STRENGTHENING OF RC SHORT COLUMNS WITH EXTERNAL CARBON FIBER POLYMERS

By

Mahmoud El.Sayed Mahmoud Mohammed Abo El.Kheir

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

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

Prof. Dr. Magdy El.Sayed Kassem

Professor of Reinforced Concrete
Structural Engineering Department
Faculty of Engineering, Cairo University

Prof. Dr. Nasser El.Shafey

Associate Professor
Structural Engineering Department
Faculty of Engineering, Cairo University

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Approved by the Examining Committee

____
Prof. Dr. Magdy E. Kassem, Thesis Main Advisor
Professor of Reinforced Concrete Structures
Faculty of Engineering, Cairo University

____
Dr. Nasser F. El.Shafey, Advisor
Professor of Reinforced Concrete Structures
Faculty of Engineering, Cairo University

____
Dr. Mohammed Talaat Mostafa, Internal Examiner
Professor of Reinforced Concrete Structures
Faculty of Engineering, Cairo University

____
Prof. Dr. Mohammed Hussein Mahmoud, External Examiner
Professor of Reinforced Concrete Structures
Faculty of Engineering, Tanta University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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2019

Engineer's Name: Mahmoud El.Sayed Mahmoud
Date of Birth: 15./09/1990
Nationality: Egyptian
E-mail: mahmoud.abo.s@ eng-st.cu.edu.eg
Phone: 01062179744
Address: Hehia-Sharkia-Egypt

Registration Date: 01/03/2014
Awarding Date: / /2019
Degree: Master of Science
Department: Structural Engineering

Supervisors:

Prof. Magdy El.Sayed Kassem
Prof. Nasser Fikry El.Shafey

Examiners:

Prof. Dr. Magdy E. Kassem, (Thesis Main Advisor)
Dr. Nasser F. El.Shafey, (Advisor)
Dr. Mohammed Talaat Mostafa, (Internal Examiner)
Prof. Dr. Mohammed Hussein Mahmoud, (External) Examiner (Faculty of engineering, Tanta University)

Title of Thesis:

STRENGTHENING OF R.C SHORT COLUMNS WITH EXTERNAL CARBON FIBER POLYMERS

Key Words:
Reinforced Concrete; carbon fiber; finite element models; cohesive zone model; parametric study.

Summary:

This research investigate the behavior of strengthening normal reinforced concrete short columns using external FRP jacket. The main parameters are; load eccentricity (e/t), cross section aspect ratio, radius of corner and cross section, and effect of retrofit reinforced concrete columns partially.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institue.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date:
Signature:

Acknowledgment

In the name of Allah the Compassionate and the Merciful

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Table of Contents

List of Tables

List of Figures

Nomenclature

A_s : Area of longitudinal steel reinforcement.
A_{sp} : Area of transverse reinforcement.
b : Breadth of the column section.
E_1 : The slope of the linear first FRP stress strain model portion.
E_2 : The slope of the linear second FRP stress strain model portion.
E_c : Modulus of elasticity for concrete.
E_{com} : The elastic modulus of the confinement in transverse direction.
E_{FRP} : Modulus of elascticity for Fiber reinforcement.
E_p : Plastic modulus for concrete.
f'_{cc} : Confined concrete axial stress.
f'_{co}: Unconfined concrete axial stress.
f_{FRP} : Fiber reinforcement ultimate stress.
$f_l{}'$: Confined concrete lateral stress.
f_{yh} : Yield strength of transverse reinforcement.
h : Depth of the column section.
k_1 : Confinement efficiency constant.
n : The shape parameter.
r : Cross section corner radius.
S : Pitch of spiral or circular hoop.
t_{FRP} : Fiber reinforcement layer thickness.
ε_{ao} : Ultimate axial strain of plain concrete.
ε_{cc} : Confined concrete axial strain.
ε_{co} : Unconfined concrete axial strain.
ε_{FRP} : Ultimate tensile strain for Fiber reinforcement.
ε_h : Fiber reinforcement strain in hoop direction.
ε_l : Confined concrete lateral strain.
ε_{ro} : The corresponding radial strain.
γ_c : Poisson’s ratio of plain concrete.
θ_r : slope of the plastic branch in FRP stress strain model.