SHEAR TESTS ON SFR-UHPC BEAMS WITH OR WITHOUT WEB OPENING

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Abstract

This paper presents the experimentally obtained shear behaviour of SFR-UHPC (steel fibre-reinforced ultra-high performance concrete) I-shaped beams with or without web openings. Steel fibres added to the concrete replace the stirrups. A comparison between beams with diagonal rebars and without is made. The shear carrying capacity of UHPC beams is significantly increased compared to normal strength or even high strength concrete.

Keywords: Shear, steel fibres, UHPC, web opening

1. Introduction

The aim of this study is to investigate the replacement of stirrups by steel fibres and the comparison between beams with or without web opening. In addition, partial replacement of shear links is investigated by comparing steel fibres with or without a single additional diagonal rebar. A mix between short straight fibres and long hooked fibres has been chosen to ensure the best contribution to the shear resistance of the beams, due to the fact that small fibres work better on micro-cracks while long fibres are starting to work after the cracks appeared.

2. Test program

Four different types of beams were used: SFR-UHPC with longitudinal reinforcement as type F, 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).

3. Test results and discussion

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All the tested beams failed in shear. Load-deflection diagrams can be seen. in Fig.1. The difference between beams with or without diagonal rebar in terms of shear capacity is shown in **Fig. 2**(for a/d=2.3).

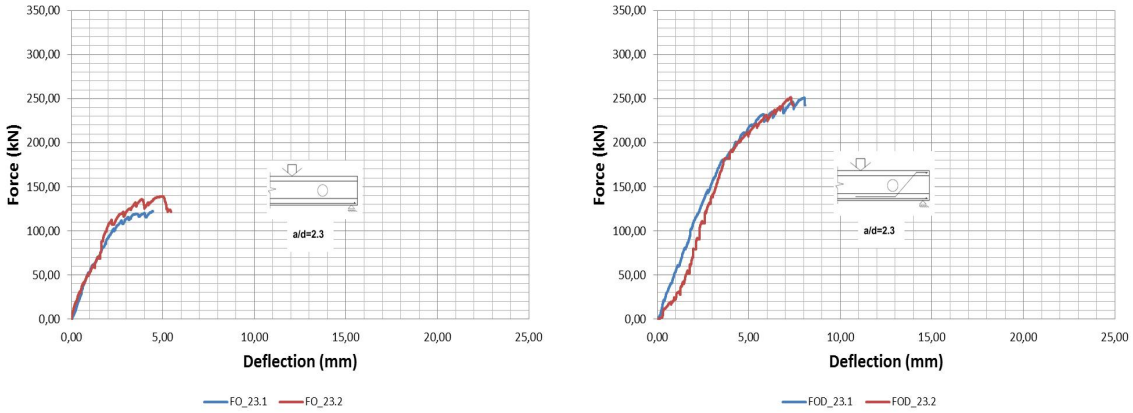

Fig. 1: Deflection under loading point for FO and FOD beams for a/d=2.3

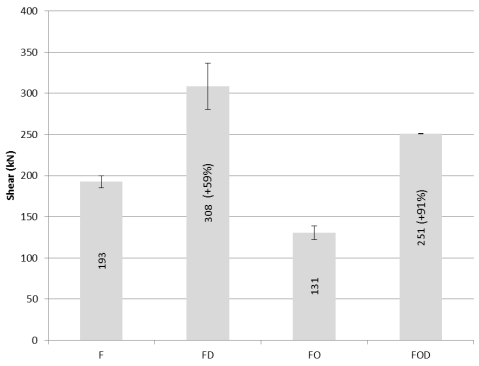

Fig. 2: Comparison between the V_{exp} of the beams for a/d=2.3

4. Conclusions

It can be observed that the FD beams collapse at a 59% higher load with respect to the F beams, and FOD beams had an increase of 91% compared to FO beams. As all beams have the same amount of fibres, the higher failure load relates to the additional diagonal rebar.

When a diagonal rebar was placed the failure is characterized by more than one critical shear crack.

The shear resistance of FO beams (with opening) was about 65% of the solid beams F, while FOD beams (with opening and a single diagonal rebar) resistance was about 80% of solid beams FD (with single diagonal rebar). The use of the fibres and diagonal reinforcement can be enough for strength and ductility requirements to avoid shear failure.