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# Numerical Analysis of the Flexural Behaviour of Concrete-Filled Rectangular Flange Girders

**Authors :** R. Al-Dujele, K. A. Cashell

**Abstract :** A tubular flange girder is an I-shaped steel girder with either one of both of the usual flat flange plates replaced with a hollow section. Typically, these hollow sections are either rectangular or circular in shape. Concrete filled tubular flange girders (CFTFGs) are unconventional I-shaped beams that use a hollow structural section as the top flange which is filled with concrete. The resulting section offers very high lateral torsional buckling strength and stiffness compared with conventional steel I-beams of similar depth, width and weight, typically leading to a reduction in lateral bracing requirements. This paper is focussed on investigating the ultimate capacity of concrete filled rectangular tubular flange girders (CFRTFGs). These are complex members and their behaviour is governed by a number of inter-related parameters. The FE model is developed using ABAQUS software, 3-D finite element (FE) model for simply supported CFRTFGs subjected to two point loads applied at the third-span points is built. An initial geometrical imperfection of (L/1000), as well as geometrical and material nonlinearities, are introduced into the model, where L denotes the span of the girder. In this numerical model, the concrete and steel materials are modelled using eight-node solid and four-node shell elements, respectively. In addition to the FE model, simplified analytical expressions for the flexural capacity are also proposed, and the results are compared to those from the FE analyses. The analytical expressions, which are suitable for design, are also shown to be capable of providing an accurate depiction of the bending moment capacity.

**Keywords :** concrete-filled rectangular tubular flange girders, ultimate capacity, confining effect, finite element analysis
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