

**STUDY ON EVAPORATION OF WATER FROM CONCRETE  
SURFACE**

(コンクリート表面からの水分の蒸発に関する研究)

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## **ABSTRACT**

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Water transport in concrete affects significantly the durability and long-term serviceability of concrete structures. Water serves as the main vehicle carrying aggressive agents into concrete and then causing deterioration. Evaporation of water on surfaces of concrete exposed to the environment is a driving force of water transport in concrete pores by creating the humidity gradient. Therefore, it is important to understand and assess quantitatively the causes affecting on evaporation rate on concrete surfaces. This study is carried out to develop a method to determine a change of evaporation rate under wind condition. Moreover, to understand moisture transport within the concrete structure, a computational model is proposed to confirm the existence of fluid movement in unsaturated concrete.

For nonsaturated concrete, during the drying process, on the exposed surfaces, water evaporates as vapor form. However, inside concrete structure, not only vapor but also liquid water transport to the exposed surfaces. These simultaneous movements were confirmed in this research by a computational model of moisture transport within the concrete structure. Numerical analysis was performed with two different types of materials: calcium carbonate and cement mortar with different water-powder ratios. The results obtained from the numerical method agreed with experimental results in a previous study on the separate transport of liquid water and vapor in nonsaturated concrete. Also, series of numerical experiments on concrete's moisture transport model were conducted to survey relationship between parameters: water-cement ratio, relative humidity, etc...and moisture content of concrete.

Not only transport of water inside concrete structure but also transport of it from concrete surfaces – evaporation needs to be evaluated accurately. There are several factors governing evaporation, of which the wind has always been mentioned as an important one. The presence of wind accelerates evaporation rate by removing escaping water molecules from the exposed surfaces. Therefore, this research mainly aimed to investigate the relationship between wind velocity and evaporation rate under both monotonic conditions of drying and cyclic drying-wetting condition. Firstly, laboratory test was carried out to investigate the dependence of amount of evaporation water on wind velocity. In this test, specimens were placed in wind tunnels with different wind velocities which produced by fans at different wind velocities. The test results proved that water evaporation due to wind effect was not dominated by only boundary condition. It is predicted that the change in air pressure near the drying surface impacted transports of water inside concrete. Based on this, the water transport model was enhanced to be a model which can determine amount of evaporation water under wind condition.

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