AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

EFFECT OF THE DEGREE OF CONNECTION ON THE ULTIMATE CAPACITY OF COMPOSITE SIMPLE BEAMS

BY

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No part of this thesis has been submitted for a degree or a qualification at any other university or institution .

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Abstract :

A proposed calculation model is adopted for the analysis of the composite simple steel-concrete beams , valid up to collapse , which takes into account the effects of different parameters such as : Material non-linearity , the effect of slip at the interface between concrete slab and the steel girder , load-slip curve , spacing and the type of connectors , type of loading , geometrical configration of the cross section .....etc . The resolution of the model is made easier in adopting the formulation by transfer matrix method , the unknown vector containing some internal forces and generalized displacements .

A computer programme is developed to deal with this mathematical model . After checking the efficiency and accuracy of the proposed model and the computer programme with the available experimental test results , a versatile parametric study is performed to investigate the effects of the degree of connection , the goemetrical dimensions of composite section and the type of loading on the overall behaviour of the composite beams.

Key words :

Composite beam and transfer matrix .

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INTRODUCTION

INTRODUCTION

Composite construction has played a very important role in structural engineering . Its use has varied from small structures to large buildings and bridges . The basic principle underlying composite construction is that certain materials may be used more effectively in certain types of stressed conditions ; thus , the combination of a material strong in compression with one strong in tension makes a very economical union for its use in structures . With basic materials such as concrete , steel , masonry , wood and timber , a number of successful combinations can be used ; however , until now , such information has not been readily available to design for practicing engineers.

The most common composite construction in buildings and bridges is the composite steel-concrete wherein a steel beam and a reinforced concrete slab (cast-in-situ or precast) are so interconnected with shear connectors that they act together as a unit . In the common type of composite beam , there is some shear transfer by bond and friction at the interface between steel beam and concrete slab. It can not be depended upon if there is a single overload or pulsating load that will destroy such bond and cause a separation of the slab from the beam . Hence , shear connectors are needed to give reliable composite action with two objectives :

1- To transfer shear between the steel and concrete , thus limiting the slip at the interface so that the slab beam system acts as a unit to resist longitudinal bending (with one neutral axis for the composite section)

2- To prevent an uplift between the steel beam and concrete slab , i.e. , to prevent separation of the steel and concrete at right angles to the interface .

Various types of shear connectors have been used to resist longitudinal shear and uplift . In a broad sense , connectors may be divided into two categories , rigid and flexible connectors. It must be pointed out that slip must occur before they are utilized ; therefor , the terms are relative . Usually the interaction between steel beam and concrete slab is incomplete due to slip caused by flexibility of shear connectors and the compressibility of concrete . It produces a discontinuity in the strain distribution at the interface . Some researches developed a partial interaction theory in the elastic range assuming a linear load-slip relation for the connectors . They showed that fairly large variations in the value of the shear connector modulus (defined as the ratio of load to slip) affected the deformations only slightly ; however , such variations affected the deflection considerably and to a large degree the elastic strains and stresses . The partial interaction theory has been extended to take into account the nonlinear load-slip characteristics of shear connectors and also the inelastic behaviour of steel and concrete material .