



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



MONA MAGHRABY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

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



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



MONA MAGHRABY



Cairo University

BIM AUTOMATED RFT DETAILS TOOL FOR BEM BASED DESIGN

By

Ahmed Hegazy Saleh Hussain

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
GIZA, EGYPT
2021

BIM AUTOMATED RFT DETAILS TOOL FOR BEM BASED DESIGN

By

Ahmed Hegazy Saleh Hussain

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. Yousef Fawzy Rashed

.....

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

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

BIM AUTOMATED RFT DETAILS TOOL FOR BEM BASED DESIGN

By

Ahmed Hegazy Saleh Hussain

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. **Yousef Fawzy Rashed,**

Thesis Main Advisor

Prof. Dr. **Hisham Maged Ibrahim Osman,**

Internal Examiner

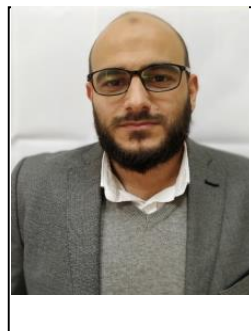
Prof. Dr. **Maher Abdel Rahman Ibrahim Adam,**

External Examiner

- Professor of Concrete Structures
Faculty of engineering, Shoubra, Banha University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

Engineer's Name: Ahmed Hegazy Saleh
Date of Birth: 11/11/1991
Nationality: Egyptian
E-mail: a.hegazy2019@gmail.com
ahmed.hegazy.n@eng-st.cu.edu.eg
Phone: 010-927-026-74
Address: 2 Abdelfattah st, Mataria, Cairo
Registration Date: 1/10/2015
Awarding Date: / /2021
Degree: Master of Science
Department: Structural Engineering



Supervisors:

Prof. Yousef F. Rashed

Examiners:

Prof. Dr. Yousef F. Rashed	Thesis Main Advisor
Prof. Dr. Hisham Maged Ibrahim Osman	Internal Examiner
Prof. Dr. Maher Abdel Rahman Ibrahim Adam	External Examiner
- Professor of Concrete Structures Faculty of engineering, Shoubra, Banha University	

Title of Thesis:

BIM AUTOMATED RFT DETAILS TOOL FOR BEM BASED DESIGN

Key Words:

BIM, Boundary element method, RFT, Revit

Summary:

BIM Process always focus in gathering information in one model and some of this information should be calculated in another specialized programs. In this thesis, a new tool has been developed as an add-in in REVIT software to model RFT for slabs, beams, prestressed slabs and vertical elements such as columns, walls and coordinates. Slabs RFT modeled as top and bottom mesh in both directions with capability of modeling additional RFT at regions which need extra RFT. Beams RFT modeled as bottom RFT extended between supports, top RFT cover negative moments at supports, stirrups hangers and stirrups with capability of concentrate stirrups at supports. For posttension slabs the tool is able to model cables with its designed profile in 3d. the tool is also model RFT for vertical elements as vertical RFT and stirrups. All these information has been modeled based on analysis and design software PLPAK which is based on boundary element method. After that RFT will be modeled as 3d element with all information as diameter, length and position. This process enables the user to get full benefit from structural analysis program such as analysis, design and print calculation note in addition to combine these features with BIM features such as drawings preparation, bill of quantities and export all necessary data to 4D analysis software. A lot of tall building with various statical systems to check adequacy of the tool.

Disclaimer

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:

Date: / /2021

Signature:

Acknowledgment

I wish to show my appreciation to all those who guided and helped me to finish this work. Deep thanks to Prof Youssef Rashed for his shared knowledge and for believing in my ability to finish this work. And also I would like to present my deep appreciation to my examiners prof Hisham Osman and prof Maher Adam their patience, comments and reviews.

I would like to express special thanks to all CUFE-BE members. Thanks to Dr. Ahmed Fady and Eng. Ahmed Torky for help me in both my academic research and my social life. Thanks to Eng. Ahmed Mahmoud (Taiko) and Eng. Anas Abdel Hakim for their support and friendship. Deep and sincere appreciation and thanks to Eng. Ahmed Khaled for enlighten my bath enlighten.

Table of Contents

DISCLAIMER.....	I
ACKNOWLEDGMENT	II
TABLE OF CONTENTS	III
LIST OF TABLES	V
LIST OF FIGURES	VI
ABSTRACT.....	1
CHAPTER 1 INTRODUCTION AND LITERATURE REVIEW	2
1.1. INTRODUCTION	2
1.1.1. overview	2
1.1.2. BIM advantages	2
1.2. LITERATURE REVIEW.....	4
1.2.1. BIM History.....	4
1.2.2. BIM software and integrated tools	4
1.2.3. Problem description	6
1.3. RELATED SOFTWARE	6
1.3.1. PLPAK.....	6
1.3.2. Autodesk Revit	7
1.3.3. Microsoft Visual Studio.....	8
1.4. THESIS OBJECTIVE.....	8
1.5. THESIS ORGANIZATION.....	9
1.6. CONCLUSIONS.....	9
CHAPTER 2 BEM & PLPAK.....	10
2.1. INTRODUCTION	10
2.2. THE BOUNDARY ELEMENT METHOD (BEM).....	10
2.3. THE PLPAK PACKAGE	11
2.3.1. PLGEN.	11
2.3.2. PLVIEW	13
2.3.3. PLCOREMAN.....	13
2.3.4. PLPOST	14
2.3.5. PLDESIGN.....	16
2.3.6. PTPAK.....	19
2.3.7. Foundation package	21
2.3.8. OPENTK.....	22
2.3.9. Revit-PLPAK exporting tool	23
2.4. CONCLUSIONS.....	25
CHAPTER 3 THE DEVELOPED TOOL	26

3.1.	INTRODUCTION	26
3.2	BEAMS RFT MODELING	29
3.2.1.	Beams file format	29
3.2.2.	Coding concept	31
3.2.3.	Export notes	34
3.3.	SLABS REINFORCEMENT MODELING.....	36
3.3.1.	Slabs file format.....	36
3.3.2.	Coding concept	36
3.3.3.	Export notes	38
3.4.	COLUMNS & SHEAR WALLS REINFORCEMENT MODELING.	39
3.4.1.	Columns file format.....	39
3.4.2.	Coding concept	40
3.4.3.	Export note.....	44
3.5.	PT-CABLES MODELING.	44
3.5.1.	File Format.....	44
3.5.2.	Coding concept	45
3.5.3.	Export note.....	47
3.6.	CONCLUSIONS.....	48
CHAPTER 4	EXAMPLES & APPLICATIONS	50
4.1.	INTRODUCTION	50
4.2.	EXAMPLE 1: FLAT SLAB RESIDUAL BUILDING	50
4.2.1.	Design and analysis models.....	51
4.2.2.	Revit model with RFT details.....	53
4.3.	EXAMPLE 2 RESIDUAL BUILDING WITH POST-TENSIONED SLABS.....	56
4.3.1.	Design and analysis models.....	56
4.3.2.	Revit model with RFT details.....	59
4.4.	EXAMPLE 3: TALL BUILDING IN PILED RAFT	61
4.4.1.	Design and analysis models.....	62
4.4.2.	Revit model with RFT details.....	63
4.5.	CONCLUSIONS.....	65
CHAPTER 5	SUMMARY AND FUTURE WORK	66
5.1.	GENERAL SUMMARY	66
5.2.	FUTURE WORK	66
APPENDIX A	TEXT FILE FORMAT	69
APPENDIX B	BILL OF QUANTITIES	82
	EXAMPLE 1 FLAT SLAB RESIDUAL BUILDING	82
	EXAMPLE 2 POST-TENSIONED RESIDUAL BUILDING	86
	EXAMPLE 3 TALL BUILDING IN PILED RAFT	88
APPENDIX C	SAMPLE OF DRAWINGS FOR PROJECTS	90