Structure Lightweight Aggregate Concrete Reinforced with Polypropylene Fibers

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Abstract:

This study investigates the effect of using lightweight expanded clay aggregates (LECA) as a partial or complete replacement for normal-weight aggregates (NWA), along with the incorporation of polypropylene fibers (PPF) on the fresh and mechanical properties of structural lightweight aggregate concrete (SLWAC) at different curing ages of 28, 90 and 365 days. A comprehensive experimental program was carried out, involving seven (07) different concrete mixtures: three (03) SLWAC mixes with LECA replacing NWA by 50%, 75%, and 100%; three (03) fiber-reinforced structure lightweight aggregate concrete (RSLWAC) mixes incorporating the same LECA replacement levels and polypropylene fibers (0.1% volume fraction); and one (01) normal-weight concrete (NWC) mix serving as the control. All mixtures were prepared with a constant cement content of 350 kg/m³ and a fixed water-to-cement ratio (w/c) of 0.54. The properties evaluated included workability, dry density, compressive strength, and flexural strength. The results demonstrated that incorporating LECA improved workability, reduced density, and enhanced mechanical performance. For the fiber-reinforced mixtures, the addition of PPF slightly reduced workability but led to further improvements in both compressive and flexural strength.