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Shear Behaviour of UHPC Concrete Beams

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Abstract

The work presented in this article aims to compare the experimental results on shear capacity of SFR-UHPC (steel fibre-reinforced ultra-high performance concrete) I-shaped beams against the modelling results. Steel fibres added to the concrete replace stirrups. The purpose of the paper is to confirm the feasibility of SFR-UHPC for I-shaped reinforced concrete beams and replacing classical stirrups by fibre reinforced concrete.

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Keywords: shear capacity; steel fibres; experiment; numerical model; ultimate strength.

1. Introduction

Ultra-high performance concrete and the use of steel fibres had a significant evolution due to the development of new materials.

In manufacturing prefabricated beams, the assembly of the reinforcement cage has a significant impact on the production, which makes replacement of stirrups by steel fibres of interest.

The aim of this study is to investigate the replacement of stirrups by steel fibres and the comparison between experimental part and modelling results.

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Nomenclature

SFRC-UHPC	steel fibre reinforced ultra-high performance concrete
a/d	shear span to depth ratio

2. Experimental program

Eight I-shaped beams made from SFR-UHPC were tested in shear until failure [1]. Each beam was tested two times, first with a shear span to depth ratio a/d=2.5 and secondly on the opposite shear span with a/d=2.3. Each element had a total length of 4 m, a cross-section of 140 mm width, 400 mm height and a web thickness of 60 mm (Fig. 1).

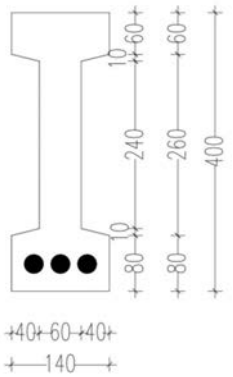

Fig. 1. Beam cross section (dimensions in mm)

Four different types of beams were used (Fig. 2):

- Type F: SFR-UHPC with longitudinal reinforcement;
- Type FD: as type F with diagonal rebar;
- Type FO: as type F with web opening;
- Type FOD: as type FO with diagonal rebar.

For each beam type 4 tests are conducted (2 times a/d=2.5 and 2 times a/d=2.3). The test setup is shown in Fig. 2. The supports allowed the horizontal movement of the tested beams. A hinge support was used at the support closed to the loading point, a roller support for the other side of the beam.

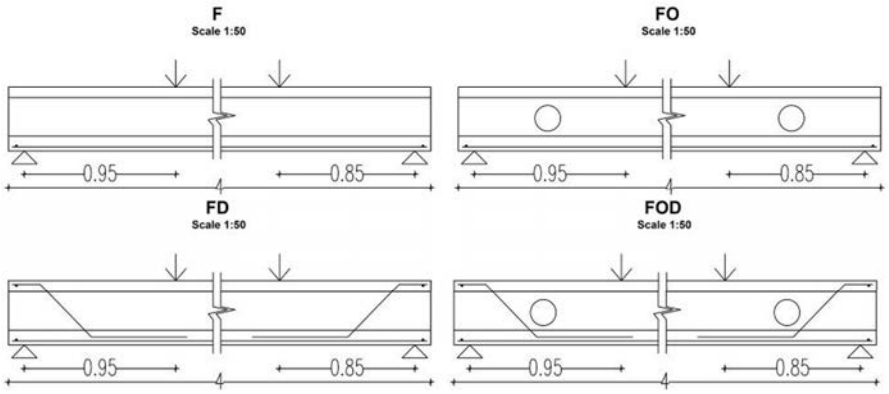

Fig. 2. Tested beams