



INTERNATIONAL SOCIETY FOR CONCRETE PAVEMENTS

ISCP e-NEWSLETTER
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OCTOBER 2013

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CONFERENCE NEWS



International Journal of Pavements Conference to be Held December 9-10, 2013 in São Paulo, SP, Brazil

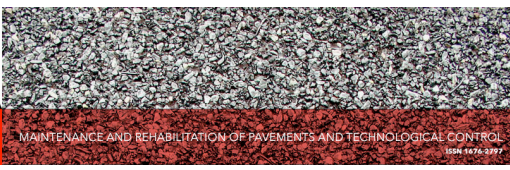
The International Journal of Pavements (IJP) has completed its 12th year of publication in 2013. The IJP publisher and editors are pleased to announce the "First International Journal of Pavements Conference (IJPC)" to be held December 9-10, 2013 at R. Martins Fontes, 71-República in São Paulo, Brazil.

The IJP journal encompasses the following subject areas:

- Accelerated pavement testing
- Modern practices to design, maintain, and rehabilitate asphalt and concrete pavements
- Airports, highways, low volume roads
- New stabilization and paving technologies
- Nondestructive evaluation; material testing and characterization
- Life-cycle analysis and pavement management
- Sustainability practices
- Innovative applications of advanced computer modeling and remote sensing technologies

This will be an excellent forum to reach out to a large number of industry professionals, educators, researchers, transportation engineers, and agency officials involved in education, research, building, and preserving transportation infrastructure worldwide.

This conference will provide a unique opportunity to interact and exchange information among professionals and educators of several countries, who are active in designing, constructing, maintaining and preserving, and managing pavement assets. Our main goal is to publicize IJPC among urban planners, engineers and architects, technologists, environmental assessment professionals, city managers, highway and airport agencies, field engineers and constructors, academic researchers, and students.



For more information, please go to:
<http://www.ijpavement.com>.
For questions, please contact:
Dr. Waheed Uddin, *IJP* Chief Editor, USA
Phone: 1-662-915-5363 | Fax: 1-662-915-5523
E-mail: cvuddin@gmail.com

PIARC Technical Committee TC4.2 on Road Pavements, Held in Liège, Belgium September 9-10



The Technical Committee (TC) on Road Pavements of the World Road Association (PIARC) held its last meeting in Liège, Belgium on September 9 and 10, 2013, prior to the Belgian Road Congress. EUPAVE was represented by ISCP Director, Luc Rens, EUPAVE Managing Director in this TC.



The three themes that dealt with in different Working Groups were:

- WG1 : Road condition monitoring and road/vehicle interaction
- WG2 : Recycling and reuse of pavement materials
- WG3 : Reducing the life cycle carbon footprint of pavement construction.

EUPAVE is involved in WG3 and will contribute with case studies on the reduction of carbon footprint through the use of recycled aggregates, the use of blended cements and the optimization of concrete batching plants.

Any valuable information is welcome! Please send information to:
Luc Rens, *EUPAVE* Managing Director | E-mail: L.rens@eupave.eu.

- ORGANIZATIONAL MEMBERS & MAJOR EVENT SPONSORS:
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 - GENIVAR
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 - NPCC
 - ONTARIO CANADA
 - PCI / Precast/Prestressed Concrete Institute
 - Stantec
 - Transports Québec
 - UCPRC
 - Wirtgen





Dutch Concrete Road Symposium



Cement&BetonCentrum organized the "Dutch Concrete Road Symposium" on October 10 in 's-Hertogenbosch, Netherlands. The conference was held at the 1931 Congress of the Brabanthallen, an historical conference and event venue on the list of national monuments. The theme of this Symposium was: "Knowledge from the Source".

The workshops and exhibits of this year's Bentonwegendag had sample projects of a variety of concrete applications. This was a great opportunity for attendees to learn about applications of concrete. "Surface Characteristics" of concrete pavements was a special topic of one of the Workshops. Pavement characteristics of concrete roads in particular, including texture, skid resistance, rolling resistance, noise reduction and the influential factors and interdependence of these properties.

The official opening was presented by Mr. Maxime Verhagen, *President of Bouwend Nederland - Building Netherlands*. Member of the European Parliament (MEP), Mr. Peter van Dalen, *Vice-Chairman of Committee of Transport and Tourism*, was invited as one of the key-note speakers. Mr. van Dalen addressed the audience with the EU-topics on EU Transport policy. Related to the costs of infrastructure, he challenged the concrete sector to design and construct innovative infrastructure with good price/quality balance and low maintenance. Mr. van Dalen also described the plans for the Trans European Network (TEN-T), for which 1 billion euro will be available for co-financing. In this perspective, the current Life Cycle Analysis (LCA) period of 25 years, must be extended to a much longer period. For reducing road fatalities, separate and safe infrastructure is needed for vulnerable groups like pedestrians and cyclists. To improve the safety of traffic, investments in maintenance remains necessary, as well as improving 'slip'-resistance (skid-resistance) and safety barriers, especially for motorcyclists. Traffic safety is one of the main priorities at national and international level!

The second key-note speaker was Mr. Robert Rasmussen, *The Transtec Group Inc., USA*, an expert on surface characteristics. Mr. Rasmussen began by pointing out the techniques to measure surface characteristics and the relation between friction and noise. He presented the variability of tested textures of hundreds of miles within 20 U.S. states and 7 countries. Conclusion: there is a lot of variability from project to project, but also within projects! The variability can often be explained by the consistency of the concrete mixture and the attention for the execution. Noise measurements on the same surface texture can differ up to 8%-10%.

Mr. André Burger, *Managing Director of the Cement&BetonCentrum*, gave a presentation that compared the CO₂-footprint of Dutch cement with worldwide used cement. The worldwide cement production is responsible for about 5% of worldwide CO₂ volume. For the cement used in The Netherlands, Mr. Burger presented a calculation that showed a CO₂-footprint of 1%. So this 1% should be used in calculation programs related to life-cycle studies for concrete in infrastructure in The Netherlands.

In the final presentation Marc Eijbersen, *CROW, the Netherlands*, announced the launch of a "Knowledge Platform for Concrete Pavements" (Voorrang aan betonkennis!). The Cement&BetonCentrum has taken the initiative to start-up such a platform to exchange knowledge between principals, consultants and contractors.



photos:
Bentonwedendag Exhibits
Mr. Peter van Dalen
Mr. Robert Rasmussen



TTCC & NCC Conferences Held in Asheville, North Carolina, USA



The semi-annual Technology Transfer Concrete Consortium and National Concrete Consortium (TTCC & NCC) were held September 23-25, 2013 at the Renaissance Asheville Hotel in Asheville, North Carolina, USA. Attendees, representing 26 State DOTs, FHWA, ACPA, concrete pavement engineers, academia, consultants and industry, participated in presentations and open discussions related to:

- | | |
|--|---|
| Roller Compacted Concrete (RCC) | Concrete Overlays |
| Florida's New Test Road | Federal Highway Pavement Direction |
| Advanced LCCA Practices | Pavement type selection |
| MAP 21 Performance Measures | Transportation Pool Fund (TPF) Projects |
| State Reports: Performance assumptions used to support LCCA | |
| Open session for states to present problems/innovations for discussion | |

Tuesday included a lunch and introduction to the technical tour hosted by the North Carolina DOT (NC DOT). The I-26 and I-40 pavements technical tour had about 100 attendees and highlighted an ACPA Award-winning job constructed 10 years ago on I-26, Madison County. Other pavements viewed were built in the 1960's and pavements that were preserved and restored, pavement restoration, etc. The technical tour was followed by a conference dinner.

ISCP Members Jerry Voigt, *ACPA* and Leif Wathne, *ACPA* each participated with presentations. Jerry presented an update on ACPA's roller compacted concrete guide specification, which under the leadership of the *ACPA RCC Task Force*, is moving ever closer to a final draft that will be presented at the ACPA 50th Annual Meeting, December 3-6. Leif provided the concrete pavement industry's perspective on performance measurement, and in particular, discussed remaining service life as a performance metric. The presentation



was part of a session on performance measures required under MAP-21, and he shared the dais with Butch Wlaschin, *Federal Highway Administration (FHWA)*, and David Luhr, *Washington State DOT*, who rounded out the program with federal and state perspectives.

Also on the program were ISCP Members: Thomas Burnam, Mike Byers, Tom Cackler, Greg Dean, Daniel DeGraff, Jim Grove, Dale Harrington, Jim Mack, Kevin McMullen, Nigel Parkes, Kurt Smith, Peter Taylor, Thomas Van Dam and Julie Vandenbosche.

The semi-annual NCC meetings are important to the transportation-construction community as a whole, because they present opportunities to discuss a wide range of topics of interest to agencies and the industry. NCC has evolved from a small group of regional state agencies/owners to a national organization representing 26 state DOTs, as well as the Illinois State Toll Highway Authority. The meetings represent the largest gathering of federal and state transportation agency officials directly involved in the specification and use of concrete pavements.

For all of the 2013 presentations, please go to:

http://www.cptechcenter.org/_development/ncc/TTCC-NCC-2013.cfm.

For the TTCC Pooled Fund States, please go to:

<http://www.cptechcenter.org/projects/ncc/TTCC%20Pooled%20Fund%20States-7-15-13.pdf>.

Please visit the CPTech Center for more details: <http://www.cptechcenter.org/index.cfm>.

NCC has evolved from a small group of regional state agencies/owners to a national organization representing 26 state DOTs & the Illinois State Toll Highway Authority



INDUSTRY RESOURCES & PUBLICATIONS

Panel Members for NCHRP Project 25-25/Task 82: "Permeable Shoulders with Stone Reservoirs"

An electronic copy of the latest final report in the 25-25 series on "Task 82: Permeable Shoulders with Stone Reservoirs" is now available. Also available are "The Project Presentation" and a "Decision Support Tool". This project was conducted at the request of the AASHTO Standing Committee on the Environment as part of NCHRP Project 25-25. This is a contractor's report conducted for the AASHTO Standing Committee on the Environment with funding provided through the National Cooperative Highway Research Program Project 25-25.



To download the pdf of the 65-page NCHRP 25-25 Task 82 Final Report: "Permeable Shoulders with Stone Reservoirs", please go to: [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25\(82\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(82)_FR.pdf).

For the Presentation "NCHRP 25-25 TASK 82", please send an e-mail to: Nanda Srinivasan, *Senior Program Officer, NCHRP, TRB of the National Academies* e-mail: nsrinivasan@nas.edu.

To download the "Decision Support Tool" in Excel form, please go to: <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3315>. It is also on page 15 of the Final Report.

- Reduced stormwater runoff volume
- Reduced stormwater runoff peak flows
- Reduced stormwater pollutant load
- Decreased downstream erosion & increased groundwater recharge
- Potential reduced lifecycle costs compared to other means of stormwater treatment



Permeable Shoulders With Stone Reservoirs

Requested by:
American Association of State Highway and Transportation Officials (AASHTO)
Standing Committee on the Environment

Prepared by:
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and
Eric Stroeder, P.E., Aaron Thornhill, P.E., and Dr. Robert Rossen, P.E.
Geosyntec Consultants
Mark Vetter
Vetter Consulting
(October 4, 2012)

The information contained in this report was prepared as part of NCHRP Project 25-25, Task 82, National Cooperative Highway Research Program, Transportation Research Board of the National Academies.

NCHRP 25-25 Task 82 Final Report, October 2013

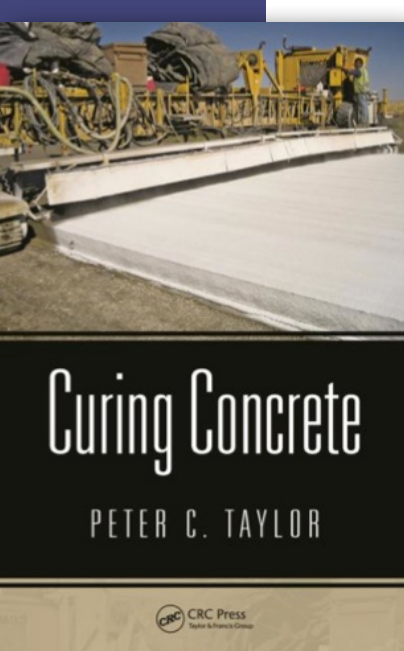
NCHRP 25-25 TASK 82

October 2013

PERMEABLE SHOULDERS WITH STONE RESERVOIRS

NCHRP 25-25 Task 82 Presentation of Permeable Shoulders with Stone Reservoirs

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New Book Explains Importance of Curing Concrete & How to Do it More Effectively



Curing is often low on the list of priorities on the construction site, but it can improve the hydration and performance of concrete, while reducing the risk of cracking. This book, by Peter C. Taylor, *National Concrete Pavement Technology Center, Iowa State University, Ames, Iowa, USA*, explains why curing is important and shows you how to do it more effectively. The author covers the fundamentals behind hydration, how curing affects the properties of concrete, what technologies and techniques you can use, and how to specify and measure curing in a construction project. The book also includes examples of curing in actual structures.

Key Features:

- Explains the benefits of curing on concrete performance
- Offers guidance on how to select and apply a curing method
- Discusses how to specify and measure curing in a project
- Includes examples evaluating the use of curing in real-world structures
- Discusses U.S. and European Standard specifications, making the book applicable for international use
- Contains more than 80 illustrations and photographs

... curing can improve the hydration & performance of concrete, while reducing the risk of cracking.

Selected Contents:

- Introduction: References.
- Cementitious Materials Chemistry and Hydration: Introduction. Portland Cement. Supplementary Cementitious Materials. Hydration. Mix Design and Proportioning. Effects of Water. Temperature Effects. Summary. References.
- Benefits of Curing on Concrete Performance: Introduction. Cracking. Durability. Strength. Modulus of Elasticity. Creep. Sustainability. References.
- Curing in Practice: Introduction. Selecting Curing Methods. Temperature Control. Moisture Control. Where, When, and How Long? References.
- Measurement and Specifications: Balancing Theory and Practice. Heating and Cooling. Moisture Control. International Specifications. Verification of Curing. Guide Specification. Payment. References.
- Real-World Experience: Introduction. Hot Climate. Cold Climate. High- Performance Concrete. Performance Parameters. Specifications and Testing. Summary. References.

"This book is a practical, yet comprehensive guide for anyone who is involved in concrete construction. It first describes the role curing plays in the hydration process, what properties are influenced by curing, guidance in the application and use of curing, how to measure and specify, and finally real-world guidance drawn from the experiences of others. ... Overall, this is an excellent publication that presents fundamental concepts of concrete curing with a practical application of real-world expertise drawn from well-respected practitioners. Why we cure, how to specify it, and what the benefits will be are well presented."

— Jim Grove, P.E., *Global Consulting Inc., Ames, Iowa, USA*

To order the book, please go to: Online: www.crcpress.com | E-mail: orders@crcpress.com
Phone: 1.800.634.7076 • 1-561-994-0555 • +44 (0) 1235 400 524

Effects of a Nonuniform Subgrade Support on the Responses of Concrete Pavement

Alexander S. Brand, Jeffery R. Roesler, and Hemant L. Chavan, *University of Illinois at Urbana-Champaign* and Francisco Evangelista Jr., *University of Brasilia, Brazil*

Intelligent compaction is gaining attention for its ability to spatially map the compaction effort of a pavement support layer, and its ability to detect areas of nonuniform compaction. These raise the issue: what are the effects of a nonuniform support condition on the stresses and deflections in a rigid pavement? This study considered multiple nonuniform support conditions, including theoretically generated and predetermined, then randomly assigned from measured field data. The slabs and nonuniform support conditions were modeled using two-dimensional and 3-dimensional finite element methods, with input variables being axle type, curling, as well as lateral and longitudinal axle movements. Overall, the study found that certain nonuniform support conditions and axle positions can significantly increase the peak tensile stress in the slab over even uniform soft support. In particular, a single slab with soft longitudinal edge support and a slab with "randomly" assigned nonuniformities were critical cases that increased the peak slab tensile stresses. When the slab was modeled with preexisting through-length surface cracks, it was found that the nonuniform soft edges support conditions would result in unstable crack growth based on the significant increase in the stress intensity factor.

When modeling a set of concrete slabs over a nonuniform support based on field data, the peak tensile stresses were increased relative to a uniform support based on the location of the wheel load relative to the nonuniformity, and also based on the adjacent differences in nonuniform soil stiffness. The field data was also statistically reassigned by normal and beta distributions to predefined area sizes, which demonstrated that with a normal distribution, the probability of low k-values along the pavement edge increased, thereby raising the probability of higher peak tensile stresses. Overall, certain nonuniform support of concrete slabs can produce much higher tensile stresses than a uniform support condition, particularly when considering different loading positions and curling conditions, soft support along the pavement edge, and preexisting cracks.

To read the entire publication, please download the PDF at:
<http://ict.illinois.edu/publications/report%20files/ICT-13-027.pdf>.

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EFFECTS OF A NONUNIFORM SUBGRADE
SUPPORT ON THE RESPONSES OF
CONCRETE PAVEMENT

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University of Brasilia, Brazil
Research Report No. ICT-13-027
Illinois Center for Transportation

September 2013

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Methods for Evaluating Fly Ash for Use in Highway Concrete

TRB's National Cooperative Highway Research Program (NCHRP) 749: "Methods for Evaluating Fly Ash for Use in Highway Concrete" presents suggested changes to coal fly ash specifications and test protocols contained in American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Transportation Materials and Methods of Sampling and Testing (AASHTO M 295). Fly ash—a byproduct of coal combustion—is widely used as a cementitious and pozzolanic ingredient in hydraulic cement concrete. The use of coal fly ash (CFA) in concrete is increasing because it improves some of its properties and often results in a lower cost of concrete.

However, the chemical and physical compositions of CFA influence constructability, performance, and durability and may contribute to problems, such as cracking and alkali-silica reactivity (ASR) in concrete pavements, bridge decks, and other highway structures. Regulatory requirements have also contributed to changes in CFA properties that may adversely affect concrete performance. In addition, current specifications and test methods do not adequately characterize CFA properties, address the effects of CFA characteristics on fresh and hardened concrete properties, or consider the alkali content of the cement. Inadequate characterization may lead to unwarranted restrictions on the use of suitable materials. In addition, existing test methods for sampling and testing CFA used in concrete do not adequately address the characterization of CFA or the performance aspects of highway concrete. Further research is needed to develop recommendations for improving CFA specifications and test protocols, thus help highway agencies better evaluate and use CFA that will provide acceptable structural performance and durability.

The objective of this research was to recommend potential improvements to specifications and test protocols to determine the acceptability of fly ash for use in highway concrete. To accomplish this objective, the research included the following:

- A study of existing specifications and classification methods for CFA to recommend changes that would provide better criteria for selection of CFA for a given level of performance.
- An investigation of new test methods for characterizing the strength activity of CFA.
- Identification of new test methods for characterizing the properties of residual carbon in CFA and investigation of approaches for estimating air-entraining admixture or agent (AEA) dosage for CFA.
- Evaluation of the use of CFA to mitigate alkali-silica reaction in concrete and provision of guidance on selection of CFA type and dosage for a specified level of field performance.

The changes suggested include modifications to the test methods currently specified as well as the introduction of new test methods for enhancing such evaluations.

The project is complete. To download the full report, please go to: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_749.pdf.

For the project information, please go to: <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=479>.

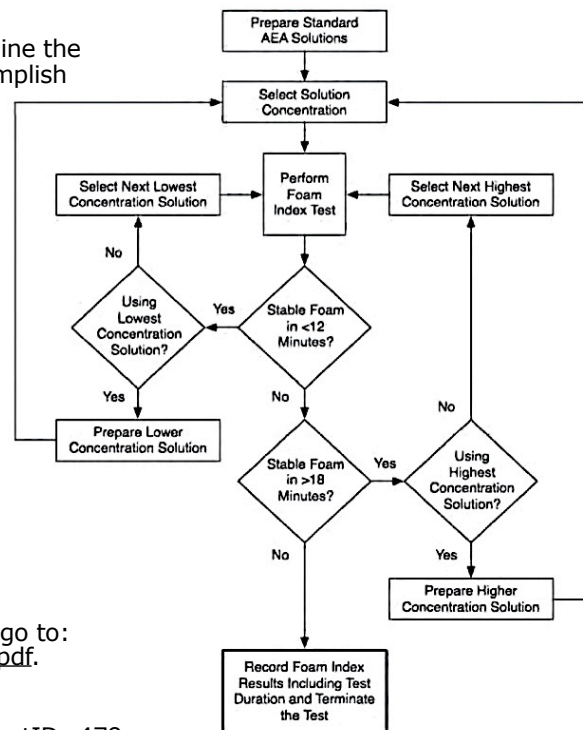


Chart: Proposed protocol for determining the optimum air-entraining admixture or agent (AEA) concentration.

Technical Report: Use of Manufactured Sands for Concrete Pavement

David Whitney, Dr. David W. Fowler and Marc Rached

Sources of quality natural sands have begun depleting in metropolitan areas where the need for concrete is high. In such areas the concrete industry has the option to either ship natural sands from outside sources or use local sources of manufactured fine aggregates (MFAs). With the depletion of sources of natural sands, the usage of MFAs has increased. Shipping aggregates from outside sources adds to the cost of concrete, so it is important to find methods to maximize the use of local materials.

MFAs are a product created when rocks are crushed using a mechanical crusher. MFAs have properties that differ from natural sands. For this reason, the plastic and hardened properties of concrete, produced using manufactured fine aggregates, differ from the properties of concrete made with natural sands. The concrete properties affected by the use of MFAs are workability, skid resistance, and finishability.

There were several goals to this research project. One was to investigate how MFAs could be used in concrete pavements without causing workability. To improve the workability of concrete made with MFAs, the use of the optimized mixture proportioning method developed by the International Center for Aggregate Research (ICAR) was investigated. Results obtained from this testing were used to make recommendations on how to optimize class P concrete mixtures made with any type and combination of aggregates.

Another goal of this research was to develop laboratory tests that could reasonably predict skid performance of concrete pavements made with different types of sand. For this purpose, concrete slabs made with different sands were evaluated for friction and texture using a circular texture meter (CTM), a dynamic friction tester (DFT), and a polisher.

The ultimate aim... to examine how more MFAs could be used in PCC pavements without affecting the quality of the concrete...



Use of Manufactured Sands for Concrete Pavement

David Whitney, Dr. David W. Fowler, Marc Rached

NCHRP Technical Report 749-1
Report Title: Use of Manufactured Sands for Concrete Pavement
Project Title: Use of Manufactured Sands for Concrete Pavement
Sponsoring Agency: Transportation Research Board of the National Academies
Publication Agency: Transportation Research Board of the National Academies

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

The ultimate aim of this research project was to examine how more manufactured sands could be used in PCC pavements without affecting the quality of the concrete produced.

To read the entire publication, please go to: <http://library.ctr.utexas.edu/ctr-publications/0-6255-1.pdf>.

New Design Guide for Bonded Concrete Overlays on Asphalt Pavements



Julie Vandenbossche, Ph.D., MS, BSCE, Assistant Professor Geotechnical and Pavements Engineering, University of Pittsburgh, made a presentation on a new design guide for bonded concrete overlays on asphalt pavements at the National Concrete Consortium (NCC) 2013 Conference, held in Asheville, North Carolina, USA in September, 2013,. The bonded concrete overlays of asphalt mechanistic-empirical design procedure (BCOA-ME) was developed at the University of Pittsburgh under the FHWA Pooled Fund Study TPF 5-165. This pavement structure has been referred to as thin and ultra-thin whitetopping.

The design guide website is also a repository for all supporting information relating to the BCOA-ME which includes practitioner's information, training tools and technical documentation regarding the theoretical aspects of the development of the design procedure. The information has been sorted based on its intended use and can be retrieved by clicking on the appropriate tabs:

- Design Guide
- Practitioner's Information
- Training
- Technical Documentation
- Sponsors
- User's Feedback

The BCOA-ME can be run directly from this site by clicking on the "Design Guide" tab.

To view the design guide and the repository, please go to:

<http://www.engineering.pitt.edu/Vandenbossche/BCOA-ME/>.

CALL FOR PAPERS & ABSTRACTS DIGEST

November 30, 2013 Due date for abstracts for the *2014 International Concrete Sustainability Conference, Boston Massachusetts* to be held May 12-15, 2014, at the Hyatt Regency in Cambridge, Massachusetts. To submit an abstract by November 30, 2013, please go to: www.concretesustainabilityconference.org.

January, 2014 Due date for final papers for *12th International International Symposium on Concrete Roads* to be held September 23-26, 2014 in Prague, Czech Republic. To submit final approved papers, please e-mail: info@eupave.eu. For the website, please go to: <http://www.concreteroads2014.org>.

February 1, 2014 Due date for abstracts for the *8th International DUT-Workshop on Research and Innovations for Design of Sustainable and Durable Concrete Pavements* to be held September 20-21, 2014 in Prague, Czech Republic. To submit an abstract by February 1, 2014, please contact: Lambert Houben, Chairman, Delf University of Technology (The Netherlands), E-mail: L.j.m.houben@tudelft.nl.

UPCOMING EVENTS

DECEMBER
2013

ACPA's 50th Annual Meeting

December 2-6, 2013 in Rio Grande, Puerto Rico
To register: <http://events.acpa.org/register/>, For additional information, call 847.966.2272

International Journal of Pavements Conference

December 9-10, 2013 in São Paulo, Brazil, <http://www.ijpavement.com/>

JANUARY
2014

93rd Annual Meeting of Transportation Research Board (TRB)

January 12-16, 2014 in Washington, D.C., USA
<http://www.trb.org/AnnualMeeting/AnnualMeeting.aspx>

FEBRUARY
2014

14th International Winter Road Congress

February 4-7, 2014 in Andorra, <http://www.aipcrandorra2014.org/?lang=en>

Concrete Sustainability Conference, Latin America 2014

February 6-7, 2014 in Medellín, Colombia, <http://www.sustainabilityconf.org/>

For events taking place in 2014 and beyond, please go to:
<http://www.concretepavements.org/calendar.htm>

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Questions? Please contact moderator Jeff Roesler: jroesler@illinois.edu

International Society
ISCP
for Concrete Pavements

The ISCP Newsletter is produced monthly by:

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ISCP invites ISCP members and friends to submit articles and calendar items to the Editor-in-Chief for future issues.

ISCP President: **Mark B. Snyder, Ph.D., P.E.** president@concretepavements.org
Vice-President: **José T. Balbo, Ph.D** vice-president@concretepavements.org
Secretary/Treasurer: **Neeraj Buch, Ph.D.** secretary-treasurer@concretepavements.org

Please visit the **ISCP Website** at www.concretepavements.org for more information about ISCP.

Maps, globes: National Geographic Family Reference Atlas of the World ©2002 National Geographic Society, Washington, D.C.
All additional sources noted on perspective pages.

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