

# بسم الله الرحمن الرحيم



**HOSSAM MAGHRABY**



# شبكة المعلومات الجامعية

## التوثيق الالكتروني والميكروفيلم



**HOSSAM MAGHRABY**



# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

### قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

**HOSSAM MAGHRABY**



# بعض الوثائق الأصلية تالفة



**HOSSAM MAGHRABY**





بالرسالة صفحات

لم ترد بالأصل



HOSSAM MAGHRABY

B 1444

# **BEHAVIOUR OF PARTIALLY STRENGTHENED REINFORCED CONCRETE COLUMNS UNDER AXIAL LOADS**

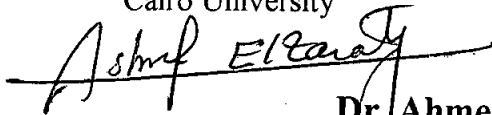
BY

**USAMA MOHAMED ABOU EL-SEOUD ABDEL HAMEED**  
B.Sc. Civil Engineering 1991

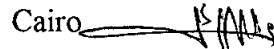
A thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
MASTER OF SCIENCE  
in  
STRUCTURAL ENGINEERING

Under the Supervision of

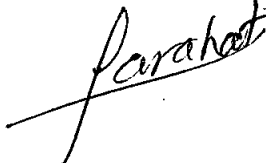
**Prof. Dr. Ashraf H. EL-Zanaty**  
Prof. of Reinforced Concrete  
Faculty of Engineering  
Cairo University



**Dr. M. Adel EL-Gammal**  
Associate Prof. Of Civil Engineering  
National Research Center  
Cairo



**Dr. Ahmed M. Farahat**  
Assistant Prof. of Structural Engineering  
Faculty of Engineering  
Cairo University



FACULTY OF ENGINEERING , CAIRO UNIVERSITY  
GIZA , EGYPT  
1999

٢٩

٢٢٢٢

**BEHAVIOUR OF PARTIALLY STRENGTHENED  
REINFORCED CONCRETE COLUMNS  
UNDER AXIAL LOADS**

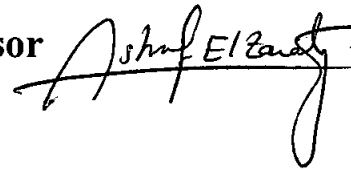
BY

**USAMA MOHAMED ABOU EL-SEOUD ABDEL HAMEED**  
B.Sc. Civil Engineering 1991

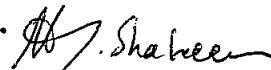
A thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
MASTER OF SCIENCE  
in  
STRUCTURAL ENGINEERING

**Approved by the  
Examining Committee**

**Prof. Dr. Ashraf Hasan. EL-Zanaty , Thesis Main advisor**



**Prof. Dr. Hamdy Hamed Shaheen , Member**



**Prof. Dr. Moustafa Fouad EL-Kafrawy , Member**



FACULTY OF ENGINEERING , CAIRO UNIVERSITY  
GIZA , EGYPT  
1999





**TO  
MY DEAR  
FATHER'S SOUL**





## ACKNOWLEDGMENT

Firstly and always , I thank God for his blessings , and I pray to him to accept all our works and to consider our work in this research to be a trail in calling for knowledge which our Prophet “Mohamed” ordered us to search for.

The author wishes to express his sincere appreciation and gratitude to Prof. Dr. Ashraf EL-Zanaty , Prof. of reinforced concrete , Faculty of Engineering , Cairo University for his supervision , encouragement and helpful suggestions during this research , which has greatly contribution in achieving this work .

The author would also acknowledge gratefully Associate Prof. Dr. Mohamad Adel Gharib EL-Gammal , head of civil Engineering department , National Research Center , for his continuing professional guidance through this research .

The author also appreciates Assistant Prof. Dr. Ahmad Farahat, lecturer of structural Engineering , Faculty of Engineering , Cairo University for his guidance and indispensable help . The valuable comments offered by Dr. Farahat during the experimental program and the effort he expended in achieving this research are greatly appreciated .

Very special deep thanks go to Prof. Dr. Sherif Essa , the head of National Research Center for his continuous encouragement and valuable advice .

Special thanks are due to Assistant Prof. Dr Hatem Mostafa , lecturer of R.C. structures , Faculty of Engineering , Cairo University for his help in offering his experience and knowledge , and the staff members of the Material Research Laboratory in the Housing and Building Research Center for their valuable assistance to complete the experimental work .

The author owes Mr. Sameh M. Osman a great debt of gratitude for his great assistance during the course of this research , especially in the final stages of this thesis .

Finally , I would like to extend my gratitude and deep appreciation to my great mother , my brothers Hazem and Amr , my sister Ola and my fiancée Heba Sabry , for their moral support , continuous encouragement , and patience Without their sincere help this thesis would not have been possible .

## ABSTRACT

The column is the most important structural element in the structure . It has usually the main responsibility of the building distortion . In this respect , the repair and strengthening of columns if it is necessary is a very important subject to reduce the building failure .

Repair and strengthening of columns by using concrete jackets is a common method from very long time . Many researches had been done to study the global behaviour of the original columns and strengthened columns .

Most of previous researches focused on the full length strengthened or complete repair of the column , even there is a local defect in this column . Non of the previous research work studied the local strengthening of the defected part in the column . In this research the partial strengthened columns to repair the defected part only is investigated experimentally .

The construction deficiencies such as the bad quality of concrete and the bad arrangement of horizontal reinforcement (stirrups) are only investigated .

This study takes into consideration four basic parameters . These parameters are as follows : -

- (a) Type of defect .
- (b) Location of defect .
- (c) Jacket height .
- (d) Type of strengthening .

**The Summary of the research chapters is as follows :-**

**Chapter one** includes historical background , the main causes of defects , different shape of building defects , determination of the defected part and its propagation , and the summary of this research .

**Chapter two** explains the objectives of repair and strengthening , the basic steps of concrete repair works , and the repair materials . The chapter includes also , a brief discussion of the different techniques of repair and strengthening



of R.C. columns. It includes also the previous researches conducted in the strengthening and repair of reinforced concrete columns .

**Chapter Three** describes the experimental program , the properties of using materials, the test program, the test procedure , studied parameters , and measurements .

**Chapter Four** discusses the experimental results including the ultimate load , the strain of both concrete and reinforcement steel , and crack pattern. Analysis of test results is also presented in this chapter .

**Chapter Five** includes a brief summary of this study . The conclusions , recommendations , and suggested future work are recommended .