EFFECT OF CREEP OF POLYMERIC FIBRES ON DEFORMATION OF FIBRE CONCRETE BEAM ELEMENTS UNDER THE LONG-TERM LOADING

J. Fládr[1], J. Krátký[2], J. Lukš[3], J. Vodička[4], J. Vašková[5]

Abstract

The paper deals with behaviour of fibre concrete members with polymeric fibres after formation of macro-crack. The polymeric fibres creep under long-term loading. For steel fibres the effect of creep can be neglected. The creep of polymeric fibres after cracking can significantly affect the service-ability limit state design. The paper presents long-term experimental research that shall verify significance of the creep effect on the long-term behaviour of the fibre concrete element with polymeric fibres.

Keywords: fibre concrete; polymeric fibres, creep, long-term loading

Introduction

The main advantage of fibre concretes compared to common concretes are tensile strength after cracking, toughness and higher ductility both in tension and compression. More pronounced are these properties in tensile zones but effect of ductility is important also in compressed zones of the fibre concrete structure after the limiting strength is reached.

The mostly used fibres for fibre concretes are the steel fibres and synthetic fibres on the polymeric basis. Mechanical properties of these types of fibres are very different. This results also in different characteristics of particular fibre concrete. In both cases the fibres are the main reason of specified advantages.

In tensile zones the tensile strength is composed from effect of fibres and the cement matrix before macro-cracking. After macro cracks occur the effect of cement matrix is eliminated and the residual strength applies to the resistance of the member. In a fibre concrete member without rebar reinforcement usually one crack occurs, whereas there are more cracks in a fibre concrete member with rebar reinforcement. The residual strength fully depends on the fibre type, i.e. mainly on the fibre strength, Young modulus, fibre geometry and anchoring in the cement matrix.

[1] Josef Fládr, Fakulta stavební ČVUT v Praze, Thákurova 7, 166 29 Praha 6, josef.fladr@fsv.cvut.cz

[2] Jiří Krátký, Fakulta stavební ČVUT v Praze, Thákurova 7, 166 29 Praha 6, jiri.kratky@fsv.cvut.cz

[3] Jiří Lukš, Fakulta stavební VŠB TU Ostrava, Ludvíka Podéště 17, 708 33 Ostrava – Poruba, jiri.luks@vsb.cz

[4] Jan Vodička, Fakulta stavební ČVUT v Praze, Thákurova 7, 166 29 Praha 6, jan.vodicka@fsv.cvut.cz

[5] Jitka Vašková, Fakulta stavební ČVUT v Praze, Thákurova 7, 166 29 Praha 6, jitka.vaskova@fsv.cvut.cz

Utilisation of the residual strength in the design of dimensions of the fibre concrete structure leads to the more economic design and reliability.

The fibres that cross the crack can creep if they are subjected to long-term tensile straining. The creep of steel fibres is insignificant as the Young modulus is high. Creep of polymeric fibres is not known. Authors of the paper have not found any information about polymeric fibres behaviour under the long-term tensile loading. The producers of fibre provide their product by certificates with information about many properties of fibres but no information about creep.

These were reasons that initiated program focused on measurement of polymeric fibres creep. A new methodology for testing was proposed. In cooperation with Technical University Ostrava, that executes the research program according to the proposal of the Department of Concrete and Masonry Structures, the measurements of fibre concrete beam elements with several types of polymeric fibres subjected to long-term loading are provided.

The paper describes new test results that will become the basis for understanding of polymeric fibres creep. The methodology of the test involves manufacturing of test specimens, their preparation before application of the long-term loading; i.e. creating of a flexural crack in the centre of the beam and its opening to given width. The width of the crack was determined with respect to record of the four-point bending test. The test was performed in advance for one beam from each set of the beams.

Before the long-term load is applied a macrocrack is formed in the specimen. The macrocrack is formed in a three-point bending test. The specimen is loaded until the deflection 10 mm is reached. The value was determined with respect to the correct width of the flexural crack before the long-term measurements start. The process of the test is in the photographs that is a part of the contribution.

The results listed in the contribution and their assessment are not completed yet (measurement continues). It shall be understand just as a one of first information about creep of polymeric fibres. The new test can be utilised for other types of synthetic fibres if they will be used in structural fibre concretes.

Aknowledgements

This paper was financially supported by the Czech Science Foundation, projects 103/09/1788 and 103/09/2039 and project SGS11/106/OHK1/2T/11.

References

[1] P. Herka, „Použití vláknobetonu pro výrobu dílců“, *9th conference Technonogie betonu (2010)*, pp. 90-96, 2010.

[2] J. Lukš, J. Vodička, J. Krátký, J. Fládr, „Hodnocení deformačních vlastností polymeových vláken ve vláknobetonu po vzniku trhlin“, *15th world conference Ecology and new building materials and products*, 2011.

[3] J. Vašková , „Konstrukční prvky z vyztuženého vláknobetonu“, habilitation, Faculty of Civil Engineering, CTU Prague, 2011