AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Structural Engineering

PERFORMANCE ASSESSMENT OF MULTI STORY STONE UNREINFORCED MASONRY BUILDINGS WITH BARREL VAULTS UNDER SEISMIC LOADS

A Thesis submitted in partial fulfillment of the requirements of the Degree of
Doctor of Philosophy in Civil Engineering
(Structural Engineering)
By

Mohamed Gamaleldeen Elsayem Hasan Ali
Master of Science in Civil Engineering
(Structural Engineering)
Faculty of Engineering, Ain Shams University, 2012

Supervised By

Prof. Dr. Abdelsalam Ahmed Mokhtar
Professor of Structural Engineering
Faculty of Engineering
Ain Shams University

Dr. Gamal Hussein Mahmoud
Associate Professor of Structural Engineering
Faculty of Engineering
Ain Shams University

Dr. Mahmoud Elghorab
Assistant Professor of Structural Engineering
Faculty of Engineering
Ain Shams University

Dr. Mohamed Kohail M. Fayez
Assistant Professor of Structural Engineering
Faculty of Engineering
Ain Shams University

Cairo - (2018)

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Structural Engineering

PERFORMANCE ASSESSMENT OF MULTI STORY STONE UNREINFORCED MASONRY BUILDINGS WITH BARREL VAULTS UNDER SEISMIC LOADS

By
Mohamed Gamaleldeen Elsayem Hasan Ali
Master of Science in Civil Engineering
(Structural Engineering)
Faculty of Engineering, Ain Shams University, 2012

Examiners' Committee

Name and Affiliation	**Signature**
Prof. Dr. Gustavo V Guinea Faculty of Engineering Universidad Politécnica de Madrid	……………….
Prof. Dr. Amr Ali Abdelrahman Professor of Reinforced Concrete Structures Faculty of Engineering Ain Shams University	……………….
Prof. Dr. Abdelsalam Ahmed Mokhtar Professor of Structural Engineering Faculty of Engineering Ain Shams University	……………….
Dr. Gamal Hussein Associate Professor of Structural Engineering Faculty of Engineering Ain Shams University	……………….

Date: 15 MAY 2018

Statement

This thesis is submitted as a partial fulfillment of Doctor of Philosophy in Civil Engineering (Structural 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.

Student Name:
Mohamed Gamaleldeen Elsayem Hasan Ali

Signature

……………..………..

Date 15 MAY 2018

Researcher Data

Name:	Mohamed Gamaleldeen Elsayem Hasan Ali
Date of birth:	03 November 1982
Place of birth:	Saudi Arabia
Last academic degree:	Master of Science
Field of specialization:	Structural Engineering
University issued the degree:	Ain Shams
Date of issued degree:	September 2012
Current job:	Teaching Assistant

THESIS SUMMARY

This thesis contains analysis details of an analytical study conducted to evaluate the unreinforced masonry structures (URM) of limestone low rise building under the seismic load and to study the effect of the wall thickness and vaults thickness on the URM load carrying capacity. These proposed structures were considered low rise building of 3 floors. The concepts of value engineering and sustainability are considered the main goals of using this type of structures.

The experimental test program was made to conduct the mechanical properties of the URM prisms and it consists of nine masonry assembly constructed with three different types of locally available stone masonry bricks, the walls were tested under compression, tensile, shear tests. The mechanical properties for these nine assemblages were calculated such as the ultimate compressive strength, ultimate tensile strength, bond strength and young's modulus. These parameters were used in the analytical analysis by Finite Element Method (FEM) programming to perform cases of study on these proposed URM buildings.

The acting stresses during the FE analysis were observed and be compared with the ultimate strength conducted from experimental tests to evaluate the ultimate capacity of the structure. The shell elements in the F.E. were chosen in the parametric study to model the proposed building for the macro-modeling technique whereas the solid elements were used in the verification process.

Keywords: Barrel Vaults, Unreinforced Masonry, Seismic, Limestone Masonry, Sustainability, URM, Low-rise Building, Abaqus.

ACKNOWLEDGEMENT

I would like to express my deepest thanks and appreciation to my supervisor, Prof. Dr. Abdelsalam Mokhtar for his guidance and advice throughout this work. I am grateful to him all for having the opportunity to work under his supervision. Also, I would like to Prof. Dr. Gamal Hussein for his great help in this work.

Special thanks for my supervisors; Dr. Mahmoud Elghorab and Dr. Mohamed Kohail Fayez for their valuable assistance, guidance, patience and endless support throughout this research, and reviewing of the manuscript are greatly acknowledged.

The experimental work was carried out at the Material Research Centre (MRC) of the Structural Engineering Department at Ain-Shams University. The help of the laboratory technicians in developing work is greatly appreciated for their distinguished assistance during the experimental work.

Finally, I would like to thank my parents and my wife for their continuous support, filling me with hope and enthusiasm, especially during the hard times.

Contents

LIST OF FIGURES