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Fiber Orientation Method in Fiberconcretes

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I. Introduction

Fiber reinforced concrete is an important material for load bearing structural elements. Usually fibers are homogeneously distributed in a concrete body having arbitrary spatial orientations. At the same time, in many situations the fiberconcrete with oriented fibers is more optimal. It is obviously possible to create the structures with oriented short fibers therein in different ways. The present research is devoted to one of them in attempt to find the ways of distributing and managing the fiber orientation in the concrete matrix.

II. Experimental Methods

One method consists in concrete preparation without fibers, dosing of the fibers nd uniformly scattering them over the concrete top surface in the mould and pressing into the concrete. This operation is carried out with a lattice that contains vertical cells or moving rolling wheels.

Another orientation technology is the use of base on prefabricated fibers device – “carpets” – in concrete according to maximal tension directions in fiberconcrete structural member. Concrete mixture is prepared and placed into the mould by layers, fibers “carpets” being prepared by attaching the fibers against the flexible warp with necessary fibers concentration (it is possible to prepare the “carpet” with non-uniform fibers concentrations) and placed into the concrete at necessary depth and with necessary orientation and concentration, see Fig. 1. [1]

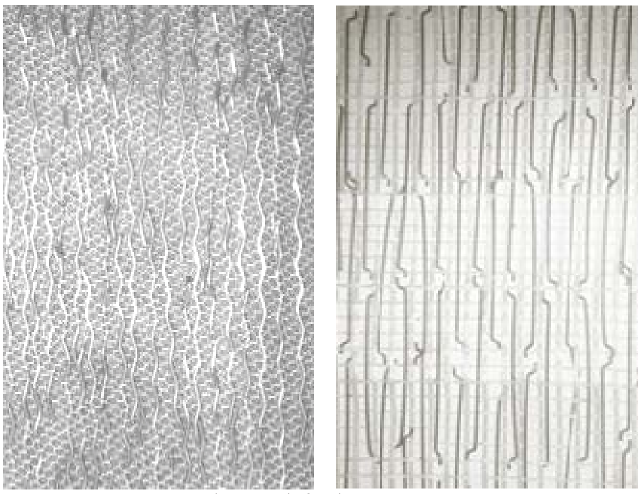

Fig. 1. Reinforcing “carpet”

Use of the device allows to orientate and dose the fibers in the concrete according to necessary directions in desired layer of the structure. If with the use of the device the fiberconcrete structural element is cracking, the fibers are bridging the cracks. The crack opens and the fibers are stretched and pull out of the concrete. [2] All fibers were oriented in the tensile stress direction. This being the case, if the fibers of desired geometrical shape are used, it is possible to govern the whole cracks opening process.

III. Discussion and Summary

Various types of non-homogeneous prism with the same amount of fibers were fabricated. Simultaneously the prisms with homogeneously dispersed fibers were produced for reference purposes, as well. The prisms were tested under four point bending conditions. During the testing, vertical deflection at the center of the prism and the crack opening were measured in real time by means of linear displacement transducers. Expedcted results were discussed. The beams were tested under four point bending conditions using Controls Automax 5 testing machine. Increasing external load resulted in a macro-crack formation at the bottom side of the beam. The fibers were pulled out of the concrete. More effective fibers layouts were recognized, they had higher fibers concentration working under pull-out conditions, being subject to tensile loads.

IV. Conclusions

Abovementioned technology has a big potential in production and development fiber reinforced concrete. Optimization of fibers location geometry allows to govern the crack opening process.

V. References

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[2] V. Lusis and A. Krasnikovs, “Technical device for fiberconcrete oriented reinforcement,” LV 14684.2013.

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