalt, such as propylene glycol, ethylene glycol and butanedioic acid. Due to the occurrence of moisture damage for asphalt mixture and original defects within chemical composition of bio-asphalt, physical and chemical modifications, adding SBS and o-Phthalic anhydride respectively, were adopted to improve the eventual pavement performance of bio-asphalt. Mixture test results shows that the physical method only improves the high and low temperature performance obviously while has no effect on the improvement of moisture damage resistance, by contrast, the chemical approach can enhance the moisture damage resistance of mixture visibly while be less likely to damage the other performances. Utilizing bio-asphalt generated from corn proposed herein as a partial alternate for petroleum-based asphalt is potential and feasible.

**Bio of the Presenter**

Dr. Zejiao DONG is a Professor specialized in Pavement Numerical Mechanics, Structural Monitoring and Sustainable Development in the School of Transporation Science and Engineering at the Harbin Institute of Technology (HIT). Dr. Dong has research interests and expertises in asphalt pavement dynamics, health monitoring and sustainable development technologies, i.e., asphalt pavement dynamics, multiscale modelling of asphaltic materials, pavement continuous health monitoring and sustainable development technologies (Bioasphalt, modified asphalt and recycling). Dr. Dong has received four project fundings from National Science Foundation of China (NSFC) and published one academic book in Chinese within the domain of asphalt pavement material characterization and mechanical analysis. Dr. Dong served as TRB Committee members on Pavement Monitoring and Evaluation and Vice Director of Key Laboratory of Specialized Material and Intelligent Control Technology for Traffic Safety.

# Numerical Investigation of Dry and Wet Mixing Processes to Improve the Performance of RAP Mixtures

Kun Zhang, Washington State University, kun.zhang2@wsu.edu

Inadequate drying and heating of wet reclaimed asphalt pavement (RAP) can cause moisture stripping and raveling in the pavements that contain RAP mixtures. However, the direct measurement of moisture and temperature evolutions of RAP materials in an asphalt plant is difficult. Therefore, in this study, a numerical analysis was explored to simulate the dry and wet mixing processes during the production of RAP mixtures. The heating and drying models were developed and implemented into discrete element method (DEM) to investigate the temperature and moisture evolutions of the mixing system during the dry mixing between superheated virgin aggregate and RAP materials. Laboratory experiments were conducted to verify the proposed heating and drying models. In addition, the asphalt coating and transfer models were developed to simulate the wet mixing process after virgin binder injection and analyze the optimal wet mixing time to achieve a uniform virgin binder coating. The simulation results showed that the optimal dry mixing time in the simulated pugmill increased as the mix discharge temperature and/or RAP contents increased in order to achieve the targeted mix discharge temperature. The optimal wet mixing time including the virgin binder coating and transferring processes was determined to be around 28 to 30 seconds, regardless of RAP percentage. The proposed numerical analysis is promising for guiding effective plant operations to determine optimal production process for RAP mixtures.

## Bio of the Presenter

Dr. Kun ZHANG is a Clinical Assistant Professor at the Department of Civil and Environmental Engineering and the Co-director of Washington Center for Asphalt Technology (WCAT) at Washington State University (WSU). He received Ph.D. degree from WSU on July 2016 with dissertation title of "Numerical and Experimental Investigation of Production and Blending Mechanisms of Asphalt Mixtures with Reclaimed Asphalt Pavement". Dr. Zhang has expertise in the areas of numerical modeling and experimental characterizations of sustainable pavement materials and their production processes. He has worked closely with industrial partners to facilitate better design of asphalt plants via numerical methods of computational fluid dynamics (CFD) and discrete element method (DEM). His research projects were/are funded by various agencies, including FHWA, DOTs, and industrial companies. He has published 6 peer-reviewed journal papers and received 3 patents related to pavement engineering.

## Long-term Field Aging of Warm Mix and Hot Mix Asphalt Binders

Weiguang Zhang, University of Florida
Shihui Shen, Pennsylvania State University, Altoona, SZS20@psu.edu
Shenghua Wu, University of Illinois at Urbana-Champaign
Louay N. Mohammad, Louisiana State University

Very limited field studies discussed the aging of warm mix asphalt (WMA) binders especially from the perspective of long-term aging. This paper aims to quantify the long-term (10 to 82 months) field aging properties of WMA binders and the control hot mix asphalt (HMA) binders, and to identify the key factors that could associate with long-term field aging of asphalt. Asphalt binders from 23 field projects consists of 65 HMA and WMA pavements were recovered and high temperature performance grade (PG) was tested. The effect of climate, month of aging, WMA technologies and original binder high temperature PG on field asphalt aging were analyzed. A prediction model that includes multiple parameters was also developed and validated. Results indicate that Evotherm WMA binder has a lower high temperature PG than HMA binder shortly after construction, but such difference reduced with time. By considering all WMA binders, no statistical difference of field aging between HMA and WMA binders was observed. It was also found that the climate effect on asphalt field aging was apparent within dry areas or freeze areas, while the aging difference between dry and freeze areas was inconclusive and needed further research. Other conclusions included (1) the field asphalt aging affects more of top-down longitudinal wheel path crack than that of transverse crack; (2) foaming WMA binder ages in slowest manner among all the binders considered; (3) PG 64-XX and PG 70-XX binders aged more than PG 58-XX and PG 76-XX binders, and (4) the prediction model has good agreement with test results and is well validated. The identified factors that affect field asphalt aging are overlay thickness, in-place air voids, effective binder content, complex shear modulus ($G^*$), and solar radiation.

### Bio of the Presenter

Dr. Shihui SHEN is the Associate Professor of the Department of Engineering at Pennsylvania State University–Altoona and an adjunct professor of Tongji University, China. She earned her doctorate degree at the University of Illinois at Urbana – Champaign. Before joining in Penn State Altoona, Dr. Shen was an Assistant Professor at Washington State University, and the director of Washington Center for Asphalt Technology, an AASHTO accredit laboratory through AMRL. Her research focuses on civil engineering material characterization and modeling, pavement engineering, railroad engineering, and innovative design and materials for transportation sustainability. She has published 40 peer reviewed journal papers and many peer reviewed conference papers and reports. Dr. Shen was the PI of the NCHRP 9-49A project and is currently serving on the NCHRP 01-55 project panel. She is also the board member of the IACIP, the associate editor of ASCE journal of materials and civil engineering, the TRB AFK30 committee member, the ASCE Bituminous Materials Committee member, and the ASCE-EMI Mechanics of Pavements committee member.

## Construct Sustainable Transportation Infrastructure: Materials and Methods Aspects

George Wang, East Carolina University, WangG@ecu.edu
Donna Hollar, East Carolina University
Kamalesh Panthi, East Carolina University

Transportation infrastructure is the important set of structural elements that supports the day-to-day function and influences the direction of human society and our future well-being. Sustainable infrastructure can be implemented in three stages: before construction, including design, research, and feasibility studies; during construction, including the ways to do construction, utilization of varied recycled and innovative materials; and after construction, including operation, life cycle analysis (environmental related), and life cycle cost analysis (service life and cost benefit). The ultimate goal is that the constructed facilities do not diminish the social, economic and ecological processes required to maintain human the functionality of natural systems. Materials and its construction and utilization methods can play an important role in all these three stages, i.e., in research, design, construction, and post construction. First of all, any infrastructure element should be designed in the way of not generating wastes after the end of its service life, i.e., should be 100% recyclable and reusable. Secondly, because transportation infrastructure consumes tremendous materials, it should help utilize all kinds of nonconventional materials generated from other industry sectors and human's activity to reach self-healing, zero-waste and zero-landfill. Thirdly, materials used in infrastructure should include innovative and functional materials that can improve the functions and performance of the constructed facilities. This presentation elaborates the utilization of varied nontraditional materials in transportation infrastructure construction, including slags, fly ash, asphalt shingles, recycled concrete aggregate, processed tire rubber, phosphagypsum; the methodology and philosophy to expand their uses to a higher extent, and from low grade use to higher grade uses, and the method and technology for recycling the infrastructure elements when reach the end of life to make all materials 100% recyclable.

### Bio of the Presenter

Having lived, studied and worked in China, Australia, Canada, and now in the United States, Dr. Wang has gained experiences from both the industry and academia. When working in the industry, Dr. Wang had been involved in numerous transportation infrastructure construction, design and research projects in the Americas and China. He has been a training expert hired by the World Bank Group, in Washington, D.C. At East Carolina University (ECU), Dr. Wang led and implemented study abroad to China program to allow students from the US and China to have opportunities to better understand, interact, and witness transportation infrastructure construction development in both countries. Dr. Wang is an active researcher. He has published numerous technical reports and papers. He is also the sole author of the new book, entitled, *The Utilization of* Slag *in Civil Infrastructure Construction*, published by Elsevier in 2016. Dr. Wang is currently an elected member on the Committee on Ethical Practice of ASCE, and TRB research panel member for NCHRP 25-44.

## Developing Low-Cost Sensor Units for Transportation Infrastructure Monitoring

Xiaochao Tang, Widener University, xtang@widener.edu

Facing the challenge of aging and deteriorating infrastructure, growing demands for usage, and constrained funding for repair and rehabilitation, transportation agencies have been increasingly seeking reliable and cost-effective monitoring technologies and systems that can provide support to decision-making for maintenance and potentially issue early warnings of distress or failure.

This presentation will present two laboratory studies to showcase the use of custom-built low- cost sensors to monitor subsurface conditions and superstructure elements.

As infrastructure failure or deterioration in many cases is associated with its substructure and subsurface conditions, the first study explores the feasibility of integrating a sensing unit – a radio frequency module – and a miniature accelerometer to monitor the subsurface conditions, such as moisture content and possible movements or motions. The prototype of the sensing unit was evaluated through a laboratory flume test that simulates flowslide. The second laboratory study demonstrates the use of a cloud-enabled sensor unit that consists of a microcontroller, a cellular module, and circuit for interfacing with strain gauges and accelerometers. The functionality and reliability of the sensor unit was examined through a cyclic four-point bending test on a steel beam.

### Bio of the Presenter

Dr. Xiaochao TANG has been an Assistant Professor since 2013 with the Department of Civil Engineering at Widener University. He received his PhD from Pennsylvania State University in 2011. Prior to his current position, he worked as a Research Associate at the Louisiana Transportation Research Center. His research and teaching expertise spans the areas of geotechnical engineering, pavement engineering, and geosynthetics. Dr. Tang had previously been involved in multiple projects funded by the Pennsylvania Department of Transportation (PennDOT) and the Louisiana Department of Transportation and Development (LA DOTD) to experimentally and numerically evaluate and quantify benefits of using geosynthetics for highway infrastructure. In addition to his analytical and numerical modeling skills, Dr. Tang has extensive experiences in instrumentation, sensor technologies, geomaterial characterization and testing. Dr. Tang has been actively involved in the research communities and serves as a voting member of ASTM D35 committee on geosynthetics, a member of TRB AFS60 committee on subsurface drainage and TRB AFD20 committee on pavement monitoring and evaluation.

**Multiscale problems of soil mechanics and multiscale analysis of geological hazard**

Yingguang Fang, South China University of Technology
Renguo Gu, South China University of Technology, rggu@scut.edu.cn

The effective prediction and assessment of geological hazard is of great importance to the construction and operation of transportation infrastructure. As such, it has been one of the issues given due attention in disaster prevention and mitigation of transportation infrastructure. Based on the opinion that soil is a multiphase geological material consisting of soil particles and structures at various scales, the author work mainly presents multi-scale problems of soil mechanical and a multi-scale analysis framework of geological hazard. We analyze the particle and structural characteristics of soil and the physical and mechanical mechanism of the multiscale coupling properties of them. Then, the multiscale problems in the deformation process and the nonlinear phenomena associated with deformation localization, parameter sensitivity and catastrophe are discussed. Furthermore, a new energy criterion for the division of particle scales and multiscale soil cell element model are established. Moreover, approaches to the multiscale problems, such as fractional-step coupling, particle size effect analysis and multiscale nested model analysis methods, are proposed. Finally, a multi-scale analysis framework of geological hazard is outlined.

## Bio of the Presenter

Dr. Renguo GU is an associate professor at the school of civil engineering and transportation, South China University of Technology. He is also a researcher in the state key laboratory of subtropical building science, chair of the laboratory of geotechnical engineering, and a registered geotechnical engineer in China. He received a bachelor's and master's degree from China University of Geosciences, and a doctoral degree from South China University of Technology in 2007. He is currently a visiting scholar at Washington State University. His current interests are focused on the use of sustainable materials in geotechnical engineering, multiscale analysis of soil mechanics, as well as underground structure engineering.

# Collaboration Management Model of Large Airport Terminal Rehabilitation & Expansion Project without Suspending Air Flights: Based on Shanghai Practice

Shaozhi Hong, Tongji University, 446078515@qq.com
Liang Ma, Shanghai University
Zhilei Wu, Tongji University
Liang Liu, Shanghai University

The terminals of large hub-airports, as one of the core functional buildings to provide overall operational functions for airport system, are large-scale comprehensive traffic buildings which are most close to and interactive with airport passengers. It is complex non-linear system engineering project to conduct rehabilitation & extension for terminal buildings without suspending air flights, considering complex technical issues, numerous participating stakeholders, awful engineering conditions and severe security and environmental requirements. Moreover, the engineering construction and airport operational management are two mutually interfering and conflicting subsystems, with overlapping interfaces. Generally, unless there are no other options, it is rare to carry on engineering construction while keeping on-going operation. However, Pudong International Airport (SPIA), which ranks the second-largest passenger volume in China, has to face this choice and following serious challenges, as well as Hongqiao International Airport (SHA) which also locates in Shanghai.

The paper provides the research and implementation of collaborative management model for rehabilitation & extension of hub-airport terminal buildings while on-going operation, based on the case study at SPIA. During the process, with efforts of the airport operational authorities, the owner (named as the Airport Construction Headquarters), the contractors, suppliers and different government authorities, the authors strengthened the project planning in early stage, constructed the collaborative management model and analyzed the main synergistic management factors, such as target coordination, organizational collaboration, process coordination, resource coordination and information collaboration etc., so as to establish a collaborative management paradigm for rehabilitation & extension of large-airport terminal buildings under on-going operation circumstance. The work was adopted by Shanghai Airport Group Authority and accomplished satisfactory results followed as performing all engineering construction successfully and safely, as well as assuring high-quality operational performance, which can be proved that SPIA obtained a number of international and domestic awards for its travelling service for airport passengers.

## Bio of the Presenter

Dr. Shaozhi HONG now serves as an associate professor and assistant director of National Maglev Transportation Engineering R&D Center (NMTC) in Tongji University which located in Shanghai, China. His research area covers urban public transportation planning & policies, planning & strategy of transportation and urban development, and focuses on planning of airport and aircity recently. Dr. Hong has been working in several corporations for over 17 years and joined Tongji University in 2012. He has accomplished 2 National S&T Key-program R&D projects, over 10 R&D and consultant projects on public transportation policy sponsored by local governments, and 4 airport regional planning projects. Being one of the core team-members, the projects he participated were awarded 1 national S&T reward, and 2 S&T rewards from Shanghai Municipal Government. He is a member of several academies, e.g., RICS (Royal Institute of Chartered Surveyors), CIOB (Chartered Institute of Building), SAVE (Society of American Value Engineers), and SCC (Shanghai Certified Consultant Committee).

# Functional Layer Material Designation of Combined Chip Seal and Slurry Seal in Airport Pavement

Jie Yuan, Tongji University
Siyuan Xu, Tongji University
Xiangdao Hou, Tongji University
Feipeng Xiao, Tongji University, fpxiao@tongji.edu.cn
Changshan Jiang, China Airport Construction Corporation of CAAC
Yong Luo, CAAC New Era Airport Design and Research Institute Co. Ltd.

With the increasing attention to preventive maintenance and rehabilitation of asphalt pavement, asphalt emulsions have gained popularity. Synchronous chip seal and slurry seal are widely used in pavement preservation due to their low cost and efficiency, but not prevalent in new pavement construction, especially for airport pavement. The objective of this study was to characterize the asphalt emulsions and functional layers of combined with chip seal and slurry seal through conventional test methods for asphalt emulsions, asphalt binders, and chip and slurry seals including setting time, residual amount on sieve of 16-mesh, Engler viscosity, standard viscosity, residue content, penetration, ductility, failure temperature, wet track abrasion test, and load wheel test. Differential scanning calorimetry (DSC) was also conducted to explore the energy differences amongst various emulsions. In addition, trial pavements at laboratory and field were also tested to evaluate the waterproof performances of the functional layers. The results of material tests showed that slurry seal (SS)-1 and synchronous chip seal (SCS)-2 were optimum emulsions. The laboratory waterproof test on trial pavement met the requirement of standards and the trial airport pavement was emphasized the importance of compaction during the construction.

## Bio of the Presenter

Dr. Feipeng XIAO is currently a Full Professor in College of Transportation Engineering at Tongji University, China. He possesses an excellent record of education and academic & industrial experiences in civil engineering. As a registered civil engineer in Maryland, he has more than 15-year work experience in pavement engineering, structural engineering and etc. Dr. Xiao was appointed as an Editor of Construction & Building Materials, Associate Editor of ASCE Journal of Materials in Civil Engineering and Editorial Board Members of other three international journals. Dr. Xiao has been widely recognized in pavement sustainable materials research including more than 100 peer reviewed articles in national and international circulating journals and international conference proceedings since ten years. He was a member of many national or international professional societies by nomination or election, such as Sigma Xi Research Society, American Society for Testing of Materials, American Nano Society, and Association of Asphalt Pavement Technologists.

# Influence of Materials and Construction Practices on the Performance of Slurry Seals in the LTPP Database

Qiao Dong, The University of Tennessee, qdong2@utk.edu
Xueqin Chen, Tongji University
Baoshan Huang, The University of Tennessee

This study investigated the influence of materials and construction practices on the performance of slurry seals in the LTPP SPS-3 experiment. The equivalent effectiveness calculated based on the area under pavement performance curve was developed to characterize long term performance of slurry seals. A data mining method, the Classification and Regression Tree (CART), was adopted to divide slurry seal projects into subsets based on the weather, traffic, materials and construction practices factors and to quantify the effects of those factors. Asphalt rate, slurry rate, aggregate type, water, maximum speed at initial curing, humidity, pavement temperature, air temperature, pavement surface cleanness and cracking type on old pavement were identified as split variables to classify slurry seal projects. Their effects on the performance of slurry seals were also quantified. The pre-treatment roughness level was identified as the most significant factor for the roughness of slurry seals. To ensure sufficient high friction resistance, the maximum allowed speed should be no more than 45 mph and the optimal asphalt rate were between 0.97 and 1.4 L/m2. Relatively high pavement surface temperature and low air humidity were helpful to improve the friction and rutting resistance. Sufficient mineral filler content could improve the resistance of slurry seals to fatigue cracking. Short time before traffic (<1.7 h) tended to induce wheel path longitudinal cracks. In addition to severe freeze condition, pavements with transverse, alligator cracking or raveling were more likely to have transverse cracks on slurry seals than those with edge, block or longitudinal cracks.

## Bio of the Presenter

Dr. Qiao DONG has been an active researcher in pavement engineering for more than 10 years since his graduate study. His research area includes pavement maintenance and rehabilitation, pavement management, pavement performance modeling, sustainable construction and infrastructure materials, asphalt and Portland cement materials characterization, pavement performance testing and structural evaluation. He has published more than 30 journal papers and gave more than 30 conference presentations in international academic conferences. His publications have been cited more than 150 times in the SCI and 400 times in google scholar. He received the fellowship of Portland Cement Association (PCA) education foundation in 2008 and was the first prize winner of the international contest on LTPP data analysis in 2010 and 2015. He was also awarded the outstanding reviewer for the Journal of Materials in Civil Engineering in 2012, 2014 and 2015. He is currently an active member of two academic committees, the Bituminous Materials Committee (BMC) of American Society of Civil Engineers, and the Pavement Maintenance Committee (AHD20) of Transportation Research Board (TRB).

**Pavement surface safety analysis with data from different devices**

Joshua Q. Li, Guangwei Yang, and Kelvin C. P. Wang
Oklahoma State University
qiang.li@okstate.edu

Pavement friction and texture characteristics are important aspects of road surface safety. Many different types of equipment have been developed and used to measure these properties. This paper investigates the suitability of using several novel texture indicators for skid resistance analysis. First, discrete wavelet transform is implemented to decompose pavement macrotexture data, which were collected from a high-speed profiler on the six high friction surface treatment (HFST) sites in Oklahoma, into multiple wavelengths. The Total Energy (TE) and Relative Energy (RE) are calculated as indicators to represent macrotexture characteristics at various wavelengths. The macrotexture energy within wavelengths from 0.97 mm to 3.86 mm contributes positively, while the energy within wavelengths from 15.44 mm to 61.77 mm shows negative impacts on pavement friction collected using a Grip Tester. Second, recognizing that Mean profile depth (MPD) is a 2-dimentioal (2D) indicator, five categories of 3-dimensional (3D) areal parameters are explored to characterize pavement texture attributes. Pavement texture and friction data are collected in parallel at predefined locations on the Long Term Pavement Performance (LTPP) Specific Pavement Study 10 (SPS-10) in Oklahoma via a portable ultra-high resolution 3D laser scanner and a Dynamic Friction Tester (DFT). Correlation analyses among the twenty-four 3D texture parameters are conducted to exclude those who exhibit strong correlations. The core material volume and the peak density are identified as the most influential macro- and micro-texture parameters which exhibit fairly good correlation with DFT friction data at high- and low-speed. Subsequently, multivariate linear friction prediction models are developed incorporating the novel texture indicators. The results indicate those texture parameters could provide better alternatives to characterize pavement surface texture attributes with respect to the pavement friction performance.

**Bio of the Presenter**

Qiang (“Joshua”) LI, Ph.D. is an Assistant Professor in the School of Civil & Environmental Engineering at OSU, and was a project engineer at Applied Pavement Technology Inc. Dr. Li has more than 15 years of experience in transportation infrastructure research, including surface characterization and evaluation for pavement safety, mechanistic-empirical based design, asset management and sustainability.

## . Development of the 2017 Ten-Year Pavement Management Plan using PaveM

Zhongren Wang, California Department of Transportation, zhongren.wang@dot.ca.gov

In this presentation, the development of the Caltrans 2017 ten year pavement management plan using the newly developed Pavement Management System—PaveM will be discussed. The Caltrans ten year plan process will be first introduced, together with the performance measures, performance goals and targets. Both Caltrans traditional performance measures and the MAP-21 performance measures will be described. Then how PaveM is used to develop the ten year project list will be presented. Various budgeting scenarios and policy constraints are analyzed to identify a funding scenario with maximum long-term cost-effectiveness. Finally, general observations will be presented about PMS' implementation in a DOT environment.

**Bio of the Presenter**

Dr. Zhongren WANG is a Pavement Management Specialist with the California Department of Transportation (Caltrans). His areas of expertise include pavement management, traffic operations and management, and intelligent management systems. A registered Civil Engineer and Traffic Engineer in the State of California, Dr. Wang has more than 20 years of experiences in project development and management, program administration, and academic teaching and research. Dr. Wang serves on four standing Committees of the Transportation Research Board (TRB). He also serves as panelists for multiple National Cooperative Highway Research Program (NCHRP) research projects. Dr. Wang published more than 30 journal papers and book chapters in various refereed journals and proceedings. He is now an associate editor of the International Journal on Transportation Science and Technology.

Dr. Wang earned his Ph.D. degree from the University of Tennessee, Knoxville, his M.Sc. degree from the National University of Singapore, his M.Sc. and B.Sc. degrees from Tongji University. All degrees are in Transportation Engineering.

# List of Posters by Students and Young Professionals

**1. Title:** Quantifying the effect of suffusion on strength of soil using network-science based community detection method
**Presenter:** Hui Tao
**Advisor:** Junliang Tao
**University:** The University of Akron
**Email:** ht25@zips.uakron.edu

**2. Title:** Study of Near-Surface Shear Failure in Airport Asphalt Pavements under Varying Aircraft Ground Manoeuvring
**Presenter:** Maoyun Li
**Advisor:** Hao Wang
**University:** Rutgers, The State University of New Jersey
**Email:** ml929@scarletmail.rutgers.edu

**3. Title:** Study on microstructure of rubberized hot recycled asphalt mixture based X-ray CT technology
**Presenter:** Ran Zhang
**Advisor:** Hainian Wang and Zhanping You
**University:** Chang'An University
**Email:** shaozhang11@163.com

**4. Title:** Recent Development of Aggregate Image-based Modeling in Highway Engineering
**Presenter:** Fangyuan Gong
**Advisor:** Zhanping You and Yu Liu
**University:** Chang'An University
**Email:** fgong1@mtu.edu

**5. Title:** Influence of graphene oxide as a surface sealer on microstructure of cementitious mortars
**Presenter:** Jialuo He
**Advisor:** Xianming Shi
**University:** Washington State University
**Email:** jialuo.he@wsu.edu

**6. Title:** Improved Transport Properties of Mortar by Graphene Oxide Modified Surface Sealer
**Presenter:** Yu Jiang
**Advisor:** Xianming Shi
**University:** Washington State University
**Email:** yu.jiang@wsu.edu

**7. Title:** Performance Analysis of Horizontal Ground-coupled Heat Pump System in Different Configurations and Geological Design Conditions
**Presenter:** Chanjuan Han
**Advisor:** Xiong (Bill) Yu
**University:** Case Western Reserve University
**Email:** cxh432@case.edu

**8. Title:** Snow fences for reducing the impacts of snow drifts on highways: A renewed perspective
**Presenter:** Sen Du
**Advisor:** Xianming Shi
**University:** Washington State University
**Email:** sen.du@wsu.edu

**9. Title:** Sustainable landslides mitigation with renewable wind energy
**Presenter:** Jiale Li
**Advisor:** Xiong (Bill) Yu
**University:** Case Western Reserve University
**Email:** jxl780@case.edu

**10. Title:** Measurement of Clay Particle Interaction Force using Atomic Force Microscopy
**Presenter:** Yuan Guo
**Advisor:** Xiong (Bill) Yu
**University:** Case Western Reserve University
**Email:** yxg223@case.edu

**11. Title:** Monte Carlo Simulation Based Assessment of Risks Associated with PPP Investments in Toll Highway Infrastructure
**Presenter:** Zhe Han
**Advisor:** Zhanmin Zhang
**University:** The University of Texas at Austin
**Email:** hanzhe@utexas.edu

**12. Title:** Effect of microbial induced calcite precipitation on surface erosion and scour of granular soil: proof of concept
**Presenter:** Ruotian Bao
**Advisor:** Junliang Tao
**University:** The University of Akron
**Email:** rb127@zips.uakron.edu

**13. Title:** Penetration in sand with a changing geometry: insights from DEM Modeling
**Presenter:** Sichuan Huang
**Advisor:** Junliang Tao
**University:** The University of Akron
**Email:** sh141@zips.uakron.edu

**14. Title:** Experimental and Numerical Investigations on the Performance of Sacrificial Piles in Reducing Local Scour around Pile Groups
**Presenter:** Chen Wang
**Advisor:** Fayun Liang and Xiong (Bill) Yu
**University:** Tongji University / Case Western Reserve University
**Email:** cwang330@hotmail.com

**15. Title:** Effects of Preparation Procedure on the Rheological Properties of Asphalt Rubber Modified with Liquid Warm Mix Additive
**Presenter:** Huayang Yu
**Advisor:** Zhen Leng
**University:** The Hong Kong Polytechnic University
**Email:** 13900586r@connect.polyu.hk

16. **Title:** Electrospun Fabrication of Nanocomposite Fiber
**Presenter:** Zhuoying Jiang
**Advisor:** Xiong (Bill) Yu
**University:** Case Western Reserve University
**Email:** zxj45@case.edu

17. **Title:** Experimental Study on Local Scour around Piers with Various Streamlining Extents
**Presenter:** Junhong Li
**Advisor:** Junliang Tao
**University:** The University of Akron
**Email:** jl175@zips.uakron.edu

18. **Title:** Microstructure-Based Random FEM Model for Holistic Simulation of the Coupled Thermo-hydro-mechanical Behaviors in Unsaturated Frozen Soils
**Presenter:** Shaoyang Dong
**Advisor:** Xiong (Bill) Yu
**University:** Case Western Reserve University
**Email:** sxd405@case.edu

19. **Title:** Reaction mechanism of graphene oxide in a chemically activated fly ash binder
**Presenter:** Gang Xu, P.E.
**Advisor:** Xianming Shi
**University:** Washington State University
**Email:** gang.xu@wsu.edu

20. **Title:** Corrosion Behavior of C1010 Carbon Steel in the Presence of an Apple Pomace Derived Green Inhibitor
**Presenter:** Mehdi H. Nazari, Ph.D.
**Advisor:** Xianming Shi
**University:** Washington State University
**Email:** m.honarvarnazari@wsu.edu

21. **Title:** Evaluation of Pavement Responses and Performance with Thermal Modified Asphalt Mixture
**Presenter:** Jiaqi Chen, Ph.D.
**Advisor:** Hao Wang
**University:** Central South University / Rutgers, The State University of New Jersey
**Email:** chenjiaqi@csu.edu.cn

# IACIP

## 2017 ANNUAL MEETING BANQUET

**(Delicious Chinese Food, Wine, Raffle Draws, Karaoke, etc.)**

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

January 8, 2017
7:00 p.m. to 11:00 p.m.

CHINATOWN GARDEN
**龍之味**

618 H Street NW, Washington, D.C.


# Directions:

1. **Take the subway Red/Green/Yellow line towards Washington, D.C. Downtown**
   **乘坐前往Washington, D.C.市中心的地铁**
2. **Exit at Gallery Place/Chinatown Station**
   **在中国城站Gallery Place/Chinatown下車**
3. **Take the 7th St./H St. Exit**
   **从7th St./H St.出口出站**
4. **The restaurant is across the intersection at 618H St**
   **出站后过街(H St.)，龍之味饭店在H街618號**