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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

EFFECTIVE WIDTH OF REINFORCED CONCRETE SLAB IN MONO- SYMMETRIC STEEL-CONCRETE COMPOSITE BEAM

A Thesis
Submitted in partial fulfillment for the
requirements for the degree of

Doctor of Philosophy
In
Civil Engineering (Structures)

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STATEMENT

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The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University, from October 2017 to March 2021.

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

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ABSTRACT

This research is carried out to study the behaviour of the reinforced concrete slab in the mono-symmetric steel composite beams under the influence of concentrated loads. The research, further, investigates the effect of using different shapes of shear connectors (i.e. channel or angle shear connectors) on the behaviour of steel-concrete composites (SCC) beams and on the slip value between the concrete slab and the steel beam. In addition, the effective slab width is studied against the slenderness ratio (L/r_s) of the steel beam, the thickness of the concrete slab, the existence of the upper steel reinforcement and the shape of the shear connector placed at the top flange of the steel beam. In this respect, ten steel-concrete composites (SCC) beams were tested in four-point bending to study the effect of the steel section size, the thickness of the concrete slab, the existence of the upper steel reinforcement mesh and the shapes of the shear connector on the behaviour of the SCC beams. Channel and angle sections are used in this study to provide the shear connection between the steel and the concrete slab section. The findings of this study have shown that the use of an angle shear connector reduces the ultimate load capacity of SCC beams compared to the beams provided with a channel shear connector. In addition, it is found that beams provided with channel shear connectors are more likely to be ductile than beams provided with angle shear connectors. It is also observed that the presence of the upper transverse steel reinforcement in the concrete slab increases the carrying load capacity of such beams. In addition, the presence of the upper longitudinal steel reinforcement in the concrete slab decreases the deflection values of such beams. Also, the presence of the upper steel reinforcement mesh decreases the slip value between the concrete slab and the steel beam. It is also observed that the ultimate load capacity of such beams increases with increasing the slab thickness. A nonlinear finite element model was developed using ABAQUS to the validation of the results of the experimental results against the results of the finite element model. Moreover, the finite element model was used to calculate the effective width of the concrete slab and comparing the results with the calculation of the effective width in the universal codes. Also, the effective concrete slab width for each SCC beam was compared to the equations found in the literature. This study showed that the results of the finite element model show a good agreement with the experimental results. Therefore, the finite element models can be used with confidence to extend the experimental program and investigate a wider range of parameters to develop design guidelines.

Keywords:
Mono-symmetric, Composite beam, Effective slab width, Angle shear connectors, Channel shear connectors, Finite element, Slip, Strain distribution, Reinforcement ratio.

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