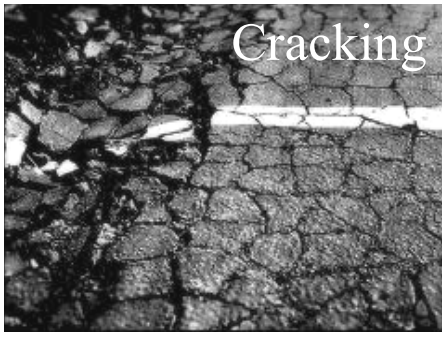
M.Sc. THESIS PROJECT

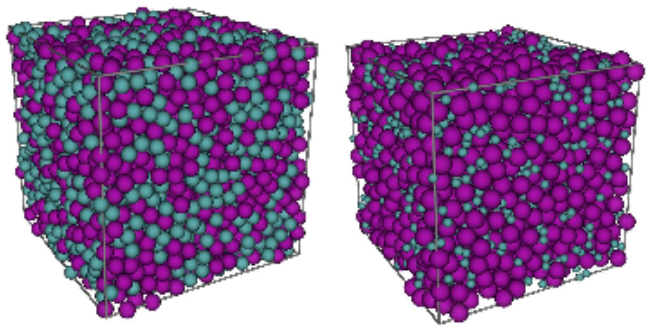
MODELING ASPHALT WITH DISCRETE PARTICLES AND CONTINUUM METHODS

The Netherlands has an extensive asphalt road system which is used by more than 7 million cars on a daily basis. Asphalt mixtures are composite materials of graded aggregates bound with bitumen plus a certain amount of voids. When looking at asphalt, kinematics at different scales apparently governs the behavior of the material: the interaction between the mortar and the stones at micro-scale, the stones arrangement and the interaction of multiple stones at the meso-scale, the (continuum) behavior of the whole road at macro-scale.
Bridging the gap between the different scales is our ambitious goal, deriving a micromechanical constitutive model that can be applied to roads on the larger continuum scale.



"LOOKING INSIDE" THE ASPHALT MIXTURE, large-scale problems for road distress phenomena like rutting, ravelling, cracking and roughness can be addressed. Thus, the mechanisms to trigger **SELF-HEALING** will be investigated and new materials with micromechanical based healing capability can be designed.

To discover the influence of the single components in the macroscopic behavior, the asphalt sample will be reproduced using a Discrete Element Method (DEM). Discrete element methods simulate particulate systems by modeling the translational and rotational degrees of freedom of each particle with simple Newton's laws, and the forces are calculated associating proper constitutive models with each particle contact. Through this method you will focus on properties like size distribution and shape of the particles as well as the cohesion strength of the bitumen in the mixture. Another challenge that will be investigated in this assignment is the coupling of the DEM method to macroscopic FEM simulations.



The project is part of the Tire-Road Consortium (www.tire-roadconsortium.com) and will be a joint thesis between the group members of the consortium: Construction Management and Engineering (CME), Elastomer Technology and Engineering (ETE), Multi Scale Mechanics (MSM), Structural Dynamics and Acoustics (SDA), Surface Technology and Tribology (STT)

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