



# **BEHAVIOR OF HIGH STRENGTH REINFORCED CONCRETE COLUMNS UNDER CENTRIC AND ECCENTRIC LOADS**

**BY**

**Heba Mustafa Mahmoud Mohamed**

A thesis submitted to the  
Faculty of Engineering; Cairo University  
in partial fulfillment of  
the requirements for the M.Sc. Degree  
in  
STRUCTURAL ENGINEERING

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2016

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**Title of Thesis:**

Behavior Of High Strength Reinforced Concrete Columns Under Centric And Eccentric Loads

**Key Words:**

High Strength Concrete, High Strength columns, High strength concrete columns under Centric and Eccentric Loads, Nonlinear Finite element analysis of high strength concrete columns.

**Summary:**

Interest in structural engineering is more growingly focused on using high performance and high strength structural materials. Concrete is eventually among the most world widely used in construction. Use of high strength concrete (HSC) is mainly attractive in the design of columns and vertical carrying members. The supplemented gain in compressive strength leads to a satisfactory diminution of the cross-sections; as such members are mainly subjected to centric & eccentric forces introduced by the gravity loads and wind pressure/seismic forces. This thesis presents an analytical investigation about the behavior of squared, columns made of variable strength concrete; under axial and eccentric loads. The research program included 34 columns; all have a squared cross-section (200x200) mm and 3000 mm height. They were arranged to enable investigating the following parameters: concrete characteristic strength ( $f_{cu}$ ); ranging between 25 & 100 N/mm<sup>2</sup>) - Longitudinal reinforcement ratio ( $\mu$ ); ranging between 1.13 and 2.26 % - Transverse steel volumetric ratio ( $\mu_{vst}$ ); ranging between 0.321% and 0.57%. The load eccentricity/depth ratio ( $e/t$ ) ranged between 0.0, 0.125, 0.25 and 0.75. The study includes non-linear finite element models prepared for the columns and structurally analyzed using an available nonlinear finite element program appropriate for presenting the non-linear behavior of concrete and steel. Concrete cracking was also included in the analysis. The effect of the above parameters on column ultimate load, mid-height, lateral displacement, and columns cracking patterns is reported and discussed.

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