

**PROCEEDINGS:
TENTH INTERNATIONAL CONFERENCE
ON CONCRETE PAVEMENTS**

**“SUSTAINABLE SOLUTIONS
TO
GLOBAL TRANSPORTATION NEEDS”**

**Organized by:
INTERNATIONAL SOCIETY
FOR CONCRETE PAVEMENTS**

**in Cooperation and in Partnership with:
TRANSPORTS QUÉBEC**

**and in Partnership with:
HOLCIM, CANADA**

**JULY 8-12, 2012
QUÉBEC CITY, QUÉBEC, CANADA**

Volume I of II

FOREWORD


These are the proceedings for the Tenth International Conference on Concrete Pavements, which was organized by the International Society for Concrete Pavements (ISCP) and held in Québec City, Québec, Canada on July 8-12, 2012. This is the tenth in a series of such conferences to bring together experts from all over the world to discuss the state of the art of concrete pavement design, construction, evaluation, performance, and rehabilitation.

The First International Conference on Concrete Pavement Design was held at Purdue University on February 15-17, 1977. The Second International Conference on Concrete Pavement Design was held in Indianapolis, Indiana on April 14-16, 1981. Both of these conferences were planned and organized by Eldon J. Yoder, Professor of Civil Engineering at Purdue University. The Third International Conference, dedicated to his memory and his many contributions to the engineering profession, was held on April 23-25 at Purdue University. The Fourth and Fifth conferences were also held on the Purdue Campus in 1989 and 1993, respectively. The Sixth Conference was held in Indianapolis, Indiana in 1997. The Seventh Conference was held at the Disney Coronado Springs Resort in Orlando, Florida, on September 9-13, 2001. The Eighth Conference was held in Colorado Springs, Colorado on August 14-18, 2005. The Ninth Conference was held in San Francisco, California on August 17-21, 2008.

The papers presented in these proceedings were selected through peer review from manuscripts submitted prior to February 2012. Eighty-three papers were accepted for this conference on the basis of the peer review comments. The papers published in these proceedings have been organized in the order as was planned for the general program, which is described beginning on page vii.

We would like to take this opportunity to thank the authors and the many reviewers who volunteered their time to ensure that the papers that appear in these proceedings are of the highest quality. We wish to thank the members of the conference steering committee, the editorial committee, the student competition committee, the workshop committee and all of the workshop chairs and speakers, the entertainment committee, and the technical visit committee for their tireless efforts in developing each of the many components that comprised the overall conference program. We extend special thanks to all of the program sponsors for their financial support, and we gratefully acknowledge the contributions of the conference collaborators for their efforts in promoting the conference. We are especially appreciative of the contributions of the conference host and partner, Transports Québec and partner, Holcim Canada.

Finally, we would like to thank: Émilie Levesque, Catherine Blais and the rest of the staff at AGORA Communications for their superb assistance in managing the conference; Sharon Prochnow (National Concrete Pavement Technology Center) and Laura Taylor (Michigan State University) for all of their assistance in registration and correspondence matters; and Amy M. Dean for the graphic design and development of the conference program and other materials, and for editing, formatting and organizing the conference proceedings.



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The mission of the society to facilitate the advancement of knowledge and technology related to concrete pavements through education, technology transfer and research at the international level.

The Society will gather and disseminate information for the concrete pavement community. The Society's efforts will promote technological advancements and competence of its members, leading to improved concrete pavement performance.

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The 10th ICCP would not have been possible if not for the efforts of all of the authors and reviewers of the delegate manuscripts that were presented in the various technical sessions (including the poster board session).

The ISCP Editorial Committee gratefully acknowledges the contributions and efforts of all of the following individuals, who served as reviewers:

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Luc Rens, EUPAVE (Belgium)

Concrete Pavements Sustainability Issues in South America

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