Effect of Internal Curing on Sustainability of High Performance Concrete (in compressive strength)

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Abstract

The most quoted definition of sustainable development resulted from the Brundtland report as "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The goal of sustainability is that life on the planet can be sustained for the foreseeable future. The lifetime of a construction material has a direct impact on sustainability. When the material deteriorates, it must be destructed and rebuilt. The lifetime is directly controlled by the durability of the construction materials. It is further influenced by the adaptability of the design to repair and renovation, and repair and renovation themselves have environmental impacts.

Internal curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing water. The additional internal water is typically supplied by using relatively small amounts of saturated, particles in concrete.

In the present study the durability of internally cured high performance concrete, HPC, exposed to internal sulfate attack, ISA, and to freezing and thawing cycles, is investigated. Two saturated curing agents, Limestone dust and Porcelanite, were used to facilitate internal curing for concrete. These agents were used as partial replacement for fine aggregate (sand) in two volumetric percentages, 20 and 30 percent. The testing program consisted mainly of three parts. The included tests were; compressive, splitting tensile and flexural strength tests in addition to density, absorption and ultra-sonic pulse velocity tests. The experimental program was extended till the age of 240 days.

The first part deal with internally cured HPC exposed to normal exposure conditions. This part was conducted just for comparisons. The second part was devoted to study the effects of ISA on internally cured HPC. Three percentages of SO3 in fine aggregate were adopted 1, 2 and 3 percent by adding natural gypsum to the fine aggregate. The experimental results showed that irrespective of the method of curing, the studied concrete mixes have suffered

degradation in both compressive and splitting tensile strengths and this degradation is positively related to the percentage of sulfate in fine aggregate.