

## **A STUDY ON THE MECHANISM OF DEAD SLOW PERMEATION OF WATER AND MODELING IN SATURATED CONCRETE**

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In recent years the construction of disposal facilities for high- and low-level radioactive waste has been under planning. Technical investigations for the construction of structures that will be durable for the order of 10,000 years have been carried out, as a part of which water transport analysis over very long timescales has been investigated. In water permeability tests on large full-scale test specimens to investigate the very high water-shielding capability of cementitious materials, it has been confirmed by visual examination of cores that pressurized liquid water is halted 5 cm from the surface. However, when a thermodynamic coupled analysis model capable of accurately tracking material behavior at an arbitrary age is used, the halting of liquid water transport when the water is pressurized cannot be reproduced, leading to great over-prediction of water transport. In this model, even though changes in water viscosity as a function of pore diameter are reflected in the permeability coefficient, Darcy's Law applies under all conditions, so it is considered impossible to completely replicate the behavior such that the blocking of liquid water as observed in tests is modeled. The reason for this is that wall friction leads to peculiar behavior of liquid water in the micro pores of porous media.

In this study, the authors set out to build a new model that takes into account the mechanism of this fluid behavior in micro pores so as to more accurately predict concrete permeability. The yield stress model used frequently in fluid dynamics was applied to the flow of liquid water in concrete, and then the effect of kinetic and static friction at the pore walls on liquid water behavior was added. A viscosity model for liquid water in micro pores was also proposed on the basis of some experimental results and this too was incorporated into the estimation scheme. The validity of these models was verified by comparing calculated data with experimental data obtained in permeation tests of saturated concrete.

The understanding obtained from this research is expected to find application in calculations of ultra-slow water permeation into concrete. It will also contribute to high-precision prediction models for concrete deterioration. As a result, the authors of this paper are suitable recipients of the JSCE's young researchers awards.