Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 179 – 187

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Finite Element Analysis of Composite Beam with Shear Connectors

Anju. T[a], Smitha. K .K[b]*

[a]*Department of Civil Engineering, KMEA Engineering College, Ernakulam, Kerala, 683561*
[b]*Department of Civil Engineering, KMEA Engineering College, Ernakulam, Kerala, 683561*

Abstract

Composite structures consisting of concrete slab and rolled up steel sections are widely used structural members in bridges and high rise buildings. The composite action is established by connecting the concrete slab and the steel section by using shear connectors. In this paper, four different types of shear connectors have been analyzed and the best connector for a particular composite beam has been evaluated based on its performance under static load keeping the loading and the amount of steel in the connector as a common aspect.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

Keywords: Composite structures ; Shear Connector

1. Introduction

A composite beam constructed by placing a concrete slab on a steel or concrete girder equipped with shear connectors is a commonly used structural member for structures such as bridges and high-rise buildings. Slab and beam type constructions are commonly used in bridges and buildings. Slab beam interaction is possible through the use of shear connector welded at the top of the flanges of the steel beam. By the use of an appropriate connection provided between the beam and the concrete slab, the slip between them can be eliminated. Thus the steel beam and the slab act as a “composite beam” similar to the action of a monolithic T- beam. Concrete is stronger in

* Anju. T. Tel.: +919809407643
E-mail address: anjukurian319@gmail.com

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.025

compression than in tension whereas steel is susceptible to buckling in compression. Hence by the composite action between the two, we can utilize their respective advantages to the fullest extent.

1.1. General

A composite beam usually shows partial composite behavior as a result of the slip deformation along the interface of the beam. In the case of pre-stressed composite structures, external axial loads are applied by a pre-stressing effect and this induced axial effect also influences the interfacial slip behavior of the composite beam. A typical composite beam consisting of a concrete slab, steel I-section and stud type shear connectors is shown in fig 1.

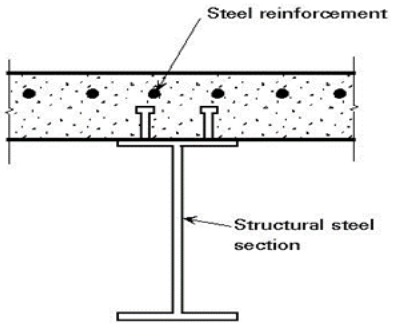

Fig 1. Composite structure with stud type shear connectors

Sandatmanesh et al. [1989] analysed the behaviour of steel beams pre- stressed with high strength steel tendon and compositely connected to a concrete deck. Bradford and Gilbert [1992] presented the derivation of a theoretical model for the time dependent response of simply supported steel-concrete composite beams. Ayoub and Filippou [2000] presented an inelastic beam element for the analysis of steel- concrete girders with partial composite action under monotonic and cyclic loading.

Dall'Asta and Zona [2002] conducted non- linear analysis on composite beams by FE method by comparing solutions deriving from finite elements with 8, 10 and 16 DOF. Liang et al. [2005] investigated the ultimate flexural and shear strengths of simply supported composite beams under combined bending and shear using the finite element method. Gattesco et al. [1997] conducted experiments on stud shear connectors to analyze the different values of slip amplitude and for a given slip history of the connectors.

Badie et al. [2002] experimented on large shear studs for composite action in steel bridge girders to propose the effect of increase in capacity and reduce the possibility of damage in connectors. Xue et al. [2008] investigated on the effect of stud type shear connectors on the composite behaviour of composite beam by conducting thirty push-out tests.

This paper evaluates the performance of various types of shear connectors commonly used in composite beam construction by conducting a nonlinear static analysis and comparing the displacements using the commercially used finite element package Ansys.