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PAVEMENT MATERIALS, STRUCTURES, AND PERFORMANCE

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Preface

A variety of topics in pavement structure and materials were covered in this special publication that contains 42 technical papers. The selected papers were organized into three technical sections: (1) Paving Materials Characterization and Modeling; (2) Pavement Evaluation, Analysis and Construction; and (3) Pavement Base and Subgrade. The materials presented in *Paving Materials Characterization and Modeling* section include aggregates, asphalt binder, hot mix asphalt (HMA), warm mix asphalt (WMA), recycled asphalt pavement (RAP), recycled asphalt shingles (RAS), and asphalt binder additives and fillers. Some new technologies include microwave heating, 3D surface roughness measurements and nano-technology. The *Pavement Evaluation, Analysis and Construction* section covers pavement field evaluation, structural analysis, as well as the construction technologies for asphalt pavement and concrete pavement. Several models are introduced to analyze and predict major pavement distresses. Pavement preservation technologies are also covered in this section. In the *Pavement Base and Subgrade* section, the papers concentrate on characterization and performance prediction of subgrade soils and other treated base materials used for pavement construction.

Each paper was reviewed by two or more reviewers as well as the editors prior to being published in this ASCE Geotechnical Special Publication (GSP). The authors were required to address the reviewers' comments until the paper met the satisfaction of the editors. All published papers are eligible for discussion in the Journal of Geotechnical and Geoenvironmental Engineering, Journal of Materials in Civil Engineering, and are also eligible for ASCE awards.

The papers collected in this publication were presented during GeoShanghai 2014 International Conference held in Shanghai, China, May 26-28, 2014. The conference was chaired by Professor Wenqi Ding and co-chaired by Professor Lianyang Zhang. The organizations that hosted this conference include Tongji University, the Chinese Institution of Soil Mechanics and Geotechnical Engineering, the Chinese Society for Rock Mechanics and Engineering and the Shanghai Society of Civil Engineering in cooperation with ASCE Geo-Institute, the International Society for Soil Mechanics and Geotechnical Engineering, the International Association of Chinese Infrastructure Professionals, the Deep Foundations Institute in the USA, the Alaska University Transportation Center (USA), University of Edinburgh (UK), Ruhr University Bochum (Germany), University of Cambridge (UK), Ecole des Ponts Paristech (France), Virginia Polytechnic Institute and State University (USA), the Shanghai Society of Theoretical and Applied Mechanics, Nagoya Institute of Technology (Japan), University of Arizona (USA), the Transportation Research Board (TRB) (USA), University of Kansas (USA), Georgia Institute of Technology (USA), Vienna University of Natural Resources and Applied Life Sciences (Austria), and University of Tennessee (USA).

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January 22, 2014

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Laboratory Preparation and Microwave Heating Test of CIPs/Asphalt Binder

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ABSTRACT: Microwave heating technology has been adopted in asphalt pavement maintenance to reduce the total cost resulting from the energy consumption. In this paper, laboratory preparation and microwave heating test of carbonyl iron powders (CIPs)/asphalt binder were carried out. The modeling procedure, microwave heating efficiency and the properties of the CIPs/asphalt binder, such as penetration, softening point and ductility, were studied. The results show that microwave heating efficiency of CIPs/asphalt binder is enormously higher than that of ordinary asphalt binder. Adding a certain amount of CIPs can improve the asphalt binder's resistance to deformation at high temperature. All these can put forward a theoretical basis to design asphalt mixtures being suitable to be used in snow and ice removal by microwave pavement maintenance vehicles.

INTRODUCTION

As to the problem that conventional heating methods requires that the energy propagates through the asphalt materials by diffusion, power microwave was adopted to heat asphalt binder with CIPs by its microwave absorbing characteristics at different frequencies (Zivkovic et al. 2012). Microwave heating is a relatively new technology, which provides alternative approaches for enhancing material properties (Chun et al. 2013). There had been many studies on the construction and evaluation of asphalt mixes pavement with microwave technology. For example, Jaselskis et al. (2001) measured the density of asphalt in real time using a differential microwave signal approach. Sun et al. (2008) built a two-dimensional heat transfer model for the asphalt mixtures within the heating range based on the theory of unsteady heat conduction to solve for temperature fields in microwave heating for recycling asphalt mixtures. Meanwhile, a volume