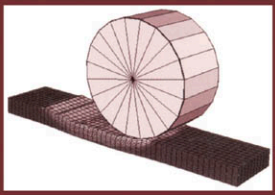
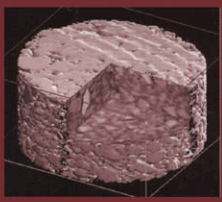
Geotechnical Special Publication No. 176

Analysis of Asphalt Pavement Materials and Systems

EMERGING METHODS





EDITED BY
Linbing Wang and Eyad Masad

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GEO INSTITUTE

GEOTECHNICAL SPECIAL PUBLICATION NO. 176

ANALYSIS OF ASPHALT PAVEMENT MATERIALS AND SYSTEMS

EMERGING METHODS

PROCEEDINGS OF THE SYMPOSIUM
ON THE MECHANICS OF FLEXIBLE PAVEMENTS

June 25–30, 2006
Boulder, Colorado

SPONSORED BY
Pavements Committee of the Geo-Institute of the American Society of Civil Engineers

The Inelastic Committee and the Granular Materials Committee of the ASCE Mechanics Division

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Published by the American Society of Civil Engineers

Library of Congress Cataloging-in-Publication Data on file.

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4400

www.pubs.asce.org

ISBN 13: 978-0-7844-0924-4
ISBN 10: 0-7844-0924-2
Manufactured in the United States of America.

14 13 12 11 10 09 08 07 1 2 3 4 5

Preface

This special publication includes 13 papers on characterization, modeling and simulation of asphalt concrete and subgrade, addressing some timely issues in mechanics of flexible pavements. They include four papers on modeling and simulations of asphalt concrete by incorporating the microscopic structures of the material, the interactions between aggregates, mastics and voids, and the use of Finite Element Method (FEM) and Discrete Element Method (DEM); two papers on the continuum approaches including nonlinear viscoelastic analysis and temperature dependency; two papers on laboratory characterization of asphalt concrete; three papers on the characterization of subgrade soil resilient modulus, incorporation of nonlinear soil behavior into pavement analysis, and the evaluation of the effect of using geogrid; and one paper on pavement evaluation.

Each paper published in this GSP was evaluated by peer reviewers and the editors. The review comments were sent to the authors and they have been addressed to the reviewers and the editors' satisfaction. The ASCE Geo-Institute Pavements Committee and the reviewers are sincerely acknowledged for their time and efforts.

The papers in this GSP include eight papers that were presented in the symposium on Mechanics of Flexible Pavements at the 15th U.S. National Congress of Theoretical and Applied Mechanics, held at Boulder, Colorado, June 25-30 2006 and five papers submitted for publication only. The symposium was supported by the Geo-Institute Pavements Committee, the Inelastic Committee and the Granular Materials Committee of the ASCE Mechanics Division.

The editors of this GSP would like to thank the Board of Governors of the Geo Institute for their approving the symposium and the special publication.

Linbing Wang, Virginia Tech
Eyad Masad, Texas A & M University

January 10, 2007

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STRESS CONCENTRATION FACTOR AS A PERFORMANCE INDICATOR FOR ASPHALT MIXES

Linbing Wang[1], P.E., Member, ASCE. Yongping Wang[2], Qingbin Li[3] and Gerardo Flintsch[4]

ABSTRACT: This paper presents some recent developments in using Finite Element Method (FEM) and the 3D microstructure of asphalt concrete reconstructed from x-ray tomography imaging to evaluate its performance. Asphalt concrete is modeled as a material composed of an effective solid and void. The stress concentration factor and its distributions are computed and correlated to the overall resistance of the mixtures against rutting and fatigue, and the internal structural quantities. The correlation of the stress concentration factor with the field performance of the WesTrack mixes indicates that mixes with large stress concentration factors, as expected, may be more prone to rutting and fatigue cracking than those with smaller stress concentration factors.

INTRODUCTION

Asphalt concrete is a heterogeneous medium comprised of three constituents of aggregates, binder and voids. The three constituents have significantly different properties. Traditional methods treat this material as a homogeneous continuum. Correspondingly, characterization of asphalt concrete is mainly in the scheme of homogeneous continuum. This treatment is valid for averaged quantities such as total

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