Ain Shams University
Faculty of Engineering
Department of Structural Engineering

Capacity of Axially Loaded SHS Columns Strengthened with CFRP Laminates

A Thesis submitted in partial fulfillment of the requirements of the degree of
Master of Science in Civil Engineering (Structural)

Submitted by
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Statement

This thesis is submitted as a partial fulfillment of Master of Science in Civil Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

This thesis describes the methodology adopted in the numerical modeling of Structural Hollow Sections (SHS) cold-formed steel columns of different slenderness ratios under axial compression load and verifying this model against experimental data from (Shaat A. A., 2007). and subsequently using it in parametric studies. The numerical model used was developed considering the material model of cold-formed carbon steel, non-linear stress-strain behavior, initial geometric imperfections, the effect of cold forming by means of applying residual stresses and its equivalent plastic strains, and the interaction between cold-formed SHS and CFRP. The numerical model developed was used to conduct a parametric study to determine the influence of; column's slenderness ratio, different steel material grade, changing steel cross-section, and CFRP reinforcement ratio on the capacity of CFRP-strengthened steel columns. Results and conclusions from this research are then summarized and suggestions for further work given.

The load carrying capacities obtained from the control and strengthened numerical models showed a good match with the experimental results from other researches with a variation in strength less than 6%. While the parametric study showed that the axial load capacity of strengthened columns decreases with increasing member slenderness ratios, while the gain in strength increases with increasing the slenderness ratio

Keywords: SHS, local Imperfections, global imperfections, Residual stresses, cold-formed

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