An experimental approach to design self-consolidating concrete

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Abstract

This paper presents the analysis of an experimental mixture design approach for self-consolidating concrete (SCC) based on two design parameters to optimize mechanical properties and durability. The first approach is based on an empirical determination of the self-consolidation ability of mixtures with a fixed mortar content, while the second approach is based on enhancing the aggregate packing. The proposed procedures enable the establishment of a mixture design nomogram that can correlate the materials' composition and properties. The effect of mixture design parameters on hardened properties of investigated mixtures developed using each of the proposed approaches was compared in terms of compressive strength to secure a given modulus of elasticity, ultrasound wave propagation velocity and rapid chloride ion penetration. The modulus of elasticity and ultrasound wave propagation velocity of the designed SCC mixtures are found to be, respectively, almost 50% and 8% higher than those of conventional concrete, even at SCC mixtures with lower compressive strength values. Lower modulus of elasticity and ultrasound wave propagation velocity were obtained for SCC mixtures than conventional concrete with compressive strength between 50 and 60 MPa.

Keywords

Mixture design model, Packing density, Self-consolidating concrete.