STUDY ON DECREASING MECHANISM OF IN-WATER STRENGTH OF CONCRETE

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Dr. Matsushita has long been engaged in fundamental studies on the static and fatigue strengths of concrete. For example, in the JSCE's standard specifications for concrete structures, the formula for predicting the fatigue strength of concrete is based on his research.

It is well known that wetting decreases the static strength of concrete. Dr. Matsushita found that wetting also decreases the fatigue strength of concrete under repeated compressive loading; this effect is incorporated into the JSCE standard specifications as a decreasing *K*-value in the formula for predicting the fatigue strength of concrete when wet.

The reason for these phenomena was unknown for a long time. After a series of studies on the influence of the content and type of moisture on the static and fatigue strengths of concrete, Dr. Matsushita clearly described the mechanism behind the decreased strength of wet concrete.

In particular, using the theories that concrete fractures are the result of a nucleating and propagating process in which surface energy is consumed, and the difference in solid-liquid surface energies is equal to that in solid-liquid surface tensions, he experimentally showed that the static compressive strength of concrete decreases as the surface tension of the internal liquid increases. He then extended the same theory to the

fatigue strength of concrete under repeated compressive loading and showed that the fatigue strength of concrete also decreases as the surface tension of the internal liquid increases. He concluded from these results that energetic theory explains why the strength of concrete under static and dynamic loading is lower in water than in air. He has continued to work on these fundamental themes and has published much important research in engineering.

The distinguishing feature of the award winner is his ability to forcefully advance his research using the “front-door” experimental method in order to arrive at a correct understanding. He has developed many basic findings into advanced concrete technologies, making him a worthy winner in the research accomplishment sector of the Yoshida Award.