# Airfield and Highway Pavements 2017

## *Testing and Characterization of Bound and Unbound Pavement Materials*

Selected Papers from the Proceedings of the International Conference on Highway Pavements and Airfield Technology 2017


**Edited by**

Imad L. Al-Qadi, Ph.D., P.E.
Hasan Ozer, Ph.D.
Eileen M. Vélez-Vega, P.E.
Scott Murrell, P.E.



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# Preface

An ever-growing number of highway and airport agencies, companies, organizations, institutes, and governing bodies are embracing principles of sustainability in managing their activities and conducting business. Overarching goals emphasize key environmental, social, economic, and safety factors in the decision-making process for every pavement project. Therefore, the theme of the conference was chosen as "Sustainable Pavements and Safe Airports." It is dedicated to the state-of-the-art and state-of-practice areas durability, cost-effective, and sustainable airfield and highway pavements. In addition, recent advancements and technologies to ensure safe and efficient airport operations are included.

This international conference provides a chance to interact and exchange information with worldwide leaders in the fields of highway and airport pavements, as well as airport safety technologies. This conference brought together researchers in transportation and airport safety technologies, designers, project/construction managers, academics, and contractors from around the world to discuss design, implementation, construction, rehabilitation alternatives, and instrumentation and sensing.

The proceedings of 2017 International Conference on Highway Pavements and Airfield Technology have been organized in four (4) publications as follows:

**Airfield and Highway Pavements 2017: Design, Construction, Evaluation, and Management of Pavements**
This volume includes papers in the areas of mechanistic-empirical design methods and advanced modeling techniques for design of conventional and permeable pavements, construction specifications and quality, accelerated pavement testing, pavement condition evaluation, and network level management of pavements.

**Airfield and Highway Pavements 2017: Testing and Characterization of Bound and Unbound Pavement Materials**
This volume includes papers in the areas of laboratory and field characterization of asphalt binders, asphalt mixtures, base/subgrade materials, and recent advances in concrete pavement technology. This volume also features papers for the use of recycled materials, in-place recycling techniques and unbound layer stabilization methods.

**Airfield and Highway Pavements 2017: Pavement Innovation and Sustainability**
This volume is dedicated to the papers featuring most recent technologies used for structural health monitoring of highway pavements, intelligent compaction, and innovative technologies used in the design and construction of highway pavements. The volume also includes papers in the area of sustainability assessment using life-cycle assessment of highway and airfield pavements and climate change impacts and preparation for pavement infrastructure.

**Airfield and Highway Pavements 2017: Airfield Pavement Technology and Safety**
This volume is dedicated to recent advances in the area of airfield pavement design technology and specifications, modeling of airfield pavements, use of accelerated loading systems for airfield pavements, and airfield pavement condition evaluation and asset management.

The papers in these proceedings are the result of peer reviews by a scientific committee of more than 90 international pavement and airport technology experts, with three to five reviewers per paper. Recent research was presented in the technical podium and poster sessions including the results from current Federal Aviation Administration (FAA) airport design, specifications, and safety technologies; design and construction of highway pavements; pavement materials characterization and modeling; pavement management systems; and innovative technologies and sustainability. The plenary sessions featured the Francis Turner Lecture by Dr. Robert Lytton and the Carl Monismith Lecture by Dr. David Anderson. In addition, two technical tours were offered: Philadelphia International Airport and the Center for Research and Education in Advanced Transportation Engineering Systems (CREATEs) Lab of the Henry M. Rowan College of Engineering at Rowan University.

Three workshops were presented prior to the conference: hands-on FAA's FAARFIELD software, design and construction of permeable pavements, and environmental product declarations.

The editors would like to thank the members of the scientific committee who volunteered their time to review the submitted papers and offered constructive critiques to the authors. We are also grateful for the work of the steering committee members in planning and organizing the conference: Katie Chou, Jeffrey Gagnon, John Harvey, Brian McKeehan, Shiraz Tayabji, and Geoffrey Rowe; as well as the local organizing committee chaired by Geoffrey Rowe and members including James A. McKelvey, Timothy Ward, Ahmed Faheem, and Yusuf Mehta for their help with the technical tours. Finally, we would like to especially thank the ASCE T&DI staff who helped put the conference together: Muhammad Amer, Mark Gable, Drew Caracciolo, and Deborah Denney.

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*Asphalt Mixture Characterization*



*Characterization of Recycled Materials in Asphalt Mixtures*

# Establishing Design Limits for Cracking Properties of Asphalt Concrete with Overlay Tester

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## Abstract

The premature cracking of the asphalt concrete (AC) layer in flexible pavements highlights the importance of a simple cracking performance test that can be used for routine applications during the design process of AC mixes. The overlay tester (OT) can be used to evaluate the formation and propagation of a crack within the AC specimens. This paper explains an alternative methodology for assessing the cracking potential of AC mixes using the OT test. The proposed methodology consists of two main stages: crack initiation and propagation. The fracture properties of the AC specimens are estimated from the critical fracture energy computed from the first OT loading cycle. The resistance of the AC mix to crack propagation is estimated from the crack progression rate, the rate of reduction in load carrying capacity of the AC specimen with the number of cycles. The process of selecting the limits for the critical fracture energy and crack progression rate to delineate the well and poor performing mixes is discussed here. The proposed cracking methodology and acceptance limits may provide a more comprehensive approach to predict and design the cracking potential of AC mixes.

## INTRODUCTION

An asphalt concrete (AC) layer must have a balance of rutting and cracking resistance to perform satisfactorily in the field (*Zhou et al., 2006*). Laboratory testing is an indispensable first step in balancing the rutting and cracking potentials of AC mixes and to minimize the premature failure of the pavements. Over the past decade, the rutting performance of the AC mixes has been satisfactorily improved by employing the wheel-tracking devices, such as the Hamburg wheel-tracking (HWT) test. One way to meet the rutting resistance requirements with the HWT test is using stiffer binders or lower asphalt contents. These measures may negatively influence the flexibility and cracking resistance of the AC mixes (*Zhou et al., 2006*).

Several performance tests have been implemented to evaluate the cracking resistance of AC mixes in the laboratory setting (*Ozer et al., 2016; Kim et al., 2006; Wagoner et al., 2005; Wu et al., 2005; Roque et al., 2002*). One such test, the overlay tester (OT) test, assesses the reflective cracking susceptibility of AC mixes through an assessment of the number of cycles to failure using a 93% reduction in load as a failure criterion. Although the OT test seems to