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ABSTRACT

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Verification of the Wenner method for the determination of the impermeability of concrete

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Within the framework of national technical approvals concrete additives can be incorporated in concrete by using the k-value concept if the impermeability of the concrete remains unaffected. So far, the impermeability of the concrete can be verified by using the electrolyte resistance measured by the Wenner method. The test is carried out using samples that are stored in water at 20 °C to prevent that different moisture contents of the concrete or fluctuating temperatures distort the result. But the electrolyte resistance depends on both the impermeability and the chemical composition and respectively the electrical conductivity of the electrolyte. Inside the concrete the pore solution is the electrolyte and its conductivity depends on the raw materials of the concrete and the water cement ratio. Therefore, it is conceivable that these two factors can influence each other. Within the research project, it is investigated if the impermeability can be quantified by the Wenner method in general and if the results are repeatable.

To verify the correlation between the electrolyte resistance measured by Wenner and the impermeability of the concrete, seven concrete mixtures and the corresponding hardened cement pastes were prepared. The impermeability of the concrete was indirectly described by using water absorption and oxygen diffusion. The structure of the hardened cement pastes was investigated by means of mercury porosimetry. In addition, a pore water analysis was determined on each hardened cement paste.

The comparison of the test results showed no general correlation between the Wenner results and the impermeability values. Concerning the concretes without fly ash a correlation between the gas diffusion and the measured electrolyte resistance could be revealed. To quantify this, the conductivities of the hardened cement pastes were also compared with the measured electrolyte resistance. Further comparisons of the measured electrolyte resistance with the results of the water absorption under atmospheric pressure, the water absorption under pressure of 150 bar or the porosity did not show any correlations. Hence, by measuring the electrolyte resistance no general conclusion can be drawn on the impermeability of the concrete.