Effect of air voids on the high-temperature creep behavior of asphalt mixture based on three-dimensional discrete element modeling

Tao Ma, Deyu Zhang, Yao Zhang, Yongli Zhao, Xiaoming Huang

PII: S0264-1275(15)30583-9
DOI: doi: 10.1016/j.matdes.2015.10.005
Reference: JMADE 744

To appear in:

Received date: 8 June 2015
Revised date: 4 August 2015
Accepted date: 2 October 2015

Please cite this article as: Tao Ma, Deyu Zhang, Yao Zhang, Yongli Zhao, Xiaoming Huang, Effect of air voids on the high-temperature creep behavior of asphalt mixture based on three-dimensional discrete element modeling, (2015), doi: 10.1016/j.matdes.2015.10.005

Effect of air voids on the high-temperature creep behavior of asphalt mixture based on three-dimensional discrete element modeling

Tao Ma [a,*], Deyu Zhang [b], Yao Zhang [a], Yongli Zhao [a], Xiaoming Huang [a]

[a] *School of Transportation, Southeast University, 2 Sipailou, Nanjing, 210096, China*

[b] *School of Engineering and Architecture, 1 Hongjing Road, Nanjing Institute of Technology, Nanjing, 211167, China*

* *Correponding author: matao@seu.edu.cn*

Abstract: This study focused on the effects of different parameters related to air voids on the creep behavior of asphalt mixture based on micromechanical modeling and virtual test through three-dimensional discrete element method (DEM). By using DEM software named as Particle Flow Code in three dimensions (PFC3D), user-defined micromechanical modeling was conducted for asphalt mixture. And virtual uniaxial static creep test of asphalt mixture was conducted by PFC3D and verified by laboratory creep test. The effects of air void content, microstructure parameters including size, elongated index and orientation of air voids, and air void distribution on the creep behavior of asphalt mixture were investigated based on virtual creep test. It is proved that bigger content, size and elongated index of air voids lead to greater creep strain of asphalt mixture. Compared to vertical orientation, horizontal orientation of air voids is more harmful to the creep behavior of asphalt mixture. Nonuniform distribution of air voids within asphalt mixture also has negative effects on the creep deformation of asphalt mixture, especially for vertical nonuniform distribution of air voids. Therefore,