# Micro-Mechanical Interpretation of Moisture Induced Damage in Asphalt

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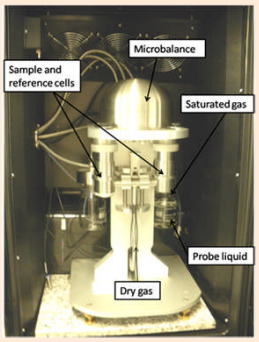


**Sorption device** for determining moisture diffusion coefficients of asphalt mixes

**X-Ray Computer Tomography** Set-up

**Instron** servo hydraulic load frame for determination of adhesive and cohesive strength of asphalt mixtures

The majority of roads in the UK and throughout the world are constructed using asphalt mixtures with over 340 million tonnes being produced in Europe in 2007. The most important factor influencing the durability of asphalt mixtures is the presence of water in the pavement structure and the detrimental effect that water has on the properties of the mixtures. Moisture-induced damage is an extremely complicated mode of distress that leads to the loss of stiffness and structural strength of the asphalt and eventually to the costly failure of the road structure. An improved understanding of moisture-induced damage in asphalt and more moisture resistant materials could have a significant impact on road maintenance expenditure.

Moisture-induced damage is governed by the interaction of water with the asphalt mix components (mastic and aggregates). The mechanical characteristics of asphalt depend on the contribution of these individual mix components and on the mechanical characteristics of the bond between them. Recently, experimental evidence has demonstrated that moisture-induced damage in the mix can occur due to the adverse effects of moisture on the mechanical characteristics of the mastic and/or the bond, although there is no general consensus as to which mechanism dominates (Kringos and Scarpas, 2008; Kringos et al. 2008).

In this project, for the first time, the micro-mechanical processes that result in moisture induced damage at the meso- and macro-scale in asphaltic pavements will be analysed in a comprehensive manner in which both cohesive and adhesive types of damage will be addressed and evaluated as a function of the physico-chemical characteristics of the components of the asphalt mix. For this to be become possible, the internal geometry of asphalt specimens (microstructure) will be modelled using X-Ray Computed Tomography (X-Ray CT) images to generate 3D finite element meshes and used in the finite element systems Computer Aided Pavement Analysis (CAPA-3D) and Ravelling of Asphalt Mixes (RoAM) developed at TU Delft. Laboratory testing to determine the diffusion coefficients of the asphalt mix components as well as moisture sensitivity testing on the bulk asphalt mixes will be conducted at NTEC.

From the combined experimental and computational analyses, it will become possible to reach an unprecedented insight into the dominant parameters controlling moisture induced damage in asphaltic mixes. On the basis of the conclusions of the combined computational-experimental studies, recommendations for practice shall be drafted focused on the improvement of moisture resistance of typical asphalt mixtures and thus contributing to the sustainability of the UK road network.