Abstract

The development of research on rheology, including the phenomenon of creep, has continued rof 100 years. They have resulted in the development of computational models around the world designed to enable prediction of creep phenomenon development over time. History shows that underestimation of this phenomenon, especially in structures particularly sensitive to its impact, such as bridge structures, can be highly hazardous in its consequences. An example of this issue is the disaster of the Koror - Babelthaupt Bridge in 1996, caused by the lowering of the joint in the keystone by 1.61 meters, and a decrease in prestressing force by about 50% in just 18 years after its construction.

The main purpose of this project report was to verify whether the accuracy of the computational models currently in use is sufficient, especially in the context of concrete material modifications used in today's building material industries.

Among others, the study section discusses ways to modify concrete mixtures and the types of deformations observed in concrete. However the main focus was given to an approximation of the phenomenon of creep in concrete with particular attention to the factors affecting its development and the potential consequences associated with its underestimation. In the further part, selected computational and laboratory methods for determining the creep rate were discussed and compared.

In the part dedicated to researches, according to the adopted program, preliminary studies were carried out, based on which the experimental plan was determined. The plan assumed making nine concrete mixtures differing in the content of blast furnace slag and aeration. In basic research, the strength properties and creep coefficient were examined for samples made from the designed mixes. The value of the creep coefficient was additionally calculated according to the adopted model.

In the analytical section, the effect of selected material modifications on the studied creep phenomenon was defined. In addition, the values obtained from laboratory tests were compared to results from the selected calculation model. On the basis of the obtained results and their analysis, a conclusion was made confirming the thesis of the project report - material modifications of concrete, such as the type and content of the additives and aeration, significantly affect the creep rate values. Above that, arguments were identified for further development of research on this subject.

This report includes 95 figures and 22 tables. It is also accompanied by a bibliography consisting of 111 literature items, 19 standards and 5 internet sources.

Keywords: concrete, rheology, creep phenomenon, computational models, shrinkage, material modifications, admixtures, additives, test methods.