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SIMULATION SAFETY MANAGEMENT OF IBS CONSTRUCTION

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A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Construction Management

Faculty of Civil Engineering
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November 2008

I declare that this thesis entitled “*Simulation Safety Management of IBS Construction*” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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To my beloved mother and father

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ABSTRAK

Industri pembinaan adalah merupakan salah satu industri paling merbahaya kerana sifatnya unik. Pengukuran dengan menggunakan piawaian antarabangsa mendapati rekod keselamatan di tapak bina adalah teruk. Banyak syarikat pembinaan di seluruh dunia mengimplementasi sistem pengurusan keselamatan, kesihatan dan alam sekitar bagi mengurangkan kecederaan, mengelakkan sebarang penyakit dan menyediakan suasana kerja yang selamat di tapak-tapak pembinaan. Peningkatan kos insuran dan kos pembayaran pampasan pekerja menyebabkan perlunya kepada penghapusan kemalangan di tapak bina. Akta Keselamatan dan Kesihatan Pekerjaan 1970 ditubuhkan untuk menyediakan garis panduan bagi pengamalan cara kerja yang selamat di tapak bina dan menjamin keselamatan pekerja. Salah satu kaedah terbaik untuk mengelakkan kecederaan dan meminima kos adalah melalui perancangan dan koordinasi yang baik sebelum dan selepas sesuatu kerja. Keadaan tempat kerja di tapak pembinaan, kurangnya latihan yang sempurna dan penggunaan peralatan keselamatan yang tidak betul sering membawa kepada kecederaan serius dan kemungkinan berlakunya kematian. Penggunaan peranca, tangga, jentera berat dan di dalam sesetengah kes melibatkan bahan-bahan kimia merbahaya meningkatkan risiko berlakunya kemalangan ketika pembinaan.

ABSTRACT

Construction is one of the most hazardous industries due to its unique nature. Measured by international standards, construction site safety records in construction are poor. Many construction companies around the world are implementing safety, health, and environmental management systems to reduce injuries, eliminate illness, and to provide a safe work environment in their construction sites. The increase in both insurance costs and workers' compensation makes it necessary to reduce eliminate worksite accidents. The Occupational Safety and Health Act of 1970 were established to provide guidelines for safe worksite practices and to ensure the safety of the workers. One of the best ways to avoid injuries and minimize costs is through good planning and co-ordination – both before and on the job. On-site working conditions, lack of proper training, and improper use of safety equipment often lead to serious injury and even death. The involvement of scaffolds, ladders, heavy equipment and in some cases dangerous chemicals, greatly increase the risk of construction accidents.

LIST OF TABLE

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRAK	v
	ABSTRACT	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiii
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Construction Fatality Rates in Europe	5
	1.3 Problem statement	6
	1.4 Aims and Objective of study	7
	1.5 Significance of the Study	8
	1.6 Research Methodology	8
2	LITERATURE REVIEW	9
	2.1 Industrialized Building System (IBS)	9
	2.2 Steel Framed and Precast Concrete Building	11
	2.3 Benefits of IBS Component	12

2.3.1	High Quality and Aesthetical Value of Products	12
2.3.2	Cleaner and Safer Construction Site	13
	Faster Construction	13
2.3.4	Greater Unobstructed Span	14
2.3.5	Lower Total Construction Costs	14
2.4	Why IBS in Malaysia	14
2.5	Why Safety and Health Should Be Well Managed?	15
2.5.1	Humanitarian Consideration	16
2.5.2	Financial Cost	16
2.5.3	Legal Sanction	17
2.6	OSH Management System of the Construction Industry	17
2.7	Safety and Health Culture	18
2.8	OSH Management System in Malaysia	19
2.9	Occupational Safety and Health Act 1994 (Act 514)	20
2.91	Elements of the OHS Management System	21
2.10	How Accidents Occur	24
2.11	Safety Practices	24
2.12	Safety Improvement	25
2.13	Safety and Health Management Systems	26
2.13.1	Management Commitment and Employee Involvement	26
2.13.2	Worksite Analysis	28
2.13.3	Hazard Prevention and Control	29
2.13.4	Safety and Health Training	30
3	RESEARCH METHODOLOGY	31
3.1	Introduction	32
3.2	Conceptualization	33
3.3	Identification of Research Focus and Scope of Study	33
3.4	Data Collection	34
3.4.1	Study of Documents	35

3.4.2	Selecting A Case Study	35
3.5	Modeling and Simulation	36
3.5.1	Using Witness Software Data	37
3.5.2	Benefits of Simulation	38
3.6	Data Analysis and Discussion	39
4	SAFETY PRACTICES OF IBS CONSTRUCTION	40
4.1	Introduction	40
4.2	Causes of Accidents	40
4.2.1	Unsafe Acts/Practices	41
4.2.2	Unsafe Conditions	42
4.2.3	Secondary Cause of Accident	43
	4.2.3.1 Management System Pressure	44
	4.2.3.2 Social Pressure	44
4.3	Most Common Types of Construction Accidents	45
4.3.1	Construction Site Falls	46
4.3.2	Crane Accidents	46
4.3.3	Scaffolding Accidents	47
4.3.4	Defective Scaffolding	47
4.3.5	Improperly Assembled Scaffolding	48
4.3.6	Run Over by Operating Equipment	48
4.3.7	Electrical Accidents on Construction Sites	48
4.3.8	Trench Collapses	49
4.3.9	Fires and Explosions in Construction Site	50
4.3.10	Welding Accidents on a Construction Site	50
4.3.11	Arc Burn Accidents	50
4.3.12	Unsafe/Dangerous Construction Equipment Accidents	51
4.3.13	Unsafe/Faulty Ladders	51
4.3.14	Defective power tools	51
4.3.15	Defective Derricks	52
4.3.16	Defective Hoists	52
4.3.17	Defective Conveyors	53

4.3.18	Defective Winches	53
4.3.19	Defective Graters	53
4.3.20	Defective scrapers	54
4.3.21	Defective Tractors	54
4.3.22	Defective Bulldozers	55
4.3.23	Defective Forklifts	55
4.3.24	Defective Backhoes	56
4.3.25	Defective Boilers	56
4.3.26	Defective Pressure Vessels	57
4.3.27	Logging Accidents	57
4.3.28	Brazing Accidents	58
4.3.29	Cutting Accidents	58
4.3.30	Elevator Accidents on construction site	59
4.3.31	Structure Failure on construction site	59
4.3.32	Building Collapse on construction site	59
4.3.33	Construction Site Supervisor Negligence	60
4.3.34	Compressor Accidents	60
4.3.35	Exploding Compressor	61
4.3.36	Gas Explosions on a construction site	61
4.4	Conclusions	62
5	DATA ANALYSIS AND MODELING	63
5.1	Safety and Health Requirements	63
5.2	Case study	65
6	CONCLUSION AND RECOMMENDATIONS	70
6.1	Conclusion	70
6.2	Recommendation	71
	REFERENCES	73

LIST OF TABLES

TABLE NO.	TITLE	PAGE
1.1	Fatality rates for selected EU member states	6
4.1	Primary cause of accidents	43
4.2	Secondary cause of accidents	45
5.1	Safety and Health Requirements in pre-cast construction	64

LIST OF FIGURES

FIGURES NO.	TITLE	PAGE
1.1	Injury rate of construction and all private industry	3
1.2	Total Industrial Accidents in Malaysia	4
1.3	Flow chart of the research methodology	9
2.1	Structural construction system in IBS	11
2.2	OHS management system elements of the BS 8800: 1996	24
3.1	Stages in Research Methodology	32
3.2	Flow chart of the research methodology	34
3.3	Model for semi-pre cast concrete houses	35
3.4	Witness 2001 Software Start Up Window	37
3.5	Elements used to build the models: Machine (activity); Buffers (queues); and Part (house)	38
5.1	Simulation Model For one hundred unit houses	66
5.2	Effects of accidents to overall completion time	67
5.3	Simulation model for one hundred unit houses	68
5.4	Effects of accidents to overall completion time	68

LIST OF ABBREVIATION

CIDB	-	Construction Industry Development Board Malaysia
HSE	-	Health and Safety Executive
IBS	-	Industrialized Building System
OSHA	-	Occupational Safety and Health Act
OSHMS	-	Occupational Safety and Health Management System
SOCSSO	-	Social Security Organization

CHAPTER 1

INTRODUCTION

1.1 Introduction

Construction accidents causes many human tragedies, de-motivate workers, disrupt site activities, delay project progress and adversely affect the overall cost, productivity and reputation of the construction industry. Although project safety management is very much a traditional concern for the construction industry, the industry seems to suffer from a general inability to manage workplace health and safety to a level where a pro-active zero-accident culture prevails. Many construction workers are killed or injured every year as a result of construction operations. Others suffer ill health. The hazards are not restricted to those working on site. Children and members of the general public are also killed or injured due to inadequate control of construction activities. The construction industry's performance has improved over the years but the rates of death, serious injury and ill health are still too high. Accident rates in the construction industry today are one-quarter of those reported in the 1960s and half those reported in the 1970s. A construction site is more dangerous than other places of work—according to the UK Health and Safety Executive (HSE), those who spend their working lives on construction sites have a 1 in 300 chance of being killed at work. There is still great potential to improve the health and safety.

It is argued that construction management must have a prime concern for safety and therefore should have a moral, economic, and legal commitment to ensure workplace safety on sites. However the responsibility for safety must commence upstream of the construction phase of a project; architects and engineers must have the technical knowledge to design buildings which can be safely constructed, as well as a commitment to safe working conditions for site workers.

Accident data prepared by the Bureau of Labor Statistics (www.bls.gov) show that the construction industry has performed much worse than the average of all industries (Figure 1.1). Although the safety performance of the construction industry has improved dramatically in the 1990s, injury rates in the construction industry are still 50% higher than that of all industries, lagging all industries by about 10 years. With an average employment of approximately 7% of the industrial workforce, the construction industry has regularly accounted for over 1,100 construction worker deaths per year or nearly 20% of all industrial worker fatalities (www.bls.gov). A more recent, but unpublished, research study by Coble and Hinze (2000) showed that the average workers' compensation insurance costs could be conservatively estimated as constituting 3.5% of the total project costs. In order to reduce and eventually eliminate construction accidents, researchers have explored techniques implemented by different construction parties to realize the "zero-injury objective." By doing so, it will indirectly increase the productivity and profitability for contractors involved in construction industry.

Many accidents in the construction industry are due to bad planning, lack of organization and poor co-ordination on construction sites. According to the European Agency for Safety and Health at Work, in the European Union, construction work leads to most serious accidents at places of work, with more than 1300 people being killed in construction accidents every year. Worldwide, construction workers are three times more likely to be killed and twice as likely to be injured as workers in other occupations. As is evident in this Code of Practice, the costs of these accidents are not borne by workers and employers only, but are also usually shouldered by the owner or owners of the project, legally known as the "client". These costs can amount to a considerable share of the contract price.

Graph Injury Rate vs Year

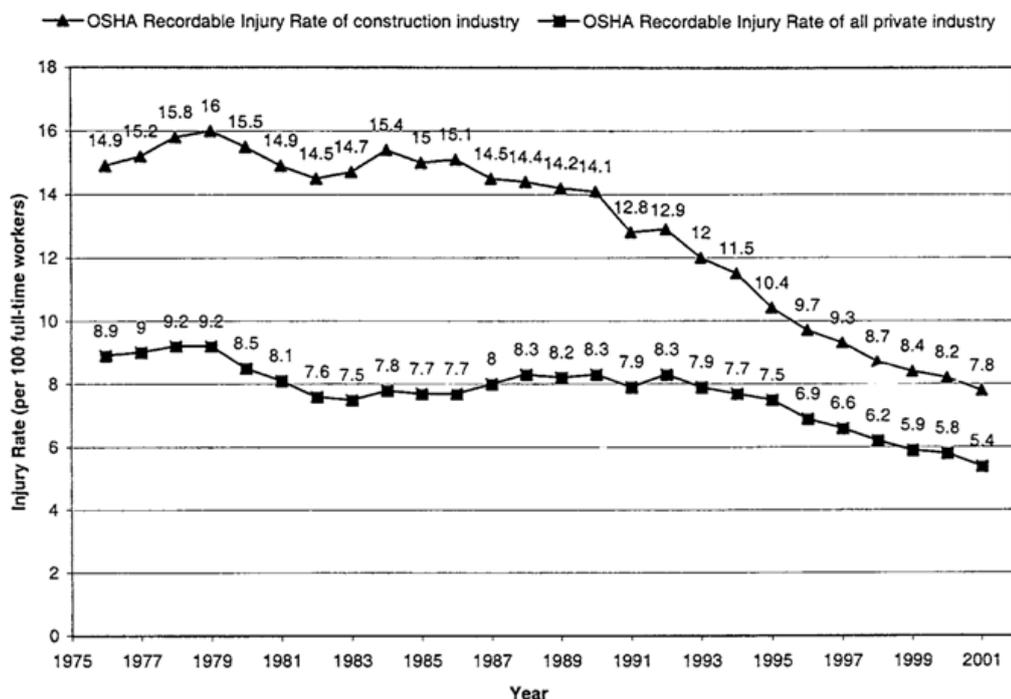


Figure 1.1: Injury rate of construction and all private industry

In Malta, most occupational fatalities occur in construction sites, and most of these fatalities are due to falls from heights. Moreover, the construction sector claims the second highest rate of occupational accidents each year, reaching 16.5% of all reported accidents in 2005. Eliminating or reducing accidents and injuries at the place of work will not only save a great deal of pain and suffering to workers but will also help to reduce the many direct and indirect financial costs related to these accidents and injuries. Furthermore, owners of projects (clients), client appointed supervisors, employers, directors, managers and other supervisors can be held responsible for failing to have effective occupational health and safety control measures in place.

It is noted that 50% of the construction workers in Malaysia are working under unsatisfactory conditions. The condition includes failure to wear safety hats and boots, construction sites failing to adhere to pre-requisite safety requirements, and using unauthorized heavy machinery. According to the Ministry of Human Resource, the accident workplace in Malaysia has decreased from 21.2 to 10.3 per 1000 workers. Figure 1.2 below shows the recorded industrial accidents in Malaysia.

The numbers of cases recorded are high, but they are decreasing year by year, partly due to better awareness of safety.

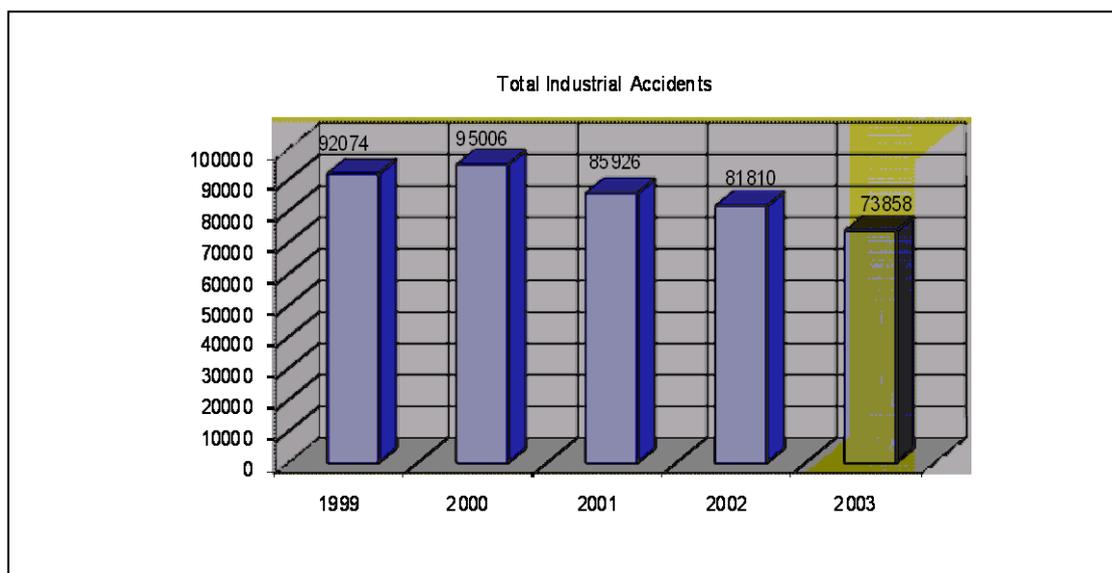


Figure 1.2: Total Industrial Accidents in Malaysia

The construction industry is currently being recognized as a major economic force in Malaysia. It is also one of the most hazardous industry. Based on the Social Security Organization (SOCSO) report in 2000, the fatality rate in the construction industry in Malaysia was of more than 3 times of all workplaces. Whereas, compensation costs paid out by SOCSO for industrial accidents and diseases accounted for almost RM650 Million. As the hidden or indirect cost of an accident is eight to 33 times more than direct costs, the total cost of accident can run into billions of ringgit.

In the field of occupational safety and health, Malaysia is now moving away from the traditional approach whereby it is believed that all occupational hazards can be controlled through detailed regulations. On 25th February 1994, Occupational Safety and Health Act 1994 (OSHA) came in force providing protection on safety and health for work activities in all economic sectors including public services and statutory authorities, except those subjected to Merchant Shipping Ordinance and the armed forces. Under Section 15 (1) and (2) Occupational Safety and Health Act

1994, employers have a duty to ensure, as far as practicable, that employees are not exposed to any hazard at the workplace.

Even though there has been a marked reduction in the number of industrial accidents and the rate of accidents per 1,000 workers since the introduction of the OSHA 1994, there has not been a credible improvement over the last five years. The rate per 1,000 workers has been at a plateau of 9.5 to 10.5 persons, while for developed nations, it is three to four persons per 1,000 workers. Even though regulations on occupational safety and health in Malaysia are quite comprehensive, the level of awareness and practicability of such regulations within the society of construction industry are generally lower than what supposed to come in force.

1.2 Construction Fatality Rates in Europe

The HSE (2001) reports that the European average fatality rate in construction was 13.3 per 100,000 workers in 1996. In contrast with that figure, the HSA (1999) has reported a rate of 8 fatalities for 100,000 workers for the Republic of Ireland in 1996. Although under the European average of fatalities, Ireland still shows a higher incidence than countries as France, the United Kingdom or Spain (Table 1.1).

Table 1.1: Fatality rates for selected EU Member States

Country	Year	Fatality Rate per 100,000 workers
Europe	1996	13.3
Germany	1996	15.4
Italy	1996	14.4
France	1996	12.1
RoI	1996	8.0
UK	1996	5.6
Spain	1996	4.2

1.3 Problem statement

Construction can be a hazardous business. This is widely recognized by OSH, and everyone in the construction industry. When accidents happen, the costs are high – in people, profits and productivity. One of the best ways to avoid injuries and minimize costs is through good planning and co-ordination – both before and on the job. To many managers, who have been brought up to the importance of construction scheduling, and controlling costs, the economic aspect of safety is the most forceful. For material losses in which no injury occurs the accounting of loss can be easily assessed; but where human loss is concerned, the costing becomes more difficult since life or a physical facility cannot crudely be financially evaluated, yet it has been widely recognized that monetary compensation to either the injured party or relatives in the event of fatality has to be paid. Most compensation payments are paid by the contractor's insurance company. Insurance companies will base their premiums upon historical evidence and a poor safety record will inevitably be reflected in insurance premiums. However, the loss to a company by an accident can be broken into:

- Lost working hours of an injured employee.
- Cost of repair or replacement of property damage, whether it is equipment or an element of the permanent construction.
- Insurance premiums increase.

The problem statement of study can be summarized as the following

- The statistics of accidents occurred in the construction sector have not been well organized and maintained.
- Proper Safety and Health Management Systems to prevent employee's accidents on construction worksite.
- Cost saving could not be justified on increase level of site safety.

1.4 Aims and Objective of Study

Projects require effective management from inception to completion if they are to be carried out safely, at minimum cost, completed on time, and subsequently to perform their functions efficiently

- To address and highlights the hazards that are most commonly found at our construction sites today.
- To identify significantly the potential for construction accidents in the individual's working practices, both the unsafe acts committed and the unsafe conditions created.
- To identify the requirements of the safety and health regulations in IBS construction.
- To simulate the construction process by Witness 2001 to study the time effect on safety

1.5 Significance of the Study

The construction industry now is facing challenges in four aspects; time, cost, quality and safety. Actually, safety is one of the most important factors in construction industry where it will effect the time, cost and quality of any construction project If safety to be breach.

Thus, this study will help to measure the safety management construction. Moreover, the compliance of the safety regulations coupled with the knowledge of safety management provides advantages to the construction companies. It decreases the accidents and the project can be completed with high quality within the given time.

1.6 Research Methodology

The research methodology has been carried out to fulfill the objectives of the study; which include the method of data collection such as the documents study, case studies, and simulation by Witness 2001. It covers the procedure such as shown in Figure 1.3

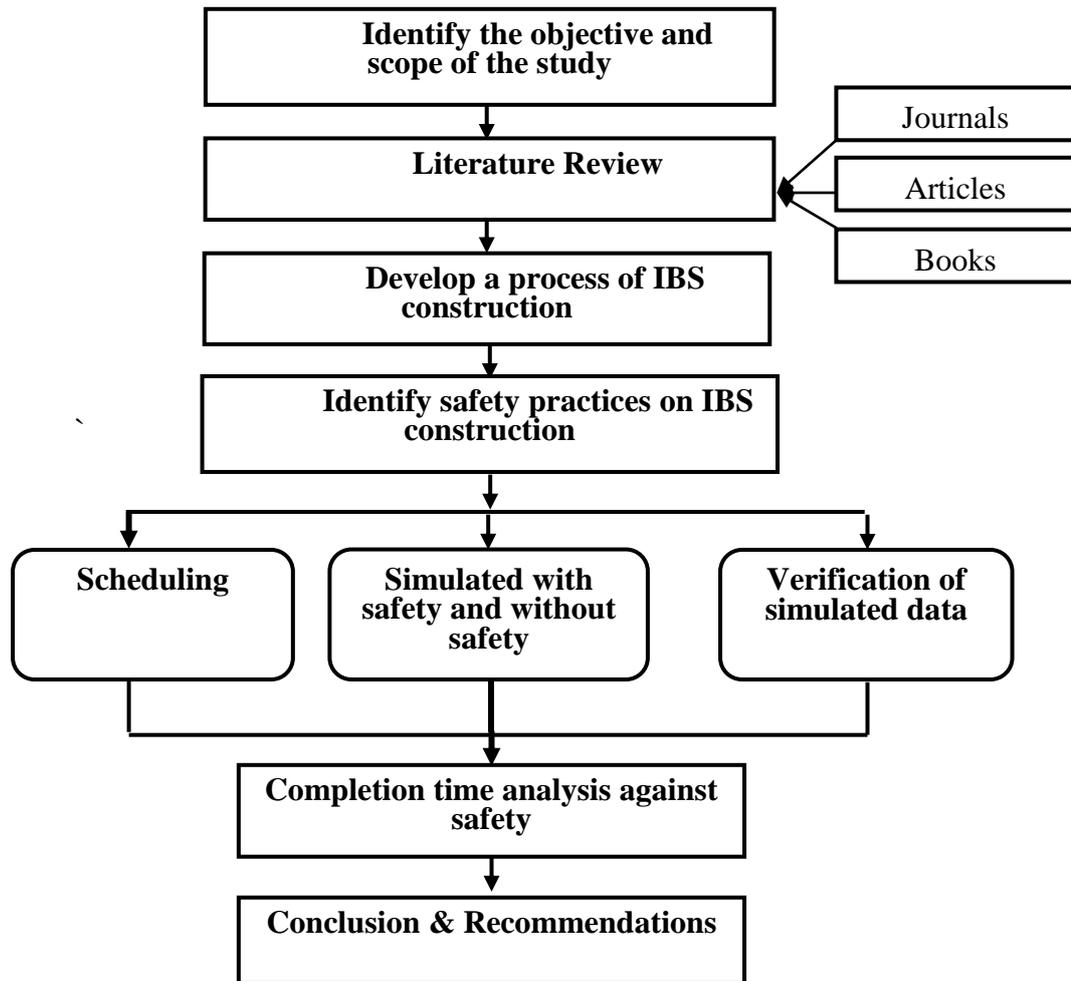


Figure 1.3: Flow chart of the research methodology

CHAPTER 2

LITERATURE REVIEW

2.1 Industrialized Building System (IBS)

Industrialized building system (IBS), according to the definition by Construction Industry Development Board Malaysia (CIDB), is building systems in which structural components are manufactured in a factory, on or off site, transported, and assembled into a structure with minimal additional site works.

Industrialized building system (IBS) is a construction system that is built using pre fabricated components. The manufacturing of the components is systematically done using machine, formworks and other forms of mechanical equipment. The components are manufactured offsite and once completed will be delivered to construction sites for assembly and erection.