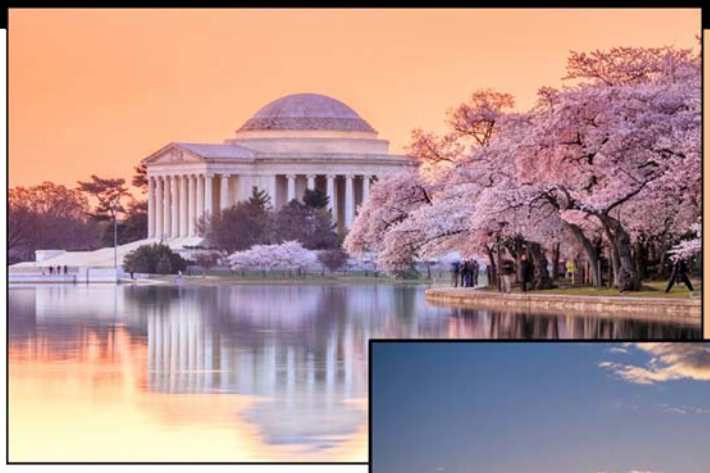
2016

THE 6TH IACIP ANNUAL WORKSHOP



Asia-US Infrastructure Technology Exchange Forum

Date: Sunday Jan 10, 2016
Time: 8:00 AM to 5:20 PM
Room: Supreme Court (M4),
Marriott Marquis
Washington, DC

THE 6TH IACIP ANNUAL WORKSHOP PROGRAM

Asia-US Infrastructure Technology Exchange Forum

Date	**Sunday Jan 10, 2016 from 8:00 AM to 5:20 PM**
Location	**Supreme Court (M4), Marriott Marquis at 901 Massachusetts Avenue, Washington, D.C.**
8:00 – 8:30	**Registration, Poster (Moderators: Dr. Xiong Yu and Shenghua Wu)**
8:30 – 8:40	**Conference Opening by Dr. Haifang Wen, Chair of IACIP Annual Workshop** • Introduction of members of the organizing committee • Acknowledge the sponsors of the annual workshop
8:40 – 8:45	**Welcome remark by Dr. Yingwu Fang, President of IACIP**
8:45 – 9:15	**Keynote Speaker** (Moderator: Dr. Hongbin Xie) • Dr. Rongji Cao, Vice president of Jiangsu Transportation Institute, "20-year Development of Superpave in China."
9:15 – 9:45	**Posters** (Moderators: Dr. Xiong Yu and Shenghua Wu)
9:45 – 11:05	**Session I** (Moderators: Dr. Xiong Yu and Dr. Xinbao Yu) • Dr. Nenad Gucunski, Rutgers University, "Robots to the Rescue: Concrete Bridge Deck Early Problem Detection and Mitigation." • Dr. Xinzhuang Cui, Shandong University, "Development and Calibration of Sensor-Enabled Geosynthetics." • Dr. Zhongren Wang, California Department of Transportation, "PaveM-The Caltrans Pavement Management System."
11:05-12:00	**Session II** (Moderators: Dr. Chung Wu and Dr. Zhanping You) • Dr. Bouzid Choubane, Florida Department of Transportation, "Accelerated Pavement Testing and Florida's Experience." • Dr. Zhiguo Yan, Tongji University, "Dynamic Construction and Visualization of Tunnel Fire Scenarios for Emergency Evacuation and Fire-Fighting."
12:00 – 1:30	**Lunch Break**
1:30 – 1:35	**Welcome next IACIP president, Dr. Yingwu Fang and Dr. Jie Han**
1:35 – 2:05	**Keynote Speaker** (Moderator: Dr. Haifang Wen) • Dr. Tuncer Edil, Professor, University of Wisconsin-Madison, "Toward More Sustainable Transportation Infrastructure."

2:05 – 3:25	**Session III** (Moderators: Dr. Xianming Shi and Shenghua Wu) • Dr. Chunying Wu, Jiangsu Transportation Institute, "Introduction of ERS Steel Deck Pavement Technique." • Dr. Yu Liu, Chang'an University, "On-going Research on Image-based Aggregate Morphology and DEM-based Mixture Structural Analysis." • Dr. Hui Li, Tongji University, "Full-Scale Structural Testing and Development of M-E Design Guidelines for Permeable Interlocking Concrete Pavement."
3:25 – 3:55	**Posters** (Moderators: Dr. Xiong Yu and Shenghua Wu)
3:55 – 5:15	**Session IV** Moderators: Dr. Xinzhuang Cui and Dr. Zhen Feng • Dr. Xueyan Liu, Delft University of Technology, "Numerical and Experimental Characterization of the Adhesive Bonding of Asphalt Surfacing on Steel Bridge Decks." • Dr. Balasingam Muhunthan, Washington State University, "Granular Fabric of Sands: Implications to Critical State and Mechanistic modeling." • Dr. Yijong (Richard) Ji, Indiana Department of Transportation, "Field and Laboratory Determination of Subgrade Resilient Modulus and Its Application in Pavement Design."
5:15-5:20	**Workshop Adjoin**: Dr. Haifang Wen

BANQUET

6th IACIP Annual Banquet (More info. at the end of this brochure)

Sunday Jan 10, 2016 from 6:30 PM to 9:30 PM

Tony Cheng's Seafood Restaurant (中国城海鲜大酒楼), 619 H Street NW, 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: $25
4. Students with IACIP membership registration and banquet ticket: $10
5. Any one buy banquet ticket only/separately (at workshop or restaurant): $25
6. Complimentary workshop registration and banquet for speakers, representative from sponsors, one student for the student posters, and organizing committees (including student members).

ORGANIZING COMMITTEE

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Haifang WEN, Washington State University

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Zhen FENG, ATCS, P.L.C.
Jie HAN, University of Kansas, Vice President of IACIP
Xiaojun LI, Washington State University
Xianming SHI, Washington State University
Haifang WEN, Washington State University, Chair of Organizing Committee of Workshop
Chung WU, Virginia Department of Transportation, Vice President IACIP
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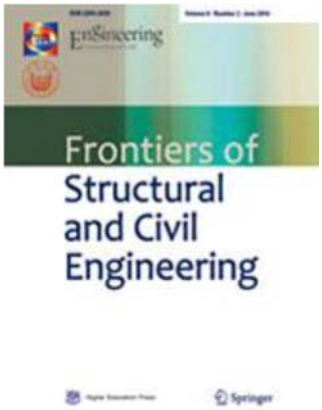
FSCE Journal (Frontiers of Structural and Civil Engineering, Transaction of Chinese Academic Engineering)



FAHE Roadway Technology & Equipment

PRESENTATION ABSTRACTS

20-year Development of Superpave in China

Dr. Rongji Cao
Vice president, Jiangsu Transportation Institute (JSTI) Group
Director, National Engineering Laboratory for Advanced Road Materials

Abstract:
In the 1990s, Superpave technology has brought worldwide attention and interests and significantly influenced the asphalt industry. Since the first set of Superpave test equipment was introduced in 1995, Superpave technology has developed for 20 years in China. Through the introduction, application and innovation, Superpave technology has already been localized and suitable for traffic situation, climate and engineering characteristics in China. The related research achievement has already been implemented in local specifications and national standard. Until now, Superpave mixture design method has been widely applied in nearly 20 provinces in China, and the roadway mileage has already exceeded ten thousands kilometers. It is instrumental for reform and progress in road engineering, improvement of pavement design and construction technology in China.

Research shows that the service life pavement can be extended by 25% when using the Superpave design method. At the end of 2015, the total mileages of China's highway achieves 4.5 million kilometers and the road construction investment each year reaches hundreds millions of dollars. Extension of pavement service life means the huge direct and potential economic benefits.

About Dr. Rongji Cao:

He is the vice president and senior researcher of Jiangsu Transportation Institute (JSTI) Group and the director of National Engineering Laboratory for Advanced Road Materials (NLARM). He got Ph.D. degree from Southeast University in road and railway engineering. He has 20 years of experience in asphalt mixture design, quality control, and pavement rehabilitation. He also engages in implementation of asphalt rubber in China and the asphalt rubber ambassador of Rubber Pavements Association (RPA). He has published over 40 papers and has 6 patents.

Robots to the Rescue: Concrete Bridge Deck Early Problem Detection and Mitigation

Dr. Nenad Gucunski, Professor and Chair, Rutgers University

Abstract:
More economical management of bridges can be achieved through early problem detection and mitigation. Development and implementation of two fully automated (robotic) systems for nondestructive evaluation (NDE) and minimally invasive rehabilitation will be presented. The NDE system named RABIT was developed with the support from Federal Highway Administration. It implements multiple NDE technologies to assess internal deterioration and advanced vision to complement traditional visual inspection. The RABIT system collects data at significantly higher speeds than it is done using traditional NDE equipment. The associated platform for the enhanced interpretation of condition assessment in concrete bridge decks utilizes data integration, and deterioration and defect visualization. The data visualization platform facilitates an intuitive presentation of the main deterioration due to: corrosion, delamination, and concrete degradation, by integrating NDE survey results and high resolution deck surface imaging. The rehabilitation robotic system was developed with the support from National Institute of Standards and Technology-Technology Innovation Program. The system utilizes advanced robotics and novel materials to repair problems in concrete decks, primarily early stage delamination and internal cracking, in a minimally invasive way. Since both systems use global positioning systems for navigation, some of the current efforts concentrate on their coordination for most effective joint evaluation and rehabilitation.

About Dr. Nenad Gucunski:

Dr. Nenad Gucunski is professor and chairman of Civil and Environmental Engineering at Rutgers University. He is also Director of Infrastructure Condition Monitoring Program at Rutgers' Center for Advanced Infrastructure and Transportation (CAIT). His expertise is in NDT/NDE of transportation infrastructure and has published more than 150 publications on various aspects of the NDE/NDT technologies development, application and automation. He is/was leading a number of important infrastructure related research projects. These include the NIST-TIP (National Institute of Standards and Technology-Technology Innovation Program) ANDERS project on the development of a systems of devices for local and global NDE assessment and rehabilitation of bridges, SHRP 2 (Strategic Highway Research Project 2) project on NDE for Bridge Decks, the Lead of the NDE Team for FHWA's Long Term Bridge Performance (LTBP) Program, and several other projects for state and federal government and industry. He is an active member of a number of societies and is serving as the chair of the ASCE's Geophysical Engineering Committee. Dr. Gucunski and his team are the recipient of the 2014 ASCE Charles Pankow Award for Innovation for the development of RABIT (Robotics Assisted Bridge Inspection Tool) for bridge decks.

Development and Calibration of Sensor-Enabled Geosynthetics

Dr. Xinzhuang Cui
Professor, Shandong University

Abstract:
Based on the strain sensitivity of electrical conductivity of conducting polymer, two types of sensor-enabled geosynthetics were developed by adding superconducting carbon black (CB) and multiwalled carbon nanotube (MCNT) into high density polyethylene (HDPE), respectively. The percolation threshold and the optimum content of conducting filling were identified. Through the uniaxial test, the tensile and creep properties of sensor-enabled geosynthetics were tested and its strain sensitivity of electrical conductivity was evaluated. In-soil pull-out tests were implemented to simulate the actual engineering situation and verify the performance of sensor-enabled geosynthetics. The influences of soil compaction degree and applied normal load on the electrical conductivity of sensor-enabled geosynthetics were analyzed.

About Dr. Xinzhuang Cui:

Xinzhuang Cui, professor, the director of Engineering Research Center for Yellow River Alluvial Soil, Shandong University. Dr. Cui is the New Century Excellent Talents in University of Ministry of Education of China. Dr. Cui's group focuses on the researches of the pavement mechanics and the technologies of road embankment construction in Yellow River alluvial region, soil reinforcement and ground improvement. His researches were sponsored by two National Programs on Key Basic Research Project of China (973 Program), four Natural Science Foundations of China and the Science Fund for Distinguished Young Scholars of Shandong Province. Dr. Cui has published 15 SCI papers and applied for 40 patents.

PaveM - The Caltrans Pavement Management System

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

Abstract:
Over the last several years, California Department of Transportation developed its new Pavement Management System, PaveM. It is a lane-based system depending entirely on automated pavement condition survey. Its engineering configuration, reporting functions, together with the challenges for its further improvement and implementation will be presented in this presentation.

About Dr. Zhongren Wang:

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.

Accelerated Pavement Testing and Florida's Experience

Bouzid Choubane, Ph.D., P.E., State Pavement Materials Engineer
Telephone: 352-955-6302, Fax: 850-412-8345, Email: bouzid.choubane@dot.state.fl.us

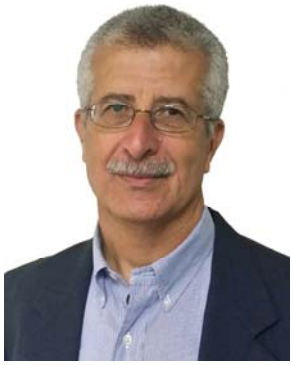
Abstract:

Since the Florida Department of Transportation (FDOT) has initiated its Accelerated Pavement Testing (APT) program in 2000, it has become a critical component of its pavement research program providing engineers with insight into new pavement technology, design methods, and construction practices. The success of the program can be attributed to the careful selection of research projects that address critical pavement performance issues and prolong the life of Florida's roadways and the subsequent implementation of research findings. While a specific economic benefit cannot be quantified for each project, significant savings can be directly attributed to the implementation of results from APT research projects. For illustrative purposes, it is conservatively estimated that over $4 million is saved annually as a result of APT research on polymer modified asphalt binders and fine-graded asphalt mixtures and the subsequent implementation of the findings.

This presentation will provide a description of the Florida's APT program and some of the investigative studies conducted thus far.

About Dr. Bouzid Choubane:

Dr. Choubane earned a Master of Science (M.S.) degree from the University of Pennsylvania and a doctoral (Ph.D.) degree from the University of Florida. He is a registered Professional Engineer in the State of Florida. Dr. Choubane has been actively involved in developing, improving, implementing, and managing technologies for highway pavements for more than 25 years. He is currently the State Pavement Materials Engineer for the Florida Department of Transportation (FDOT). In this role, he is responsible for providing strategic direction and oversight for pavement-related work and research programs.



Dr. Choubane has also been involved in pavements and pavement materials issues at the national and international levels. He serves on a number of committees of the TRB of the National Academies, Expert Task Groups as well as on various technical advisory panels and editorial boards. He is past chair of the TRB Committee on Full-Scale Accelerated Pavement Testing and past chair of ASTM International Committee on Pavement Management. He has served as a member of the University of North Florida College of Engineering Advisory Board and is also a Courtesy Professor at the Department of Civil and Coastal Engineering of the University of Florida. He authored or co-authored over sixty peer-reviewed technical papers and served as the editor for two Special Technical Publications.

Dynamic Construction and Visualization of Tunnel Fire Scenarios for Emergency Evacuation and Fire-Fighting

Dr. Zhiguo Yan and Dr. Hehua Zhu
State Key Laboratory for Disaster Reduction in Civil Engineering, Department of Geotechnical Engineering, Key Laboratory of Geotechnical and Underground Engineering of the Ministry of Education, Tongji University, 1239 Siping Road, Shanghai 200092, China

Abstract:
For road tunnels, because of its confined space and insufficient exits, fires usually result in fast temperature rise, high peak temperature and severe accumulation of hot toxic smoke within in the tunnels. High temperature seriously damages tunnel lining structures and operation equipment installed within the tunnels such as video monitor, signal board and lighting. Hot smoke, which is the most fatal factor on emergency evacuation and rescue in tunnel fires not only reduces visibility, blocks safe evacuation and fire-fighting, but also causes passengers and firefighters death. Numerous serious tunnel fires worldwide distinctly emphasized the importance of prompt and effective evacuation and appropriate fire rescue, especially for long tunnels with heavy traffic densities. The prompt and effective evacuation and fire rescue depends on quick and accurate fire detection and alarm, effective emergency ventilation and smoke control as well as appropriate fire-fighting strategies and emergency management, which all are clearly related to real-time situation within the accident tunnel. In this paper, an attempt has been made to get real-time information of accident tunnel with longitudinal ventilation through construction and visualization fire scenario during fire accidents. The newly developed method, full-scale experimental tests and engineering application are present in this works.

About Dr. Zhiguo Yan:
Dr. Zhiguo Yan is an Associate Professor at Tongji University. His main research interests are fire safety in tunnel and underground space, mechanical behaviors and high temperature performance of tunnel structures, and modeling and testing for microcapsule-enabled self-healing cementitious composite.

Toward More Sustainable Transportation Infrastructure

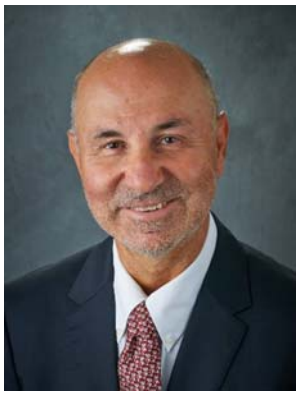
Dr. Tuncer B. Edil
University of Wisconsin-Madison, Madison, Wisconsin, USA
Email: edil@engr.wisc.edu

Abstract:
Recyclable materials and industrial byproducts provide an environmentally and economical alternative to natural earthen materials when used safely and wisely in geotechnical construction. In particular, the construction of various elements of transportation systems requires large quantities of materials and locally available recyclable materials can be used extensively enhancing sustainability of construction, such as recycled asphalt pavement and concrete aggregate, coal combustion residues (fly ash, bottom ash). These materials need to be characterized relative to their mechanical properties relevant to the application. Durability characteristics such as freeze-thaw and wet-dry resistance is important in transportation application as these materials are used near surface. Being recycled materials or industrial byproducts, their acceptance requires an assessment of environmental suitability in terms of handling and potential impacts on surface and ground water quality. Finally, their constructability and field behavior need to be evaluated. Unlike natural earthen materials, i.e., soils and rock, we do not have many decades of experience with these materials that create challenges in their acceptance. However, their role in sustainable earthen construction is central. Because these materials need not to be mined and require little processing, they reduce energy consumption and greenhouse gas generation associated with these processes. Sometimes they offer superior properties to conventional materials or enhance the properties of conventional materials thus reducing the amount of material required contributing to sustainability. Needless to say there are significant financial benefits as recyclable materials typically cost less. Sustainability evaluation (i.e., life cycle assessment and life cycle cost analysis) of material alternatives in a project is described using a sustainability-rating program called BE^{2}ST-in-Highways (Building Environmentally and Economically Sustainable Transportation-Infrastructure-Highways).

In the U.S., the rail industry spends $500 Million per year for Class 1 railway maintenance due to degradation of the ballast layer supporting the track. Certain components of the railway require maintenance more frequently due to unpredicted or accelerated deterioration (i.e., bolted rail joints, crossings, bridge approaches, etc.). One primary contributor to substructure deterioration is ballast fouling. As the amount of fouling increases, the strength of the ballast layer decreases, leading to higher rates of track deformation and failure. Thus, prevention or mitigation of fouling would greatly reduce costs for railway track and ballast maintenance. A new technology under evaluation aims at stabilizing the track substructure by injection of polyurethane into the ballast layer. In this study, several new polyurethane injection techniques were developed and tested. For polyurethane stabilized ballast, in static and cyclic compression tests, accumulation of plastic strain was 60-85% less and compressive strength 90% higher than untreated ballast. In flexural strength and flexural fatigue beam tests, flexural strength and fatigue behavior were comparable to soil-cement. Strategic polyurethane injection into defective substructure is; in essence, a surgical tool to enhance strength and performance of problematic railway elements, avoid disruptive and expensive maintenance activities, and lengthen track lifecycle and sustainability.

About Dr. Tuncer Edil:

Dr. Tuncer Edil has been an active researcher and educator for nearly 35 years at the University of Wisconsin-Madison. He is currently serving as Research Director of the new Recycled Materials Resource Center sponsored by FHWA and Wisconsin Highway Research Program. He has undertaken several projects relating to highway construction and has been actively involved in the use of recycled materials. He was appointed as founding Chair of newly formed ASTM Subcommittee D18.14 on Geotechnics of Sustainable Construction. Dr. Edil is a former Editor-in-Chief of ASCE's Journal of Geotechnical Engineering and current Editor-in-Chief of Geotechnical and Geological Engineering journal. He is the recipient of numerous personal and team/project awards from ASCE, ASTM, and other organizations. He is the holder of the 2007 Special Science Award from the Scientific and Technological Research Council of Turkey. He served as President of the U.S. Universities Council on Geotechnical Education & Research and President of the ASCE Wisconsin Section. He received 2013 Thomas A. Middlebrooks Award, Terzaghi Award and the rank of Distinguished Member from ASCE.



Introduction of Epoxy-Resin-Stone (ERS) Steel Deck Pavement Technique

Dr. Chunying Wu
National Engineering Laboratory for Advanced Road Materials, JSTI GROUP, Nanjing, P.R. China

Abstract:
At present, the construction of long-span steel bridge in China is in the peak period. Since 1990s, some typical design methods have been introduced for steel bridge deck pavement, such as double-layer stone mastic asphalt (SMA), double-layer epoxy asphalt concrete, guss asphalt concrete etc. However, each method has its own defects and is not applicable to all the situations.

Epoxy-resin-stone (ERS) is an independent innovation and an integrated technique for steel deck pavement. ERS steel deck pavement structure is made up of three layers, which are epoxy bonding chips layer (EBCL), RA05 and SMA10 from bottom to top. EBCL is the adhesion layer between steel deck and Resin asphalt (RA05) layer to provide the shearing resistance and RA05 is the united layer as a stiffness step and a heat insulation layer in the deck pavement. SMA10 is the function layer to provide the comfortable and safety traveling. Based on the engineering practice experiences, this new structure fully utilize the advantages of the materials and has a better workability than the other kinds of steel deck pavements. Furthermore, ERS is more efficient in the life cycle of the steel deck pavement.

About Dr. Chunying Wu:

Dr. Chunying Wu received her PhD from Shanghai Jiao Tong University. She was a Nuffic Holland government scholarship winner, head of the Division of Materials and Pavement of Jiangsu Transportation Institute Group. Her research area includes asphalt materials, pavement structure design, anti-cracking water-stabilization bases, concrete bridge deck pavement technology, pavement maintenance technology, etc. She was leading and participating in many projects on scientific research, pavement design, and consultation of highway construction and has rich experience in research and engineering practice. The project of "Investigation of double-layer SMA mixture of Concrete Bridge Deck Pavement" won the outstanding Award from China Highway and Transportation Society. She published 19 papers and obtained 6 national patents.

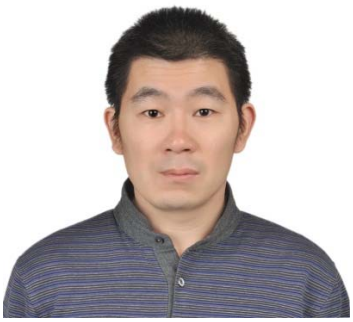
On-going Research on Image-based Aggregate Morphology and Discrete Element Method (DEM)-based Mixture Structural Analysis

Dr. Yu Liu and Zhanping You
Highway School of Chang'an University, South Erhuan Middle Section, Xi'an City, Shanxi Province, 710064, China

Abstract:
Mineral aggregates are the most important highway construction materials and have been extensively studied in decades. Different from the traditional experiment-based approaches, X-ray Computational Tomography (X-ray CT) was employed in this on-going research to scan individual aggregate particles and a small library of aggregate images have been built in a well-organized mode. Through a newly-developed MATLAB program, aggregate particle surface were characterized with the Fourier functions and spherical harmonics. Morphological features of aggregate particles were quantified through operating mathematical analysis on the corresponding Fourier functions or spherical harmonics.

The aggregate particles' Fourier functions and spherical harmonics were further employed by the DEM-based mixture structure analysis: the basis for structural analysis is the reconstruction of individual aggregate particles, mixing of individual particles, compaction under the gravity load, compaction under various compaction energy, and mechanical analysis of stone-based materials. Through analyzing the DEM simulation results, the ultimate goal of this research is to improve understanding of mineral aggregates. Through this research, various findings have been observed and will be presented in the workshop.

About Dr. Yu Liu:
Dr. Yu Liu is an associate professor from Highway School of Chang'an University located at Xi'an City of China. He was studying at Department of Civil & Environmental Engineering in Michigan Technological University from 2007 to 2011 for his Ph.D. degree. His doctoral research is focused on asphalt concrete microstructure and micromechanics under supervision from Prof. Zhanping You. After graduation from Michigan Tech., Dr. Liu came back to China and joined Highway School of Chang'an University. His current research areas include (1) aggregate morphology through X-ray CT & MATLAB programming; (2) lab tests and virtual tests on stone-based mixes based on discrete element modeling; (3) pavement engineering in special regions. The courses which Dr. Liu are teaching Highway Pavement Engineering, European & American Highway Design Standards, Asphalt & asphalt mixtures, and Micro-structural and Numerical Analysis of Highway Construction Materials.



Full-Scale Structural Testing and Development of M-E Design Guidelines for Permeable Interlocking Concrete Pavement

Hui Li[a,c*], David Jones[a], Rongzong Wu[a], John Harvey[a] and David R. Smith[b]

a University of California Pavement Research Center, Dept. of Civil and Environmental Engineering, University of California, Davis, CA 95616, USA
b Interlocking Concrete Pavement Institute, 14801 Murdock Street, Suite 230, Chantilly, VA 20151 USA
c College of Transportation Engineering; Tongji University; Shanghai, 201804, China
*Ph: +1 530-752-5363; Fax: +1 530-752-9189; Email: hili@ucdavis.edu

Abstract:
Although permeable pavements are becoming increasingly common for stormwater management across the world, they are mostly used in parking lots, basic access streets, recreation areas, and landscaped areas, all of which carry very light, slow moving traffic. Only very limited research has been undertaken on the mechanistic design and long-term performance monitoring of permeable pavements carrying higher traffic volumes and heavier loads, and previous work has focused primarily on permeable pavements with open-graded (porous) asphalt or (pervious) Portland cement concrete surfacing. Very little research has been undertaken on the behavior of permeable interlocking concrete pavement as a surface and structure to support more heavy trucks.

To understand how permeable interlocking concrete pavements (PICP) perform under heavy traffic loading, a research project was conducted at the University of California Pavement Research Center (UCPRC) with funding from the interlocking concrete pavement industry. The results of this project were used to develop a mechanistic-empirical (M-E) design method for PICP. This method is based on mechanistic analysis and was partially validated with accelerated pavement testing (APT) results. This paper presents a summary of the structural performance of PICP under heavy traffic loading with a Heavy Vehicle Simulator (HVS). The results include the rutting performance of PICP sections with three different thicknesses of subbase layer (reservoir layer) under dry, wet and drained conditions and with different load levels. The rut development with loading repetitions in the surface, base and subgrade layers is discussed.

About Dr. Hui Li:

Dr. Hui Li is Professor in the School of Transportation at Tongji University, Shanghai, China with support from "China 1000s Plan" (www.1000plan.org), and adjunct research scientist in the Department of Civil and Environmental Engineering at the University of California Davis. Dr. Li is a registered Professional Engineer in the State of California. He completed his Ph.D. in Civil and Environmental Engineering at University of California Davis. He holds a B.S. in Civil Engineering and a M.S. in Highway and Railway Engineering from the Southeast University, Nanjing, China. Dr. Li also holds a M.S. in Environmental and Resource Economics from University of California, Davis. Dr. Li's research interests include sustainable pavement, resilient infrastructure systems, sustainable development in built environment, environmental impact assessment, life cycle assessment, and numerical modeling and simulation. Dr. Li has authored more than 50 publications and 3 patents, including 3 books or chapters and over 20 SCI journal articles. Dr. Li is member in TRB Committee of Environmental Analysis in Transportation (ADC10), RILEM Committee of Engineered Healing of Asphalt Concrete (EHA), ASCE Committee of the Transportation & Development Institute, ACI Technical Committee of Sustainability of Concrete (ACI 130) and Pervious Concrete (ACI 522), International Association of Life Cycle Civil Engineering (IALCCE), Association of Environmental and Resource Economists (AERE).

Numerical and Experimental Characterization of the Adhesive Bonding of Asphalt Surfacing on Steel Bridge Decks

Dr. Xueyuan Liu, Delft University of Technology
E-mail: X.Liu@tudelft.nl

Abstract:
Since the first orthotropic steel deck bridge (OSDB) was opened in 1950 over the Neckar River in Mannheim, Germany, the OSDB has become a popular economical alternative when the following issues are important: lower mass, ductility, thinner or shallower sections, rapid bridge installation, and cold-weather construction . Nowadays more than 1000 orthotropic steel bridges have been built in Europe, out of which 86 are in the Netherlands. OSDBs are also popular in Asia and especially in China and Japan. The application of OSDBs is developing fast in China.

In the Netherlands, an asphaltic surfacing structure for orthotropic steel bridge decks mostly consists of two structural layers. The upper layer consists of porous asphalt (PA) because of reasons related to noise reduction. For the lower layer a choice between mastic asphalt (MA), or guss asphalt (GA), can be made. Mostly, various membrane layers are involved, functioning as bonding layer, isolation layer as well as adhesion layer.

The asphalt surfacing structures for OSDBs is a complicated and yet not properly solved technical problem. The high flexibility and large local deformations, wind and earthquake forces, temperatures and other natural factors make the problem even more complicated. Due to the special characteristics of OSDBs, fatigue cracking, rutting, delaminating and other damage types are commonly reported and these severely destroy the performance of steel bridges. Fatigue damage can also occur at the interface regions between the membrane layers and the surfacing layers but, also, within the membrane materials. It is necessary to study into the damage mechanism, distributions, evolution etc. in the surfacing systems on OSDBs. Laboratory or in-site field tests of damages on bridge pavements are quite costly in time as well as the budget. Proper FE models are always helpful and economical as an auxiliary method.

In this presentation, firstly, the development of an adhesive contact interface element implemented within the FE package CAPA-3D is described. This element is used in FE simulations to model the adhesive and contact behavior of the membrane to the surrounding substrate materials. The element includes several new features necessary for the modelling of adhesive delamination of flexible membranes. The contact constraint conditions allows for modelling no-penetration, stick and frictional slippage between two objects. An adhesive traction-separation law that governs the constitutive response of the element will be presented.

The model was calibrated and verified by comparing the model predictions and experimental tests on Membrane Adhesion Test (MAT) and 5-Point Bending (5PB) test specimens. By using the proposed model, the development of fatigue damage and the severe damage locations in 5PB beam are investigated. Thirdly, the evolution of damages for four selected multilayer surfacing systems at temperatures +10°C are simulated.

About Dr. Xueyuan Liu:

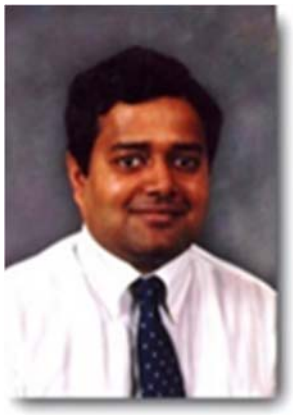
Dr. Liu is currently a Senior Researcher in the Section of Pavement Engineering of the Faculty of Civil Engineering & Geosciences of TU Delft. His research interests include constitutive modelling of pavement materials, pavement mechanics and material experimental characterization, asphalt surfacings on orthotropic steel deck bridge, inter layer systems, induction healing in asphalt materials, non-linear finite element analysis techniques and mechanics of multiphase media etc. Dr. Liu has published more than 100 technical and journal papers on the mechanics and the finite element modelling of granular, concrete and asphaltic materials. Dr. Liu is a member of RILEM Technical Committee of Cracking in Asphalt Pavements WG3 and a member of Delft Centre for Materials (DCMat). He is also a member of ISAP, AAPT and IACMAG and MPC.

Granular Fabric of Sands: Implications to Critical State and Mechanistic modeling

Dr. Balasingam Muhunthan
Professor and Chair of Civil and Environmental Engineering
Washington State University

Abstract:
Recent advances in our understanding of the micro-and meso-physics of granular materials enables us to develop models that can capture the effects of granular fabric on their mechanical behaviour. In this presentation we describe a mechanistic model, which recognizes that volume changes in granular materials are induced by two mechanisms. One is purely kinematic, and is a result of individual grains having to move over each other in a shear deformation: "The Reynolds Effect". This is the defining characteristic of the mechanics of granular materials. The second cause of volume changes is as a direct response to changes in stress, as in any standard continuum. These conceptual ideas are used to systematically develop a family of elastic/plastic models, involving non-associated flow rules, isotropic and kinematic hardening, and induced anisotropy. The recognition of the two distinct mechanisms of volume change shows that the classical concept of a critical state widely used in soil modelling must be replaced with the more general concept of a "Reynolds Taylor State" to better explain the observed experimental behaviour in sands. In this state, which is attained early on in a deformation, the sand is still dilating but the difference between the stress and dilation ratios is constant (Taylor's stress-dilatancy relation), as is the effective pressure. In a general deformation, the shear stress, and stress and voids ratios do not become constant until later in the deformation, when a critical state is finally attained. Implications of this paradigm shift to modelling granular media are highlighted.

About Dr. Balasingam Muhunthan:



Dr. Balasingam Muhunthan is Professor and Department Chair of the Department of Civil and Environmental Engineering at Washington State University. He received his Ph.D. in Civil Engineering from Purdue University in 1991 in the area of geomechanics. He has been with WSU since graduation and is also the Founding Director of the X-ray computed tomography laboratory. He has held visiting professorships at Cambridge University, University of Auckland, and the Georgia Institute of Technology.

Dr. Muhunthan has gained national and international renown for the body of work he has produced on the advanced microstructure characterization of materials, constitutive modeling, and analysis of dam failures. He has published his research extensively, secured more than $ 8.0 million in research funds, and has been invited to present seminars at several universities and forums around the world. His numerous accolades include the Crampton Prize from the Institute of Civil Engineers UK, Outstanding Researcher Award from the Department of Civil and Environmental Engineering, Excellence in Teaching Award from the Department of Civil and Environmental Engineering as well as the College of Engineering at Washington State University, International Fellowship Award from the US National Science Foundation, and Fellowships from Churchill College, Cambridge and Purdue University. Dr. Muhunthan is a Fellow of ASCE and is a licensed professional engineer in the state of California.

Field and Laboratory Determination of Subgrade Resilient Modulus and Its Application in Pavement Design

Yijong (Richard) Ji, Ph.D., P.E.,
INDOT Office of Research and Development, 1205 Montgomery Street, West Lafayette, Indiana 47906, USA. Email: yji@indot.in.gov, Tel: 765-463-1521 ext. 252, Fax: 765-497-1665

Abstract:
This paper presents a comparison study of the experimental results from the falling weight deflectometer (FWD) test and laboratory resilient modulus test on granular subgrade materials and its application in flexible pavement design. Field and laboratory testing programs were conducted to develop an practical methodology for estimating resilient modulus (Mr) values of subgrade soils for use in the design of pavement structures in this paper. Soil characterization database was established, A multiple regression model can be used to predict Mr value using several factors including soil properties, soil type and state of stresses for three popular AASHTO soil types (A-4, A-6 and A-7-6) in Indiana, and this prediction models developed were verified compared with laboratory MR tests with high R2 value. In-situ MR seasonal variation based on abundant FWD test data in five testing sites was conducted in order to find the correlation between resilient modulus, temperature and precipitation for the period from 2006 to 2012. The proposed method can accurately predict subgrade MR in lab. However results from lab testing are significantly lower than recommended rang by MEPDG and backcalculation one after adjust factor of 3. The design examples showed that the seasonal variation of temperature and precipitation can affect the design thickness as much as by 15% in general in the same traffic.

About Dr. Richard Ji:

Dr. Richard Ji is an INDOT pavement structure research engineer, a registered professional engineer in Indiana since 2007. His job duty is responsible for pavement related research and NDT testing includes pavement NDT evaluation, pavement materials, pavement modeling, and pavement design. He is also actively involving with the TRB committee and NCHRP panels. He graduated from Michigan State University with Ph.D in Civil Engineering at 2005. Since then, he published numbers of TRB conference paper, JTRP technical report and peer reviewed journal papers.

Poster: Toward More Sustainable Transportation Infrastructure

Development of an Analytic Approach Utilizing the Extended Common Midpoint Method to Estimate Asphalt Pavement Thickness With 3-D Ground-Penetrating Radar

Shan Zhao and Imad Al-Qadi
University of Illinois at Urbana-Champaign

Abstract: As a nondestructive technique, ground-penetrating radar (GPR) has been applied to estimate asphalt pavement thickness. The extended common midpoint (XCMP) method is a method that can be used on the air-coupled, pulsedhorn antenna to increase the accuracy of asphalt pavement thickness estimation without calibrating the dielectric constant by taking cores. 3-D GPR is a multi-array, stepped-frequency radar that can measure both in-line and cross-line directions at a very close sampling interval. By developing signal-processing and numerical analysis techniques, this research integrates 3-D GPR with the XCMP method. By validating the developed algorithm at a full-scale test site, the study concludes that by using signal processing techniques and numerical analysis approaches, 3-D GPR can be used to accurately predict asphalt layer thickness using the XCMP method when the layer thickness is greater than 114mm.

LIST OF STUDENT POSTERS

1. Title: Experimental Characterization and Microstructure Based Random FEM Simulation of Freezing and Thawing Effects on Soils
Student: Shaoyang Dong
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: sxd405@case.edu

2. Title: Mineral Aggregate Morphological Characterization and its Application through X-ray CT Imaging Analysis and MATLAB Programming
Students: Fangyuan Gong, Shun Yao, Xiaodong Zhou
Advisor: Zhanping You and Yu Liu (Co-advisor)
University: Chang'an University

3. Title: Determination Of Aggregate-Mastic Interface's Property for Potential Numerical Modeling Inputs through Nanoindentation Test
Student: Minghui Gong
Advisor: Jun Yang
University: Southeast University
Email: gong83@purdue.edu

4. Title: A Coupled Fluid-Solid Numerical Model in Describing Soil Particle Movement in both Laminar and Turbulent Flows
Student: Yuan Guo
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: yxg223@case.edu

5. Title: Feasibility of Geothermal Heat Exchanger Piles Based Snow Melting System: A Simulation Based Analysis
Student: Chanjuan Han
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: chanjuan.han@case.edu

6. Title: Feasibility Analyses of Using Renewable Wind Energy for Landslides Mitigation
Student: Jiale Li
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: jxl780@case.edu

7. Title: Erosional behavior of granular materials under turbulence channel flow: Insights from coupled CFD-DEM modeling
Student: Junhong Li
Advisor: Junliang (Julian) Tao
University: University of Akron
Email: jl175@zips.uakron.edu

8. Title: Towards Development of a Universal Kinetic Model to Predict Rheological and Damage Properties of Asphalt Binder Subjected to Oxidative Aging
Student: Fang Liu
Advisor: Haifang Wen
University: Washington State University
Email: fang.liu3@wsu.edu

9. Title: Experimental Investigation of Clear-Water Local Scour around Submerged Bridge Foundations
Student: Chen Wang
Advisor: Fayun Liang & Xiong Yu
University: Tongji University & Case Western Reserve University
Email: cwang330@hotmail.com

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

11. Title: Investigation of Blending Mechanisms for Reclaimed Asphalt Pavement (RAP) Binder and Virgin Binder in Laboratory-Produced RAP Mixtures
Student: Kun Zhang
Advisor: Haifang Wen
University: Washington State University
Email: kun.zhang2@wsu.edu

12. Title: Development of Regularization Methods on Ground-Penetrating Radar Signals to Predict Thin Asphalt Layer Thickness
Student: Shan Zhao
Advisor: Imad Al-Qadi
University: University of Illinois at Urbana-Champaign
Email: szhao28@illinois.edu

13. Title: Meso-scale Structural Analysis on Asphalt Concrete Mixtures Based on Discrete Element Method
Student: Xiaodong Zhou, Kuai Zhang, Fangyuan Gong
Advisor: Zhanping You and Yu Liu (Co-advisor)
University: Chang'an University

14. Title: Exploratory Investigation into Upcycling of Coal Fly Ash as Sole Binder for Mortars
Student: Gang Xu
Advisor: Xianming Shi
University: Washington State University
Email: gang.xu@wsu.edu

15. Title: Laboratory investigation into the mix design of high-volume fly ash mortars
Student: Sen Du
Advisors: Xianming Shi and Yong Ge
Universities: Washington State University and Harbin Institute of Technology
Email: sen.du@wsu.edu

16. Title: High Efficiency Thermoelectric Generator with Electrically Parallel Structure
Student: Guangxi Wu
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: gxw94@case.edu

17. Title: Utilization of Steel fiber from Waste Tires in Concrete: Mechanical and Microstructural Characterizations
Student: Jianying Hu
Advisor: Xiong (Bill) Yu
University: Case Western Reserve University
Email: jxh546@case.edu

18. Title: Dynamic Displacement Measurement of a Large-Scale Arch-Truss Based on Digital Image Processing
Student: Yang Yang, Kamil Nizamiev
Advisor: Xiong (Bill) Yu, Dario Gasparini
University: Case Western Reserve University
Email: yxy379@case.edu

19. Title: Soil Behavior Under Dynamic Cavity Expansion-Contraction Loading: Insights from DEM Modeling
Student: Sichuan Huang
Advisor: Junliang Tao
University: The University of Akron
Email: sh141@zips.uakron.edu

20. Title: Microscopic Modeling of Suffusion of Granular Soils
Student: Hui Tao
Advisor: Junliang Tao
University: The University of Akron
Email: ht25@zips.uakron.edu

21. Title: Energy Harvesting From Pavement via PVDF: Hybrid Piezo-Pyroelectric Effects
Student: Jie Hu
Advisor: Junliang Tao
University: The University of Akron
Email: jh184@zips.uakron.edu

溪水清音

IACIP Banquet

Sunday January 10th, 2016,
6:30 PM to 11:00 PM
Tony Cheng's Seafood Restaurant

(中国城海鲜大酒楼),

619 H Street NW, Washington, D.C.

Hosted by IACIP 757 - 925 - 2674

菜单

西湖牛肉羹
白灼大虾
椒盐肉排
脆皮挂炉鸭
玉兰扒牛肉
宫保鸡丁
十锦荷叶饭
鲜菇蒸鲜鱼

酒水饮料
水果色拉
清水

IACIP Banquet

IACIP Banquet Restaurant Information

Tony Cheng's Seafood Restaurant

Address:

619 H Street, NW, Washington DC, 20001 (Phone: 202-371-8669)

Direction:

1. Take the subway redline towards DC Downtown

乘坐前往DC市中心的地铁-红线

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

坐四站下车，到达中国城站Gallery Pl/Chinatown

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

从7th St./H St.出口出站

4. Cross the street to the right

出站后过街(H St.)右拐，步行一百米到达饭店