NARC RESEARCH STUDENTSHIP #3

UNIVERSITY OF NOTTINGHAM

RESEARCH STUDENT:	Mr York Lee
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Project Description

This project was concerned with using the Discrete Element Method (DEM) to model the mechanical behaviour of asphalt mixtures. DEM models a particle as a ball or a number of balls bonded together. PFC3D DEM software was used to model the mechanical behaviour of idealised asphalt mixtures. The effect of bitumen was represented as shear and normal contact stiffnesses.

The preliminary simulation was performed to simulate the behaviour of highly idealised asphalt mixture in a uniaxial compressive test. The numerical sample preparation procedure was developed to artificially generate a test specimen that replicated an idealised mixture. The elastic simulations were performed to examine the effect of sample size, loading rate and the shear and the normal contact stiffnesses on elastic bulk material properties. The elasto-visco-plastic simulations were then performed to simulate the time dependant deformation behaviour of an idealised asphalt mixture.

At each stage of research, prediction from the model was compared with data previously collected for this type of idealised mixture. Simulations and studies were performed to understand the effects of particle contact stiffnesses ratio (in compression, tension and shear) on dilation behaviour of idealised mixture. The model could successfully predict the dilation gradient of idealised mixture to the realistic level under uniaxial compressive test.

The model was used to simulate triaxial compressive tests. In the longer term the model was further developed to model the dilation of the idealised asphalt mixture by taking account the shape and grading of aggregate.