

Non-Homogeneous Fiber Reinforced Concrete with Steel Fiber

Vitalijs Lusiš¹, Videvuds-Arijs Lapsa², Andrejs Krasnikovs³
¹⁻³Riga Technical University, Concrete Mechanics Laboratory

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I. INTRODUCTION

SFRC is a composite material with a matrix – concrete, and reinforcement – short steel fibers. Addition of discontinuous short fibers to the concrete matrix is playing an important role in improvement of many mechanical properties of concrete [1]. Traditionally, fibers are homogeneously dispersed in the concrete. At the same time, in many situations the fiberconcrete with homogeneously dispersed fibers is not an optimal solution (majority of added fibers do not participated in the load bearing process). It is obviously possible to create structures with oriented fiber distribution therein in different ways. The present research examines experimentally the behaviour of composite steel fiber reinforced concrete beams with non-homogeneously oriented fibers.

II. MATERIALS AND EXPERIMENTAL METHODS

The aim of the conducted research is a study of the fibers position, orientation and dosage on the post-cracking behavior of steel fibers reinforced concrete. Fibrous oriented reinforcement creation technique – implies preparation of reinforcing elements where fibre orientation in the necessary direction is obtained prior to concreting using fiber „catch” prepared by attaching fibers to flexible warp with the necessary fiber concentration. The use of such reinforcement elements leads to the possibility to prepare with non-uniform fiber concentrations and catch with differently oriented fibers. In our case reinforcing catch were placed in the mould into the concrete at a necessary depth.

Layered beams with predictable oriented short fiber content in plies were fabricated according to technology can be found in RTU Latvian invention patents No. 14667 and No. 14684 [2], [3]. Fibers with catch were incorporated into concrete specimens in four different ways. During bending, increasing external applied load macro-crack is started at the bottom side of the beam. This is why the maximal fiber content in prepared beams was concentrated at the bottom side of the beam.

Four points loading was realized by a 150 kN load frame of universal testing machine Controls Automax 5 for all specimens. The loading was applied monotonically, while the load and deflections were recorded. For each load value, the crack widths were also recorded. The tests were run under controlled displacement up to a total mid span deflection equal to 6 mm.

III. DISCUSSION AND SUMMARY

The results obtained from the tests are critically assessed, and it is shown that fibers contribute immensely to the structural integrity. were used for the set of beams, the post-cracking behavior differed significantly. Looking on experimental data is easy to conclude: prisms with non-homogeneous fibers distribution, having fibers oriented are expressing highest load bearing capacity. As expected the post cracking capacity became higher with increasing amount of fibres. The results were mainly influenced by the orientation and number of fibers acting at the crack section.

IV. CONCLUSIONS

According to the testing results, specimens with fibers distribution in sample body were reached the highest load carrying capacity during crack opening stage as they had the highest concentration of fibers in the part of prisms subjected to maximum tensile stresses.

It was shown that steel fibers can increase significantly the bending resistance of concrete structural element when steel fibers are working optimally oriented.

V. REFERENCES

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