ABSTRACT

Liu, Xin, M.S.C.E, Purdue University, May 2016. Absorption and Desorption in Concrete. Major Professor: Jason Weiss.

Absorption is a transport property which influences the durability of concrete. Specifically, recent work shows that absorption can be used to determine the freeze-thaw durability of concrete elements. This work examines from aspects of concrete drying and wetting. First it examines the absorption of partially dried concrete. Second this assesses desorption-absorption isotherms for concrete mixtures the work consider connect with varying air contents on an attempt to determine the water absorption behavior of the concrete pore network on the absorption property. Third the work assesses the drying behavior.

ASTM C1585-13-13[1] is a common standard test method that is used to determine the initial sorption and secondary sorption and total absorption in unsaturated concrete. This work exams samples conditioned at 50% and 75% relative humidity. As the use of mass change alone is insufficient to characterize concrete performance, the degree of saturation was used to describe the behavior of samples. This thesis performed absorption tests on concrete with different water to cement ratios, varying air content and air void quality, and different sample conditioning at 50% and 75% relative humidity. Plots of the degree of saturation and square root of time were developed.

The results indicated that, as expected, samples conditioned at 50% relative humidity can absorb more water than the samples from the same mixture that were conditioned in 75% relative humidity. Also, the samples containing a higher volume of air had a lower degree of saturation (DOS) after conditioning and initial absorption. From the absorption results, we can also tell that the nick point occurred range can be predicted following the model shown in Todak It was found that the secondary sorption is not related to the air content.

The Dynamic Vapor Sorption (DVS) test is used to determine desorption and absorption of a sample that is 5mm x 4mm x 1mm thick. In the DVS test, samples were cut in small pieces and saturated in limewater. This test described how the water vapor vacated and filled the capillary pores and gel pores and showed the results in the mass changes of the samples. The results showed higher water to cement ratio, the more water samples absorbed and desorbed.

The third test is a drying test, followed by SIMCO STADIUM LAB TEST. In this test, 100 mm diameter cylindrical samples were cut in 50mm in thickness. After the samples were saturated in limewater, they were placed in the 50% relative humidity chamber. The mass changes were reported in 30 days [2]. The results shows that the higher water to cement ratio samples lose more water.