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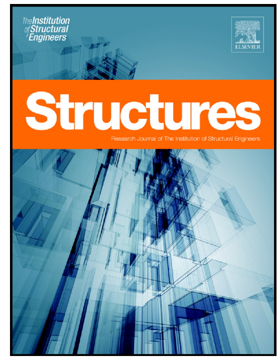

Behaviour of Composite Beams Made Using High Strength Steel

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Behaviour of composite beams made using high strength steel

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Abstract

High strength steel (HSS), defined as material with a yield strength of between 460 and 700 N/mm^2, is becoming increasingly popular in appropriate construction projects owing mainly to its excellent strength to weight ratio. The current paper is concerned with the use of high strength steels in steel-concrete composite beams, which is a relatively new application. In order to investigate the behaviour of these members, a finite element numerical model is developed and validated using available test data. The model represents composite beams made from HSS acting together with either solid or profiled concrete slabs. It accounts for the geometrical and material nonlinearity as well as the nonlinearity caused by the shear connectors. An extensive parametric study is conducted in order to assess the influence of the most salient parameters such as material properties, shear connection, distribution of shear connectors and beam geometry on the response, in terms of the bending capacity, stiffness, slip distribution and failure mode. The numerical results are compared with current design provisions and new reduction factors are proposed in order to obtain safe and economical design solutions.

1 Introduction

This paper is concerned with the behaviour of composite beams made from high strength steel. Composite beams comprising concrete slabs connected to steel sections using shear connectors are increasingly common in modern structures such as bridges and high rise buildings. The composite performance of the steel and concrete provides excellent strength and stiffness whilst using both materials in an efficient manner. The amount of composite action that is achieved depends on the degree of shear connection which develops between the steel and concrete, and this affects the strength and stiffness of the composite beam. A well-designed composite member can lead to significant savings in terms of section depth, material consumption and overall cost, as well as lower environmental pollution and carbon footprint and reduced energy consumption [1].