Repairing of RC Structures by Steel Fibred High Strength Concrete

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Abstract

Steel fibered high strength concrete (SFHSC) is effective for repairing structures from normal strength concrete (NSC). Design of NSC structures that should be repaired is based on general concepts for design of two-layer beams, developed by the authors. Such beams are effective when their section carries large bending moments. Steel fibers increase the ultimate deformations of high strength concrete. The required ductility level of the repaired element is achieved by selecting appropriate fibers' content. This is important for design of structures to dynamic loadings. The paper is focused on interpreting the experimental data in order to find the optimal fibre content and correspondingly the highest Poisson coefficient and ductility of the repaired elements' sections. The experimental results, obtained in the frame of this study, form a basis for provisions, related to repairing of NSC beams and slabs, using SFHSC.

Keywords: Steel Fibered High Strength Concrete; Repairing; Two-Layer Beam; Ductility

1 Introduction

Repairing of existing reinforced concrete (RC) structures is important for extending their service life. Methods for retrofitting were developed due to different causes, such as inadequate maintenance, overloading of the RC member, corrosion of the steel reinforcement and other reasons.

Strengthening by section enlargement can be performed by adding a new concrete layer to the structural element. The most important issue in this case is to ensure proper bonding between the concrete of the existing element and that, applied for its strengthening.

Experiments were carried out to investigate the efficiency of different repairing techniques. It was shown experimentally that a cement-based material can have a tensile strain capacity up to 2.5 %. SHCC layers of about 30 mm depth can withstand crack opening displacements of up to 0.6 mm **Error! Reference source not found.**[1].

Concrete model elements, strengthened by ultra high performance fibre reinforced concrete (UHPFRC) in the tension zone, were tested **Error! Reference source not found.**[2]. Behavior of concrete beams repaired by UHPFRC in the tension zone under flexural stress was evaluated. Both the deformability of the structure and the creep of new and substrate materials contribute to a significant decrease of the induced stresses.

Structural behavior of a cracked RC one-way slab, repaired using different techniques, was studied [3, 4]. The efficiency of different repair techniques and their effects on the structural behavior had been analyzed.

A typical problem appears in roof beams, in which a part of their section comes above the slab. This uncovered part of the beam is subjected to aggressive surrounding environment. As a result, the compressed zone of the beam's section is usually locally damaged. For repairing of such beams a recently developed idea of two-layer bending elements can be successfully applied [5]. In such beams the damaged part is proposed to be replaced by a steel fibred high strength concrete (SFHSC).

A method for obtaining the class of SFHSC and the load bearing capacity of the beam after retrofitting is proposed. SFHSC cubic and cylindrical specimens as well as short two-layer

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