The wearing course constitutes the top layer of asphalt pavements and is typically designed for a lifespan of about one decade. Wearing courses are usually made of densely graded, compact asphalt. Alternatively, porous asphalt can be used which is primarily designed with respect to a good noise reduction characteristic. Due to its hollow structure it is able to reduce the noise pressure level significantly. In addition, the hollow structure results in a good water drainage capacity. This implies that, together with water, road debris is infiltrated into the asphalt. If the debris accumulates on the bituminous surface of the pores the outstanding acoustical properties worsen and the acoustical life cycle of porous asphalt decreases notably in comparison to the structural life cycle.

The aim of this project is to lay the foundations to simulate the deposition of particles in porous asphalt on a pore scale. With this new numerical approach the simulation time for a life cycle of porous asphalt could be significantly reduced compared to laboratory experiments. Further the flexibility in testing slight modifications of existing asphalt types will be increased. The geometry is to be reconstructed from tomographical measurements in combination with three-dimensional image reconstruction techniques and serves as input for pore scale simulation of flow and transportation using the Lattice Boltzmann Method. The simulations are done with the implementation of the Lattice Boltzmann Method of the institute for computational modelling in civil engineering at the TU Braunschweig.

The air permeability of the porous asphalt is a basic characteristic of its acoustical performance. Further, the geometrical reconstruction of a three-dimensional computer-tomography scan is the basis for realistic numerical simulations of the flow on the pore scale. Therefore the permeability is measured on a laboratory scale and compared to the numerical results calculated from the reconstructed geometry of the same sample. It is found out that the simulation results are quite sensible to small geometrical variations. While the undisturbed probes deliver good results the results of the disturbed probes are not acceptable. An estimation via the reconstructed inner surface shows, that the inner geometry is not represented sufficiently. Therefore more precise image reconstruction techniques have been developed and implemented. Edge-preserving filter techniques are used because simple (Gaussian) filter techniques would glaze the whole picture. Further the image segmentation was automated and enhanced by making use of prior information and parameter estimation techniques. The final influence of the enhanced pre-processing is to be quantified.
The next step will be implementation of the road debris infiltration with the water phase. Particles that can be resolved by the numerical resolution are explicitly modelled. The interaction with other particles and the walls will follow a simple collision model neglecting rotation. Smaller particles, which cannot be resolved by the discretisation of the flow field, will be modelled in a consecutive project. Finally, a first order sorption model is aimed to be introduced in cooperation with the TU Braunschweig.