

Effect of Aggregate Roughness on Strength and Permeation Characteristics of Lightweight Aggregate Concrete

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This paper aims to examine the effect of surface roughness of lightweight aggregate particles (LWA) on the strength and permeation characteristics of lightweight aggregate concrete (LWAC). Changing the smooth surface texture of LWA particles was achieved by applying surface polishing to make rough texture of the aggregate particle surface. LWAC mixes with different LWA surface roughness (smooth and rough) were produced, and their strength and permeation properties were investigated. Cut section method was adopted to measure the surface roughness of LWA particles. The surface profile was measured by using ImageJ software on images captured using the optical microscope (OM) and scanning electron microscope (SEM) with different magnifications. The ability of making the surface of LWA particles rough by polishing them was proved by means of 2D roughness measurements. From the results, it was found that using treated LWA with rough surface helped in enhancing the strength (compressive) and the permeation properties (water absorption and sorptivity) of lightweight aggregate concrete (LWAC). Making the LWA rough helped in improving the compressive strength by about 13.5% owing to enhancing the ITZ between the LWA particles and the cement paste as well as improving the chemical bonding and mechanical interlocking forces between them. In addition, using rough lightweight aggregate led to reduce the water absorption and cumulative volume of water absorbed by about 9% and 12%, respectively, compared to values of mix with original (smooth) LWA.