Strength development of high-performance concrete using nanosilica

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Abstrak

The mechanical properties and durability of high-performance concrete can be improved with the use of nanosilica. Still, the relationship between the content of nanosilica and the mechanical properties of concrete needs to be verified in order to develop of compressive strength that can be applied to any concrete mixture. The aim of this study was to develop mathematical equations that account for the relationship among concrete's compressive strength, the modulus of elasticity with its compressive strength, and the modulus of rupture with its compressive strength. The specimens of f'c80-NS10-SF5 and f'c100-NS10-SF5 were fabricated by mixing natural nanosilica and silica fume, and those of f'c80-NSHD5-SF5 and f'c100-NSHD5-SF5 were fabricated by mixing commercial nanosilica and silica fume as the main composition materials, with the addition of other materials. The compressive strength and indirect tensile strength of the concrete were tested at 1, 3, 7, and 28 days. New mathematical models of generalized compressive strength against concrete age were empirically developed and then validated in order to derive new insights into the substitution of natural nanosilica for commercial nanosilica in the civil-engineering industry.