



INVESTIGATIONS OF RC STRUCTURES SUBJECTED TO BLAST LOADS

By

Ahmed Ashraf Hanafy Said Gomaa

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

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Under the Supervision of

Prof. Dr. Walid AbdElLatif Attia

Professor of Structural Analysis and
Mechanics, Faculty of Engineering, Cairo
University

Dr. Mostafa M. Abdelwahab ElSayed

Assistant Professor, Structural Engineering
Department, Faculty of Engineering, Cairo
University

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Approved by the
Examining Committee

Prof. Dr. Walid AbdeILatif Attia, Thesis Main Advisor

Prof. Dr. Adel Yehia Akl, Internal Examiner

Prof. Dr. Hatem Hamdy Ghith, External Examiner
- Housing & Building National Research Center

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Engineer's Name: Ahmed Ashraf Hanafy Said
Date of Birth: 3/6/1991
Nationality: Egyptian
E-mail: Ahmed.ashraf.hanafy.91@gmail.com
Phone: 01004682361-01272000150
Address: 21aman street- dokki
Registration Date: 01/10/2013
Awarding Date: 01/12/2016
Degree: Master of Science
Department: Structural Department



Supervisors:

Prof. Dr. Walid AbdElLatif Attia
Dr. Mostafa M. Abdelwahab ElSayed

Examiners:

Prof. Dr. Walid AbdElLatif Attia (Main advisor)
Prof. Dr. Adel Yehia Akl (Internal examiner)
Prof. Dr. Hatem Hamdy Ghith (External examiner)
- Housing & Building National Research Center

Title of Thesis:

**INVESTIGATIONS OF RC STRUCTURES SUBJECTED TO
BLAST LOADS**

Key Words:

blast loads; moment curvature; single-degree-of-freedom; damage level; progressive collapse

Summary:

Recently, progressive collapse of civilian and military facilities became more common as a result of increased number of terrorist attacks and explosions. In order to mitigate this type of collapse, more studies have to be performed on evaluating the nonlinear response of buildings under such extreme loads. Since columns are the key load-bearing elements in structures and exterior columns are probably the most vulnerable structural components to terrorist attacks, column's failure is normally the primary cause of progressive collapse in structures. However, the available techniques, specified in modern blast resistance design standards, for evaluating the response of reinforced concrete (RC) columns under blast loads does not consider the influence of axial on the lateral behavior of columns (buckling effect). This research focuses on studying experimentally the influence of changing exterior column design parameters, such as column aspect ratio, shear reinforcement (stirrups) and also axial load (that already exist from the gravity load), on their lateral behavior. It has been shown that increasing column depth and axial load significantly increases the column's capacity and subsequently, the lateral behavior structures under the action of blast loads. On the other hand, doubling the shear reinforcement slightly increases the column's capacity, but less damage and crack widths are expected. In addition to previous, a case study of a twelve-story RC residential building is considered in this research. In this case, six different thread scenarios (with scaled-distances varies from 1.0 to 4.0 $\text{m/kg}^{1/3}$) covering a wide range of design basis threat levels are considered. The thesis outcomes are expected to contribute to the growing reinforced concrete blast performance database of experimental results and the future development of reinforced concrete column design provisions under blast loads in Egypt.

Acknowledgments

All thankfulness to **ALLAH** for helping to finish this work. I would like to express my thankfulness to my supervisors, Prof. Dr. Walid AbdElLatif Attia, Professor, Structural Engineering Department, Cairo University and Dr. Mostafa ElSayed, Associate Professor, Structural Engineering Department, Cairo University, for their guidance, help, support and encouragement.

I am deeply grateful to my father ENG.\ Ashraf Hanafy for his support, advice, patience and assistance. Especial thanks for Dr. Mostafa ElSayed for his support, assistance, teaching and guidance in my working life.

Dedication

I dedicate this research to parents, for their caring, guidance, supports, patience and help. I do believe that, I couldn't success in all my life steps without their continuous support. God bless them.

Table of Contents

Acknowledgments	ix
Dedication	xi
Table of Contents	xiii
List of Tables	xvii
List of Figures	xix
List of Symbols	xxiii
Abstract	xxvii
CHAPTER 1: Introduction	1
1.1 Background	1
1.2 Objectives.....	1
1.3 Scope and Methodology.....	1
1.4. Thesis outline	2
Chapter 2: Literature Review	5
2.1. Recent terrorist attack.....	5
2.2 Explosion Process	9
2.3 Ideal blast wave characteristics	10
2.3.1 External explosions.....	11
2.3.2 Internal explosions.....	12
2.4 Blast scaling laws	13
2.5 Material Modeling.....	14
2.5.1 Concrete Model	14
2.5.2 Reinforcement Steel Model	15
2.5.3 DYNAMIC EFFECTS	16
2.5.4 Dynamic increase factor	17
2.6 Structural Response of Elements under Blast Loading.....	17
2.6.1. Single degree of freedom (SDOF) model.....	17
2.6.2 Load factor and load-mass factor	18
2.7 ISO-Damage Curves	19
2.8 RC Columns Failure Mechanisms	20
2.9 Damage States Identification	20
2.9.1 Damage State I (DS-I): Superficial Damage	21
2.9.2 Damage State II (DS-II): Moderate Damage.....	21
2.9.3 Damage State III (DS-III): Heavy Damage	22

2.9.4 Damage State IV (DS-IV): Hazardous Damage.....	22
CHAPTER 3: EXPERIMENTAL PROGRAM AND TEST OPSERVATIONS	25
3.1 Specimen Design.....	25
3.1.1 Scaling	27
3.1.2 Materials	27
3.2 Casting of the Test Specimens	32
3.3 Test Setup.....	34
3.3.1 Installation of the Test Specimens.....	35
3.3.2 Instrumentation.....	36
3.3.3 Loading Procedure.....	36
3.4 Experimental Results.....	37
3.4.1 Crack Pattern	37
3.4.2 Load-deflection curves	51
3.4.3 Support rotation angle	57
3.5 Damage States Identification	57
3.5.1 Damage State I (DS-I): Superficial Damage	58
3.5.2 Damage State II (DS-II): Moderate Damage.....	58
3.5.3 Damage State III (DS-III): Heavy Damage.....	58
3.5.4 Damage State IV (DS-IV): Hazardous Damage.....	58
3.5.4 Damage State V (DS-V): Blowout	59
CHAPTER 4: ANALYTICAL MODEL FOR PROGRESSIVE COLLAPSE OF A GENERIC BUILDING.....	61
4.1 Material constitutive models	61
4.1.1 Concrete Model	61
4.1.2 Reinforcement Steel Model	62
4.1.3 SIF and DIF	63
4.2 Moment –Curvature Relationship	64
4.3 Load-Deflection Relationship	66
4.4 Verification of the analytical model.....	66
4.5 Case Study.....	67
4.5.1 Thread scenarios	68
4.5.2 Results	75
CHAPTER 5: Summary and Conclusion	109
5.1 Recommendations for future research are as follows:	110
List of references	113

