



Cairo University

EFFECT OF CONFINEMENT WITH LATERAL REINFORCEMENT ON REINFORCED CONCRETE COLUMNS

By

Eng. Mohamad Abdelzaher Mohamed Shanan

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Structural Engineering

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Title of Thesis:

Effect of Confinement with Lateral Reinforcement on Reinforced Concrete Columns

Key Words:

ANSYS, Strength; Confinement; nonlinear finite element analysis; Nonlinear behavior.

Summary:

This study presents the effect of confinement variables on strength and ductility of normal and high strength reinforced concrete columns confined with transverse steel under axial compressive loading. Nineteen normal strength concrete rectangular columns were tested in this research. A set of Twenty high strength concrete columns tested by other researchers were analyzed. The study presents a nonlinear finite element analysis for these specimens using ANSYS15. A parametric numerical study was conducted by ANSYS15 to clarify and evaluate the effect of new values of variables on strength and ductility of the columns. Analytical model for effective concrete strength was developed for normal-strength and high-strength concrete columns.

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Nomenclature

A_c	Area of concrete core of column section.
A_{ch}	Cross-sectional area of a column measured out-to-out of confining steel.
A_g	Gross area of column section.
A_s	Area of longitudinal steel.
A_{sh}	Total cross-sectional area of transverse reinforcement within spacing 's'.
A_{shx} , A_{shy}	Total area of lateral steel perpendicular to x and y axes, respectively.
ΣA_s	Summation of transverse reinforcement area.
A_{sp}	Area of circular hoop
ΣA_{st}	Summation of transverse reinforcement area.
b_c	Core dimension measured center-to-center of perimeter hoop.
b_{cx} , b_{cy}	Core dimension measured center-to-center of perimeter hoop.
d_b	Bar diameter of transverse reinforcement.
C_x , C_y	Widths of concrete core parallel to the x-axis and y-axis, respectively.
D'	Diameter of core concrete
d	Effective depth of tension reinforcement.
d_s	Diameter of spiral reinforcement.
E	Modulus of elasticity.
E_c	Modulus of Elasticity of plain concrete.
E_{sec}	Secant modulus of elasticity of confined concrete.
f'_c	Ultimate compressive strength of plain concrete obtained from standard cylinder test.
f'_{cc}	Confined concrete compressive strength in member.