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Experimental Investigation for Non and Partially Composite Cold-Formed Steel Floor Beams

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Abstract

In this study, six full-scaled models of RC floors supported by cold-form steel sections have been tested. Each model consists of RC 75mm thick slab supported on two parallel cold-formed steel beams with a span of 3m and spacing of 500mm. The slab has an overhang part of 250mm on each side. In the first and fourth models, the slab has been casted directly on the top flanges with no shear connector to simulate the effectiveness of friction in resisting of the lateral-torsional buckling. Shear studs have been drilled in the second and fifth models to ensure the composite action. Finally, the flanges have been embedded for the third and sixth models. A single channel beam is used in the first, second, and third models while a built-up beam is used in the fourth, fifth, and sixth models. Each model has been loaded up to failure under a pure bending with two-line loads located at the third points. Data for loads, deformations, and strains have been gathered. Except the fourth and the sixth models that failed in local buckling modes, all other models failed in global lateral-torsional buckling modes. For the single beam models; the load carrying capacity of the non-composite model is 82.9% less than the capacity of the composite models with shear studs and embedded flange. For the built-up models; the load carrying capacity of the non-composite model is 44.2 % less than the loads of the composite model with shear stud and 48.7% less than the model with the embedded flange.

Keywords: Cold-Formed Steel; Floor Beam, Experimental; Lateral-Torsional Buckling; Noncompsite Action; Composite Action.

1. Introduction

During the last few decades the using of the Cold-formed steel beams has increased significantly where they have been utilized as floor beams. Since the cold-formed steel members are a relatively thin with respect to their width and have mono-symmetric or unsymmetric cross-sections, they may buckle at stress value lower than the yield stress when subjected to compression or bending. Lateral-torsional buckling behavior of the cold formed steel members is more complicated than that of the hot-rolled sections. Experimental tests of simply supported laterally unbraced cold-formed beams was executed in 1998 by Put et al [1]. At the same time, Pi et al. [2] provided a numerical investigation using an advanced finite-element model to study the elastic lateral-torsional buckling and inelastic strengths of the cold-formed steel beams to improved design rules.

In 2012 N. D. Kankanamge and M. Mahendran developed a finite element model using ABAQUS. The model has been verified using available numerical and experimental results and subsequently it has been used to study the behavior and design of cold-formed steel beams subject to lateral–torsional buckling [3]. M. Anbarasu dealt with the ultimate

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