Hanaa Mohammed

بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

Safaa Mahmoud

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

STRENGTHENING OF RC BEAMS WITH OPENINGS SUBJECTED TO TORSION USING CFRP

By

Amar Mohamad Diaa Zarzour

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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Prof. Dr. Hany Ahmed Abdalla

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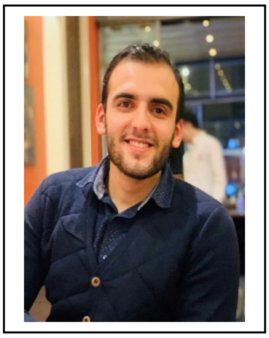

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Title of Thesis:

STRENGTHENING OF RC BEAMS WITH OPENINGS SUBJECTED TO TORSION USING CFRP

Key Words:
RC beams; Repairing; CFRP; Torque; Rotation angle

Summary:
An experimental study will be presented to evaluate the behavior of RC beams with openings subjected to pure torsion repaired with CFRP. The effect of CFRP configuration, the opening's width and CFRP Layers were the three main parameters in this study.

The experimental results indicated that the presence of the opening in the beams leads to the decreasing of the cracking and ultimate torques. Repairing the beam specimens with CFRP improved the ultimate torque, and ultimate rotation angle. Using one-layer Vertical CFRP configuration in repairing beams with openings improved the ultimate torque by 109.52% and using one-layer Inclined CFRP improved the ultimate torque by 61.90%. Increasing the layer of CFRP to two layers led to the increase in the ultimate torque by 128.50%. Finally, in case of repairing beams with opening width of 300 mm and 500 mm with constant height of 150 mm by using one layer of vertical CFRP, the ultimate torque increased by 109.5% and 128.5%, respectively.

DISCLAMER

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 institute.

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

Name: Amar Mohamad Diaa Zarzour   Date: / /2022

Signature:

Dedication

To my grandfather and grandmother who supported and trusted me.
To my wonderful family, my mother, father, fiancée, sisters, brother and friends to whom I owe and love so much. God bless them and grant them good health.

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First and foremost, I thank ALLAH, the most gracious, the ever merciful for helping me finish this work.

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My sincere appreciation and gratitude to my **father**, my **mother,** my **fiancée,** my **sisters**, and my **brother** for their help and patience during the preparation of this work.

I would also like to thank all everybody who has helped me in any way to accomplish my thesis such as my friends.

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