Mechanical properties of concrete with SAP. Part II: Modulus of elasticity

In this study, focus is on the modulus of elasticity for concrete with superabsorbent polymers (SAP). The results show that based on composite theory it is possible to establish a model, which predicts overall concrete elasticity. The model assumes a three phase material of aggregate, cement paste, and air with volume fractions of the three phases as well as elastic properties of paste and aggregates as input parameters. Addition of SAP changes the E-modulus, because it both has an influence on properties of the cement paste and on the volume of air voids. Here, the E-modulus is an example of a mechanical property, and the same methodology can probably be applied to other mechanical properties. It is often assumed that a range of mechanical properties of concrete can be derived if the compressive strength is known. The link between the compressive strength and other mechanical properties is often a more or less empirical relation. The results show that when introducing SAP, models of a more empirical nature can be misleading (and e.g. relations stated in codes are often of this empirical nature). The reason is twofold: First, the empirical models often have a general problem with the effect of air voids. Second, SAP addition may at the same time lead to increased compressive strength (as shown in [5]) and reduced E-modulus. A prediction based solely on compressive strength therefore overrates the modulus of elasticity, so the empirical models are unsafe to use for concrete with SAP.

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