



**The 5th International Conference on
Maintenance and Rehabilitation of
Pavements and Technological Control**

FINAL PROGRAM

**The Canyons Resort, Park City, Utah
August 8-10, 2007**

Welcome to MAIREPAV5

MAIREPAV5 is the 5th International Conference on **MA**intenance and **RE**habilitation of **PAV**ements and Technological Control. The objective of this series of conferences is to provide a forum for researchers, government agencies, consultants and contractors to exchange technological advancements and innovations related to building and maintaining longer-lasting road and airfield pavement. The first conference was held in São Paulo, Brazil by Mackenzie University in 1999, the second in Auburn, USA by the University of Mississippi in 2001, the third in Guimarães, Portugal by University of Minho in 2003, the fourth in Belfast, Northern Ireland by the University of Ulster in 2005, and the fifth in Park City, Utah, USA by the University of Iowa in 2007.

The main theme of MAIREPAV5 is the sustainable maintenance and rehabilitation of pavements. This issue is emerging as a key challenge for many countries in the 21st century. It is well known that road and airfield pavement is the backbone of the economic prosperity and public welfare. But, the sustainability challenges pavement builders and managers to respond creatively to new and dynamic problems of rehabilitating and maintaining pavements in the most environmentally friendly manner by lowering energy cost, reducing traffic noise, and minimizing air and water pollution.

This conference features:

- Two workshops on asphalt binder/emulsion and pavement rehabilitation/recycling
- A plenary session with opening remarks by John Njord of Utah DOT and Yong-Joo Cho of Korea MOCT and keynote presentations by Peter Stephanos of FHWA, Roger Smith of Texas A&M University, Ray Brown of Auburn University, and Imad Al-Qadi of University of Illinois
- Eighty-four peer-reviewed papers from thirteen countries in three technical tracks with five sessions each
- Six networking events that includes Wednesday's welcoming dinner; Thursday's breakfast, lunch and banquet at the mountain lodge by gondola with Seung Su Kim of Kumho Co. as an invited speaker; Friday's breakfast and farewell luncheon

We would like to recognize the co-sponsors of MAIREPAV5: International Society for Maintenance and Rehabilitation of Transportation Infrastructure (iSMARTi), Federal Highway Administration (FHWA), Transportation and Development Institute (T&DI) of American Society of Civil Engineers (ASCE), Transportation Research Board (TRB), Korean Society of Road Engineers (KSRE), and Public Policy Center (PPC) and Civil & Environmental Engineering Department of the University of Iowa. We would like to record our indebtedness to distinguished members of the International Organizing and Scientific Committee who helped with the peer-review of papers and provided valuable guidance in making this conference a success. Finally, we would like to thank the authors from all over the world who convened in Park City, Utah to share their knowledge and experiences in building and maintaining road and airfield pavements. It is our honor and privilege to host MAIREPAV5. Enjoy!

M. Asghar Bhatti / Hosin "David" Lee, Co-chairs of MAIREPAV5

Opening Remarks

Congratulations on hosting “The Fifth International Conference on Maintenance and Rehabilitation of Pavements and Technological Control”, and I’m very honored to give a welcoming speech as the president of Korean Society of Road Engineers. This conference was held in Sao Paulo, Brazil in the first time, moving venues to Auburn, USA, Minho, Portugal, and Belfast, Northern Ireland over the years. The conference has significantly contributed to the development of technology for pavement maintenance and rehabilitation. I’m very pleased that our institution has an opportunity to sponsor the meeting this year.

Our institution was established in 1999 as Korean Society of Pavement Engineers, and now has about 2,000 members who are actively engaged in the development of road pavement technology. The International Conference on Road & Airfield Pavement Technology was hosted in Seoul in 2005, which invigorated discussion on the road maintenance issues in Asian region.

Ever since the opening of Seoul-Busan express highway in 1970, Korea now has roads of approximately 102,000km in length, and 77% of them are paved. As of the end of 2006, some 16 million automobiles have been registered, and the roadway carries 95% of the total transportation. Every year, the Korean government spends about 15 billion US dollars for road construction and maintenance.

In 2001, a 7.7km of test road was constructed to develop the Korean MEPDG, and pavement related specifications. Various types of gauges were installed at 40 pavement sections to monitor the long term pavement performance. Moreover, researches are actively progressed in Korea to achieve the advanced technologies for asphalt and concrete pavements. I wish a great success of the conference in this beautiful town, Park City, Utah, and hope that everyone learns brand new ideas and perspectives from one another.

Thank you.

Yong-Joo Cho, Director General of Road Bureau at MOCT
President of Korean Society of Road Engineers (KSRE)

Acknowledgements

We gratefully acknowledge the following individuals and organizations for their contributions to the success of the 2007 5th International Conference on MAIntenance and REhabilitation of PAVements and Technological Control (MAIREPAV5).

Conference Co-chairs



M. Asghar Bhatti

Public Policy Center, Civil and Environmental Engineering,
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Hosin "David" Lee

Public Policy Center, Civil and Environmental Engineering,
University of Iowa
Chairman, ASCE T&DI Highway Pavement Committee, 2006-2008

International Organizing Committee

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Ray Brown, Auburn University, USA
Rita Moura Fortes, Mackenzie Presby. U, Brazil
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International Scientific Committee

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Neeraj Buch, Michigan State University, USA
Chia-Pei Chou, National Taiwan Univ., Taiwan
Gerardo Flintsch, Virginia Tech, USA
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Haifang Wen, University of Wisconsin, USA
Chris Williams, Iowa State University, USA
Moon Won, University of Texas at Austin, USA
David Woodward, University of Ulster, UK

Workshop

WEDNESDAY, August 8 2007

8:00 a.m. – 6:00 p.m.	Registration (Kokopelli Ballroom Lobby)	
1:00 p.m. – 2:40 p.m. Kokopelli I	Exhibitions Open (White Pine Ballroom)	<p>▶ Workshop I: Asphalt Binder and Emulsion for Rehabilitation Workshop Chair: Hussain U. Bahia, Professor, University of Wisconsin-Madison</p> <p>THE NEED FOR MODIFIED ASPHALT BINDERS AND ADVANCED TESTING METHODS Hussain U. Bahia, Professor, University of Wisconsin-Madison, ASCE Bituminous Materials Committee</p> <p>EMULSION FOR PAVEMENT MAINTENANCE AND REHABILITATION Jeremy Bucholz, Plant Formulation Support Engineer, SEM Materials, L.P.</p> <p>CONCEPTS FOR PERFORMANCE GRADING OF ASPHALT EMULSION (PGE) Hussain U. Bahia, Professor, University of Wisconsin-Madison, ASCE Bituminous Materials Committee</p>
2:40 p.m. – 3:00 p.m.		Afternoon Break (Kokopelli Ballroom Lobby)
3:00 p.m. – 5:00 p.m. Kokopelli I	Exhibitions Open (White Pine Ballroom)	<p>▶ Workshop II: Pavement Rehabilitation & Recycling Techniques Workshop Chair: Jason Harrington, Recycling Engineer, Federal Highway Administration</p> <p>FHWA'S FALCON ENVIRONMENTAL STEWARDSHIP – RECYCLING EFFORTS Jason Harrington, Recycling Engineer, Federal Highway Administration</p> <p>FUNDAMENTALS OF ASPHALT PAVEMENT RECYCLING Arlis Kadrmas, development Engineer, SEM Materials, L.P.</p> <p>HIGH PERCENTAGE RECYCLING WITH HOT FOAMED ASPHALT Norman Smith, Group Vice President, Astec Industries, Inc.</p> <p>TECHNIQUES OF RECYCLING DEMOLISHED CONCRETE INTO SPECIFICATION AGGREGATES FOR RE-USE Rick C. Givan, President, Recycled Materials Company, Inc.</p>
5:30 p.m. – 6:30 p.m.		iSMARTi Meeting (Kokopelli III)
6:30 p.m. – 9:00 p.m.	Welcoming Dinner (The Canyons Pavilion located outside Grand Summit Hotel)	

Technical Program

Session A	Asphalt Pavement (Kokopelli I)
Session B	Concrete Pavement (Kokopelli II)
Session C	Pavement Management (Kokopelli III)

THURSDAY, August 9 2007

7:00 am – 8:00 am	Exhibitions Open (White Pine Ballroom)	Continental Breakfast (Kokopelli Ballroom Lobby)	
8:00 am – 9:00 am Kokopelli Ballroom		Opening Ceremonies Presided by Paulo Pereira, University of Minho	
		 <p>John Njord, Executive Director, Transportation of Utah Department of Transportation, USA</p>	 <p>Yong-Joo Cho, Director General, Road Bureau at Ministry of Construction & Transportation, Korea</p>
9:00 am – 10:20 am Kokopelli Ballroom		Keynote Addresses Presided by Tien F. Fwa, National Singapore University	
		 <p>Peter J. Stephanos, Director, Office of Pavement Technology, FHWA, FHWA's National Pavement and Materials Program</p>	
10:20 am – 10:40 am		Coffee Break (White Pine Ballroom)	
10:40 am - 12:00 pm Kokopelli Ballroom	Keynote Addresses Presided by Chia-Pei Chou, National Taiwan University		
	 <p>Ray Brown, Professor, Auburn University, Importance of Good Construction on Reducing Maintenance Costs</p>	 <p>Imad Al-Qadi, Professor, University of Illinois at Urbana-Champaign, Reflective Cracking Initiation and Propagation Mechanisms</p>	
12:00 pm – 1:00 pm	Lunch (The Canyons Pavilion)		

<p>1:00 pm – 3:00 pm</p> <p>Kokopelli I</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Exhibitions Open (White Pine Ballroom)</p>	<p>▶ Session A.1 Asphalt Pavement Materials</p> <p>Session Chair: Kwang Woo Kim, Kangwon National University</p> <p>A.1.1 A HAMBURG WHEEL TRACK STUDY ON HMA MIXES USING ACID AND NON ACID MODIFIED PMAS AND LOCAL AGGREGATES WITH AND WITHOUT LIME, Howard J. Anderson and Kevin VanFrank (USA)</p> <p>A.1.2 DEVELOPMENT OF “HYBRID ASPHALT MIXTURE” FOR EXPRESSWAY MAINTENANCE, Shigeru Shimeno, Kazumasa Kawamura And Daijirou Matsumoto (Japan)</p> <p>A.1.3 EVALUATION OF THE VISCO-ELASTIC PROPERTIES IN ASPHALT RUBBER AND CONVENTIONAL MIXES, Manuel J. C. Minhoto, Paulo A. Pereira and Jorge C. Pais (Portugal)</p> <p>A.1.4 HYBRIDIZED MODIFIED ASPHALT (HMA) WITH ENHANCED PG PLUS CHARACTERISTICS, G. Mohammed Memon and Terry L. Atha (USA)</p> <p>A.5.2 MIXING METHOD RENOVATION FOR REDUCING STIFFNESS OF RECYCLED ASPHALT MIXTURE, Tae W. Park, Sung U. Kim, Nam W. Park and Kwang W. Kim (Korea)</p>
<p>Kokopelli II</p>		<p>▶ Session B.1 Concrete Pavement Materials</p> <p>Session Chair: Juanyu “Jenny” Liu, University of Alaska Fairbanks</p> <p>B.1.2 MEASUREMENT OF PCC COEFFICIENT OF THERMAL EXPANSION FOR VARIOUS AGGREGATE TYPES, Neeraj Buch, Shervin Jahangir-nejad and Joel Brown (USA)</p> <p>B.1.4 EVALUATION OF PAVEMENTS WITH THIN-BONDED CONCRETE OVERLAYS THROUGH 3D FINITE ELEMENT MODELING, Taizo Nishiyama, M. Asghar Bhatti and Hosin “David” Lee (USA)</p> <p>B.1.5 QUANTIFYING THE EFFECTS OF TRUCK WEIGHTS ON AXLE LOAD SPECTRA OF SINGLE AND TANDEM AXLE CONFIGURATIONS, Syed Waqar Haider and Ronald S. Harichandran (USA)</p> <p>B.1.7 INFLUENCE OF TRAFFIC INPUTS ON RIGID PAVEMENT PERFORMANCE USING M-E PDG IN THE STATE OF MICHIGAN, Syed Waqar Haider, Hassan K. Salama, Neeraj Buch and Karim Chatti (USA)</p>
<p>Kokopelli III</p>		<p>▶ Session C.1 Pavement Construction</p> <p>Session Chair: Doug Atkin, FHWA- Utah Division</p> <p>C.1.1 EVALUATION OF SELECTED REINFORCING MATERIALS FOR RETARDING REFLECTION CRACKING OF ASPHALT OVERLAY ON CONCRETE PAVEMENT, Byung J. Cho, Young S. Doh, Seung Zoon Kwon and Kwang W. Kim (Korea)</p> <p>B.4.2 TRAFFIC NOISE STUDY TO ANALYZE THE EFFECTS OF VEHICLES AND PAVEMENT SURFACE TYPES, Sungho Mun and Kwang Ho Lee (Korea)</p> <p>C.1.3 EFFECT OF HIGH GROUNDWATER LEVEL ON ROADWAY PAVEMENTS: A FULL-SCALE EXPERIMENTAL STUDY, W. Virgil Ping, Ching-Chin Ling, Bruce Dietrich and David Horhota (USA)</p> <p>C.1.4 NEW TECHNOLOGIES IN THE PAVING PROCESS BASED ON "COMMON PRACTICE" AND OPERATORS' HEURISTICS, Henny ter Huerne, Seirgei Miller and André Dorée (Netherlands)</p>
<p>3:00 pm – 3:20 pm</p>	<p>Coffee Break (White Pine Ballroom)</p>	

3:20 pm – 5:20 pm	<p>▶ Session A.2 Asphalt Pavement Performance Modeling</p> <p>Session Chair: Arlis Kadrmas, SEM Materials, Inc.</p> <p>A.2.1 EVALUATION OF ASPHALT INTERLAYER MIXES TO MITIGATE REFLECTIVE CRACKING IN COMPOSITE PAVEMENTS, Thomas Bennert and Todd Lynn (USA)</p> <p>A.2.2 BASIC STUDY ON RUT SHAPE CHARACTERISTICS IN CONSIDERATION OF VEHICLE DYNAMICS, Kazuya Tomiyama, Akira Kawamura, Alimujiang Yiming, Tateki Ishida and Shigenori Nakajima (Japan)</p> <p>A.2.3 CHANGE OF DEFORMATION STRENGTH DUE TO MIXTURE AGING, Jae H. Jung, Jong S. Lee, Jun S. Kweon and Kwang W. Kim (Korea)</p> <p>A.2.4 A STUDY ON TEMPERATURE DEPENDENT MODULUS FOR ASPHALT CONCRETE, Kunihito Matsui, Kiyoshi Fujinami, Shigeo Higashi and Tasuku Nagae (Japan)</p> <p>A.2.5 EFFECTS OF LAYER INTERFACE SLIP ON THE RESPONSE AND PERFORMANCE OF ELASTIC MULTI-LAYERED FLEXIBLE AIRPORT PAVEMENT SYSTEMS, James W. Maina, Morris De Beer, and Kunihito Matsui (Japan)</p> <p>B.5.3 DEVELOPMENT OF A SIMPLIFIED DESIGN PROCEDURE FOR DETERMINING LAYER THICKNESS IN LONG LIFE PAVEMENTS, Hyun Jong Lee, Jung Hun Lee, Hee Mun Park and Soo Ahn Kwon (Korea)</p>
Kokopelli I	<p>▶ Session B.2 Concrete Pavement Performance Modeling</p> <p>Session Chair: Alan Woodside, University of Ulster</p> <p>B.2.1 FULL-SCALE FIELD TESTING OF RAPID-SETTING MATERIALS FOR SLAB REPLACEMENT, L. A. Barna, J. S. Tingle and P. S. McCaffrey (USA)</p> <p>B.2.2 FINITE ELEMENT MODEL TO STUDY STRUCTURAL PAVEMENTS DESIGN: INVESTIGATION IN TERMS OF STRESSES AND STRAINS CONSIDERING ELASTO-PLASTIC FRICTIONAL CONTACT MECHANICS TECHNOLOGIES, Alex Alves Bandeira, João Virgílio Merighi and Rita Moura Fortes (Brazil)</p> <p>B.2.3 STUDY OF THE BOND STRENGTH IN THE INTERFACE OF POROUS CONCRETE AND PORTLAND CEMENT CONCRETE USING IN PAVEMENTS, Rita Moura Fortes and João Virgílio Merighi (Brazil)</p> <p>B.2.4 A WAVELET-BASED INTERPRETATION OF VEHICLE-PAVEMENT INTERACTION, H. M. Zelelew, A. T. Papagiannakis and B. Muhunthan (USA)</p> <p>B.2.5 DYNAMIC TIME DOMAIN BACKCALCULATION OF FWD DATA, Ming-Lou Liu, Yi-Fang Chuang and Jui-Chang Chuang (Taiwan)</p> <p>B.1.6 SINIFICANT M-E PDG DESIGN INPUTS FOR JOINTED PLAIN CONCRETE PAVEMENTS IN MICHIGAN, Syed Waqar Haider, Hassan K. Salama, Neeraj Buch and Karim Chatti (USA)</p>
Kokopelli II	<p>▶ Session C.2 Pavement Economic Analysis</p> <p>Session Chair: Chuck Larson, Stantec, Inc.</p> <p>C.2.1 A COST-COMPARISON METHODOLOGY FOR SELECTING ASPHALT CONCRETE MIXTURES, Kevin K. McGhee and Trenton M. Clark (USA)</p> <p>C.2.2 LIFE-CYCLE COST ANALYSIS AND USE POLICIES FOR MODIFIED ASPHALT PAVEMENT, Kimio Maruyama, Jun Tako and Masayuki Kaneko (Japan)</p> <p>C.2.3 ECONOMICS ANALYSIS BETWEEN RIGID AND FLEXIBLE PAVEMENT, Silvio Rodrigues Filho and Cássio Eduardo Lima de Paiva (Brazil)</p> <p>C.2.4 PAY FACTOR DEVELOPMENT FOR HOT MIX ASPHALT PAVEMENTS USING FATIGUE TESTING DATA, Michael Zelenock, Andrea Kvasnak, Jason Bausano and R. Christopher Williams (USA)</p> <p>C.2.5 VEHICLE OPERATING, ACCIDENT AND USER TIME COSTS IN PAVEMENT MANAGEMENT SYSTEMS: APPROACH FOR PORTUGUESE CONDITIONS, Bertha Santos, Luís Picado-Santos and Victor Cavaleiro (Portugal)</p> <p>C.2.6 MODELS FOR THE ANALYSIS OF MAINTENANCE STRATEGIES EFFECTS ON ROAD PAVEMENTS LIFE CYCLE COSTS, José Manuel Coelho das Neves and João Gomes Morgado (Portugal)</p>
Kokopelli III	<p>Ride Gondola to Red Pine Lodge (only way to the Red Pine Lodge)</p>
6:00 pm – 6:30 pm	Ride Gondola to Red Pine Lodge (only way to the Red Pine Lodge)
6:30 pm – 9:00 pm	<p>Conference Banquet (Red Pine Lodge): Invited Speech: "SBS-based Porous Asphalt Modifier for Dry Mixing" by Seung Su Kim, Senior VP, Kumho Petrochemical</p>



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