AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL DEPARTMENT

THE IMPACT OF APPLYING BUILDING INFORMATION MODELING ON DESIGN AND CONSTRUCTION STAGES

A THESIS SUBMITTED TO
THE FAULTY OF ENGINEERING
AIN SHAMS UNIVERSITY
IN FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE IN
STRUCTURAL ENGINEERING

BY

ALAA MASOUD ABD EL-RAHMAN AHMED
BSc. 2011 STRUCTURAL DIVISION
CIVIL ENGINEEERING DEPARTMENT
AIN SHAMS UNIVERSITY

SUPERVISED BY:

PROF. AYMAN HUSSEIN HOSNI KHALIL
PROFESSOR OF CONCRETE STRUCTURES
STRUCTURAL ENGINEERING DEPARTMENT
AIN SHAMS UNIVERSITY

DR. MAHMOUD MOHAMED EL-KATEB
ASSISTANT PROFESSOR
STRUCTURAL ENGINEERING DEPARTMENT
AIN SHAMS UNIVERSITY

2017

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL DEPARTMENT

APPROVAL SHEET

THESIS : MASTER OF SCIENCE IN CIVIL ENGINEERING (STRUCTURAL)

STUDENT NAME : ALAA MASOUD ABD EL-RAHMAN AHMED

THESIS TITLE : THE IMPACT OF APPLYING BUILDING INFORMATION MODELING ON DESIGN AND CONSTRUCTION STAGES

EXAMINERS COMMITTEE

Signature

Prof. Mohamed El-Saeid Eisa .....
Professor of Concrete Structures
Structural Engineering Department
Faculty of Engineering – Cairo University

Prof. Ashraf M. Samy Biddah .....
Professor of Concrete Structures
Structural Engineering Department
Faculty of Engineering – Ain Shams University

Prof. Ayman Hussein Hosni Khalil .....
Professor of Concrete Structures
Structural Engineering Department
Faculty of Engineering – Ain Shams University

Date: / / 2017

STATEMENT

This thesis is submitted to faculty of engineering Ain Shams University for the degree of Master of Science in civil engineering structural department.

The work included in this thesis was carried out by the author for the department of civil engineering (structural division), Ain shams university.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Date: 02/07/ 2017

Name: Alaa Masoud Abd EL-Rahman Ahmed

Signature:

AUTHOR

Name	:	Alaa Masoud Abd EL-Rahman Ahmed
Date of birth	:	20 December 1989
Place of birth	:	Cairo
Academic Degree	:	B.Sc. of Civil Engineering (Structural)
University	:	Ain Shams University
Date	:	June 2011

ACKNOWLEDGEMENTS

First of all, I thank GOD who guided and helped me to finish this work in the proper shape.

I would like to thank everyone that has helped and contributed to present my thesis. I would like to especially thank and appreciate Prof. Ayman Hussein and Dr. Mahmoud El-Kateb for their help. They have highly supported me throughout the duration of preparation my thesis. This thesis would not have been possible without the kind help and support of these people.

I would like to thank my father, my mother for all their caring efforts at all times. They have been great and very supportive of me all throughout my education, especially when researching and preparing my thesis.

Alaa Masoud Abd EL-Rahman Ahmed

ABSTRACT

THE IMPACT OF APPLYING BUILDING INFORMATION MODELING ON DESIGN AND CONSTRUCTION STAGES

The main aim for any construction projects is to make balance between time, cost and quality. All members in construction projects (managers, engineers, workers, builders...etc.) try to find the ideal methods to achieve less time with less cost and best quality. Over the years all people belong to design and construction services tried to improve methods and instruments to achieve project management triangle; time, cost and quality.

With the development of civilization, the projects become more complicated and need more scientific and development methods to satisfy the new development. Many methods and theories began to appear to make full control on project management and to face the new types of construction projects. Building Information Modeling (BIM) is one of the new methods which appeared to satisfy the development of construction projects.

This research studies the impact of applying BIM in design and construction stages, and how it increases the quality of co-ordinations between all disciplines in projects, which reflects directly on the productivity of construction projects.

Construction always faces low productivity with other industries due to poor planning and co-ordination problems. BIM is a process which is used to overcome these problems by controlling co-ordinations between project team members, making design more clear, presenting full information about design process and showing most conflicts between disciplines before performing construction process so that conflicts will be solved before starting construction process.

Most case studies of construction projects find that apply BIM process will make project productivity increases with various ratios, these ratios depend on how BIM process is circulated and organized from project members.

This research tries to find the ideal usage of BIM in design and construction stages and finds out how applying BIM affects directly in project management triangle; Time, cost and quality.

The thesis outline is divided into the following chapters:

- **Chapter (1)**
  An introduction to the research. This chapter discusses the importance of the research, types of construction project stages, and the scope of the research program.

- **Chapter (2)**
  Presents a brief review of the available literature on the history of applying BIM with definitions, managing design, and construction process. Construction productivity are also documented in the same chapter.

- **Chapter (3)**
  Presents the BIM process. This chapter describes project management in design and construction stages and present case study to ensure process steps.

- **Chapter (4)**
  Presents BIM questionnaire. The analysis and results of questionnaire will show how BIM affects in construction projects.

- **Chapter (5)**
  Presents research summary and conclusions with suggestions for future studies.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AEC : **A**rchitectural, **E**ngineering, and **C**onstruction

AIA : **A**merican **I**nstitute of **A**rchitects

BIM : **B**uilding **I**nformation **M**odeling

BOQ : **B**ill **O**f **Q**uantities

CAD : **C**omputer-**A**ided **D**esign

DWG : **D**ra**W**in**G**

IFC : **I**ndustry **F**oundation **C**lasses

LOD : **L**evel **O**f **D**etail

MEP : **M**echanical, **E**lectrical and **P**lumbing

NWC : **N**avis**W**orks **C**ache File

O&M : **O**perations and **M**aintenance

QA : **Q**uality **A**ssurance

QC : **Q**uality **C**ontrol

QTO : **Q**uantity **T**ake-**O**ff

RFI : **R**equest **F**or **I**nformation

RVT : **R**e**V**i**T** project file

RTE : **R**evit **T**emplate

TXT : **T**e**XT**

TQM : **T**otal **Q**uality **M**anagement

VDC : **V**irtual **D**esign and **C**onstruction

2D : Two-Dimensional

3D : Three-Dimensional

4D : Four-Dimensional (3D + time)

5D : Five-Dimensional (4D + cost)