شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

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

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

Ain Shams University
Faculty of Engineering
Public Works

Performance of Strengthened Reinforced Concrete Skeleton Structures Subjected to Blast

A Thesis submitted in partial fulfilment of the requirements of the degree of Doctor of Philosophy in Civil Engineering (Structural Engineering)

by

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Date: November 2021

Dedication

This work took years from my life. I wish to dedicate it to those who suffered to educate, prepare and help me to be as I am,

TO MY MOTHER AND MY FATHER

I wish to dedicate my thesis

TO MY SISTERS

For their encouragement and help to complete this work.

Statement

This thesis is submitted as partial fulfillment of Doctor of Philosophy in Civil Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Thesis Summary

Terrorist bombing is currently regarded a threat to almost all countries around the world as it leads to loss of human lives, damage of structures and infra-structure in addition to serious negative impact on security and economy. Being the main carrying elements in skeleton structures, if columns are damaged or collapsed due to blast this may lead to partial or progressive collapse of the structure. It is therefore essential to direct research to improve the resistance of columns to blast so as to provide protection to the structure.

This thesis presents numerical investigation of the response of reinforced concrete (RC) elements and skeleton structures to near-field explosion and the effectiveness of different strengthening systems in improving the blast resistance. Three-dimensional finite element modeling and nonlinear dynamic analysis were made using software LS-DYNA for several RC columns and walls that have been tested under blast load in published research. Detailed numerical modeling and dynamic analysis are also performed for RC columns protected by several blast retrofit systems: steel jacket, reinforced polyurethane bricks (RPB) with light steel wrapping and increase the compressive strength of concrete that have been previously tested experimentally under near-field blast load. The numerical results showed agreement with published experimental results regarding displacement and damage pattern for all cases, which validates the adopted numerical approach, and demonstrated the

effectiveness of the retrofitting systems in improving the blast performance. Numerical analysis was made for columns with conventional reinforcement detailing and columns with seismic resistant reinforcement detailing recommended by seismic mitigation codes. Results show that seismic detailing of columns enhances the failure shape of the column and decreases the displacement values compared to columns with conventional reinforcement detailing.

Application was made on a multistory RC slab-column building protected by RC walls with different connection details and subjected to blast loads. Connection of the RC walls to top and bottom floor slabs only was found to provide better blast protection rather than using full four-side connection to the adjacent columns and slabs, thereby minimizing the distortion and failure of columns and increasing the chances of safeguarding the RC building and human lives from damage and injury.

Keywords:

Special reinforcement detail, Retrofitted systems, Blast load.