Non-linear analysis of statically indeterminate SFRC columns

Ali A. Abbas[1], Sharifah M. Syed Mohsin[2], Demetrios M. Cotsovos[3], Ana M. Ruiz-Teran[4]
[1]School of Architecture, Computing & Engineering, University of East London, London E16 2RD, UK
[2]Faculty of Civil & Earth Resources, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantang, Pahang, Malaysia
[3]Institute of Infrastructure & Environment, School of the Built Environment, Heriot-Watt University, Edinburgh, EH14 4AS, UK
[4]Department of Civil and Environmental Engineering, Imperial College London, London SW7 2AZ, UK

ABSTRACT

The structural behaviour of steel fibre-reinforced concrete (SFRC) has been studied using non-linear finite element analysis (NLFEA) and ABAQUS software. An interesting feature of this work is the consideration of statically indeterminate SFRC. Most of the SFRC specimens studied in the literature are simply supported beams, and information on statically indeterminate columns is sparse. In addition, both axial and lateral loads were considered in order to allow for compression and flexural effects on the columns. The aim of the work was to examine the potential for using steel fibres to reduce the amount of conventional transverse steel reinforcement without compromising and strength requirements. To achieve this, the spacing between shear links was increased while steel fibres were added as a substitute (spacing between shear links increased by 50 and 100 % with fibre volume fraction Vf increased to Vf = 1, 1.5,2 and 2.5 %). The numerical model was carefully calibrated against existing experimental data to ensure the reliability of its predictions. Parametric studies were subsequently carried out, which provided insight into how the steel fibres can help reduce the number of conventional shear links.

Keywords: fibre-reinforced concrete, finite element methods, structural analysis

DOI: 10.1002/suco.201300004