

A COMPARATIVE ANALYSIS OF THE CREEP OF THE HARDENING CONCRETE AND CONCRETE MODIFIED WITH DISPERSE-REINFORCEMENT

Abstract

The concrete matrix has a minor limit deformability. This causes the cracks and fractures to occur. Most commonly cracks occur in the first days of the hardening of the concrete mixture. The process of transformation of the hardening concrete is accompanied by the changes of endurance, Young's modulus and contraction. And in the massive elements also the changes of temperature, which generate a significant stresses in the material. In order to correctly estimate the consequences of the early loading of concrete, the changes of its mechanical and rheological properties during hardening should be studied and described. The fiber additions used currently change the concretes' endurance and deformability parameters, thus justifying the need to specify the description of the fiber concrete rheological properties.

In the analysis, a thesis was assumed that in comparison with the plain concrete, the fiber concrete, apart from differences in the physical properties, is characterized also by different rheological properties. The description of delayed deformations of fiber concrete loaded at an early age requires the specification with reference to the standard determination, which concern, first of all, the plain concrete. The standards used currently when designing concrete structures do not address in a more specified way the creeping when the tensile strength is applied. During the scientific work, the creeping of the loaded fiber concrete was analyzed in a linear range to the level of approx. 40% of break strength and in a non-linear range at effort reaching approx. 85% of the material endurance at the moment of loading. The research was conducted for both squeezed concrete as well as stretched concrete, and at the changing age of the concrete at the moment of its loading – 24, 96, 168 and 672 hour. The obtained results were compared with the reference concrete, without fibers. The analysis of the studies' results in the light of the standard arrangements allow for the formulation of conclusions of qualitative character, indicating the need to specify the standard description.

In the further part of the study, the concept of own description of the loaded concrete creeping at an early age was presented, which took into consideration the stochastic character of the concrete structure and referenced to the Kelvin-Voigt model. The verification of this model was conducted by analyzing the probability density of random variables Q for hypothetically assumed distributions: gamma, exponential and deterministic – determining their detailed form, and further through approximation of results of creeping studies with continuous functions resulting from the above mentioned distributions. The comparative analyses of the creeping of plain concrete and concrete with the addition of disperse-reinforcement indicated to differences concerning, first of all, the concretes loaded at the early stages of concrete transformation.