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**SAFETY COST IN PRE-CAST CONCRETE CONSTRUCTION**

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

**Faculty of Civil Engineering  
University Technology Malaysia**

**MAY 2008**

I declare that this project report entitled  
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**DEDICATION**

To:  
My parents  
and  
My Beloved Family

Thank you for your love and support

## ACKNOWLEDGEMENT

First of all I want to extend my appreciation to everybody who contributed to the accomplishment of this dissertation. My dissertation supervisor, Ir. Dr. Rosli Mohamad Zin of the Faculty of Civil Engineering is specially remembered for his time, patience and effort in 'moulding' me and my thought processes. The completion of this dissertation would not have been possible without his conscientious guidance and encouragement.

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## **ABSTRACT**

Safety in pre-cast construction is a very important factor that needs to be properly considered and assessed in order to avoid any unnecessary delays, losses, and claims. In pre-cast construction there are three main stages of work flows beginning with fabrication of pre-cast components followed by transportation and installation of the components. In each stage there are different hazards and risks that need to be addressed by the contractor. Thus, the construction contractor has the responsibility to provide good safety standard in each stage of the work flows. One of the controlling factors for providing good safety standard is the cost of safety itself. Lack of knowledge about cost of safety and its portion of the project budget may have significant impact on the profit margin or the risk of financial difficulties will be higher. Therefore, this study is carried out with the aim to identify the cost of safety in pre-cast construction. The data was collected through documents study, case study, and structured question interviews in order to identify the safety requirements in pre-cast construction and the cost of complying with these requirements. The results indicate that the safety cost in pre-cast construction is between 1.5% to 2.5% of total project cost where the safety physical measures contributed the majority percentage of safety cost (about 83% of the safety cost).

## ABSTRAK

Keselamatan dalam proses pembinaan berteraskan teknik pra-tuang merupakan faktor penting yang perlu diambil perhatian untuk mengelakkan kelewatan, kerugian dan tuntutan. Dalam kaedah pembinaan pra-tuang, terdapat tiga peringkat utama yang terlibat iaitu bermula dengan proses penghasilan komponen pra-tuang diikuti dengan penghantaran dan pemasangan komponen-komponen terbabit. Pada setiap peringkat, terdapat berbagai-bagai risiko yang perlu di ambil perhatian oleh pihak kontraktor. Oleh sebab itu, kontraktor pembinaan mempunyai tanggungjawab untuk mematuhi piawai keselamatan yang baik pada setiap peringkat kerja. Satu daripada faktor untuk mematuhi piawaian keselamatan yang baik adalah kos keselamatan itu sendiri. Kekurangan ilmu berkaifan kos keselamatan dan bahagiannya daripada keseluruhan kos projek akan memberikan impak yang besar terhadap unjuran keuntungan ataupun menjadikan risiko terhadap faktor kewangan meningkat. Oleh sebab itu, kajian ini dijalankan dengan maflamat untuk mengenalpasti kos keselamatan di dalam pembinaan secara teknik pra-tuang. Data telah dikumpul melalui kajian terhadap dokumen-dokumen berkaitan, kajian kes dan temuduga berstruktur untuk mengenalpasti kehendak-kehendak keselamatan dalam teknik pembinaan secara pra-tuang dan juga kos untuk menuruti keperluan-keperluan tersebut. Keputusan kajian mendapati kos keselamatan di dalam teknik pembinaan secara pra-tuang adalah di antara 1.5% dan 2.5% daripada kos keseluruhan projek dimana kaedah keselamatan fizikal merupakan penyumbang terbanyak (83% daripada kos keselamatan).



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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

The construction industries are currently perceived as a major economic force in Malaysia as well as an important engine of growth for the country's development. However it is also one of the most hazardous industries.

The Social Security Organization (SOCSO) record shows that a total of 4654 out of 73858 industrial accidents recorded in 2003, were come from the construction industry. In Japan, statistics from the Japan Construction Safety and Health Association (JCSHA) as shown in Figure 1.1 also put the construction industry as the sector with the highest accidents rate among all industries. The pink points in the chart show the total share of accidents contributed by the construction industry among all industries from 1958 to 2000 which is between 25 to 34.2%.



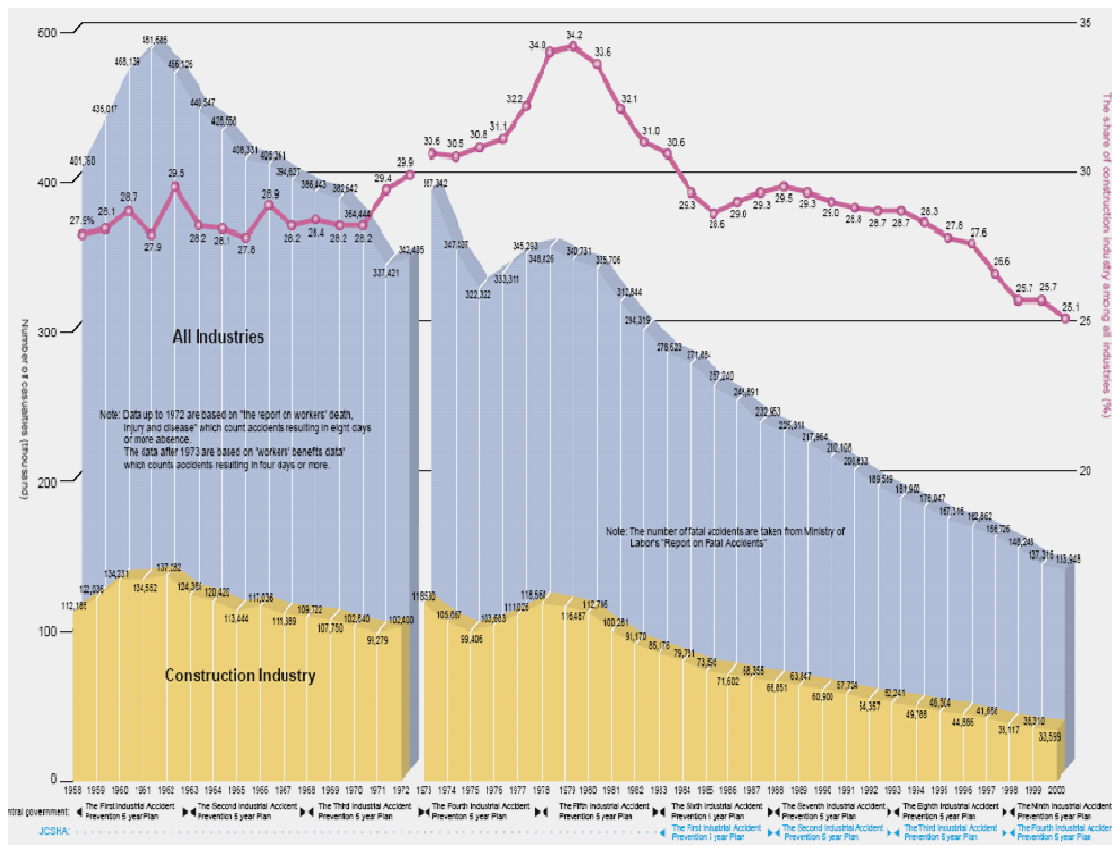


Figure 1.1 Industry Accidents Statistics from 1958 to 2000 (JCSHA 2002)

Therefore it is very important to improve safety in this industry. Malaysia is also now moving towards an approach which believes that all occupational hazards can be controlled through detailed regulations. On 25th February 1994, Occupational Safety and Health Act 1994 (OSHA) came into force providing protection on safety and health for work activities in all economic sectors including the public services and statutory authorities, except those subjected to the Merchant Shipping Ordinance and the armed forces, under Section 15 (1) and (2) of the 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 work place.

In Malaysia the practice of safety which includes the construction sites is regulated by two main acts: (1) The Factories and Machinery (FMA) Act 1967 which widely used by the Department of Occupational Safety and Health (DOSH) to ensure safety, health and welfare at the workplace, (2) One of the regulations under the Budding Operation of Work Engineering and Construction (BOWEC) act which is created specially to focus on the activities at construction industries. Both these acts however have their limitations. The BOWEC emphasizes on the safety and health only at different elements of construction such as machineries, working and load platform, scaffolding, floor opening, electrical safety, etc. The FMA1967 meanwhile, only enforceable to factories and machinery, it is also considered prescriptive, rigid and too dependent on government enforcement, making it ineffective in controlling issues of occupational safety and health at the workplace. Every employer involved in the construction industry is requires to comply with all the requirements of the safety and health regulations as stipulated to OSHA 94, FMA 1967 and BOWEC at the work place.

One of the common divisions in construction industry is the Industrial Building System (IBS) which has been introduced in Malaysia since 1966 for the projects which involve pre-cast construction. According to Construction Industry Development Board Malaysia there are five types of the IBS used in Malaysia:

1. Pre-Cast Concrete Framing, Panel and Box Systems.
2. Steel Formwork Systems.
3. Steel Framing System.
4. Prefabricated Timber Framing Systems.
5. Block Work Systems.

There are many hazards and risks associated with these five types of IBS at every stage of the construction process starting from the manufacturing stage to the erection stage. In every stage there are regulations

and requirements to provide safety environment at the work place that has to be met.

Any effort to meet the requirements of safety and health regulations at work place to ensure that all employees are working in a safe environment may be a costly exercise which affects the project budget. In this study the safety cost in IBS construction is defined in order to determine how much it takes from the project budget.

## **1.2 Problem Statement**

IBS is believed to be relatively not a new approach in Malaysia. However, several studies indicated that there is lack of consideration of safety and risk evaluation in IBS construction. Besides, the safety performance in the Malaysian construction industry has lagged behind most other industries as evidenced by its disproportional high rate of accidents as mentioned earlier in this study.

Furthermore, accident statistics can play an important role as a prime indicator for measuring safety performance as well as a framework for evaluating accident prevention programmes. However, the statistics of accidents occurred in the Malaysian construction sector have not been well organized and maintained. In addition, the assessment of the cost to provide safety in IBS construction is also unknown.

As mentioned earlier, the construction industry is considered the most hazardous industry. Thus the companies which are involved in this industry (contractors, suppliers, subcontractors, etc) should have knowledge about many things related to safety in order to provide good safety environment such as:

- The Occupational Safety and Health Act 1994 specifically regulations on IBS.
- The requirements of those regulations on IBS.
- The cost of complying the requirements to provide safe working environment.

The cost of the requirements to provide safe working environment is almost unknown from those companies because of several reasons such as they are new in this business, not many studies about cost of safety in IBS is available or it is so complex to them.

In general, the problem of this study can be summarised in the following main points:

1. Not many studies about safety cost in IBS.
2. Lack of knowledge in how much the safety progress in IBS cost and how it effects on the project budget.

### **1.3 Aim and Objectives of the Study**

The aim of this study is to provide a general perspective of safety cost in pre-cast concrete construction and its effect on project budget to help the engineers, contractors and the suppliers to have better understanding when they start a new project.

The specific objectives of this study are as follows:

1. To identify the requirements of the safety and health regulations in pre-cast concrete construction.
2. To identify the cost of complying the safety requirements in pre-cast concrete construction.

### **1.4 Scope and Limitations of the Study**

The scope of this study is focused on safety cost in IBS constructions specific in pre-cast concrete construction. The study is limited to the site safety in pre-cast concrete construction (installation stage) where the most of construction accidents happened and it the study area is Johor Bahru. The data collected in this study are mainly from the companies' safety manuals documents study, case studies, and interviews.

## **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.

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

## **1.6 Research Methodology**

The research methodology of this study is divided into four main stages as follows:

1. Identify problem and scopes of study.
2. Data collection via documents study, case studies, and interviews.
3. Analysis and results.
4. Conclusions and Recommendations.

Figure 1.2 shows the flow chart of the research methodology and the arrangement of the four stages of the over all work.

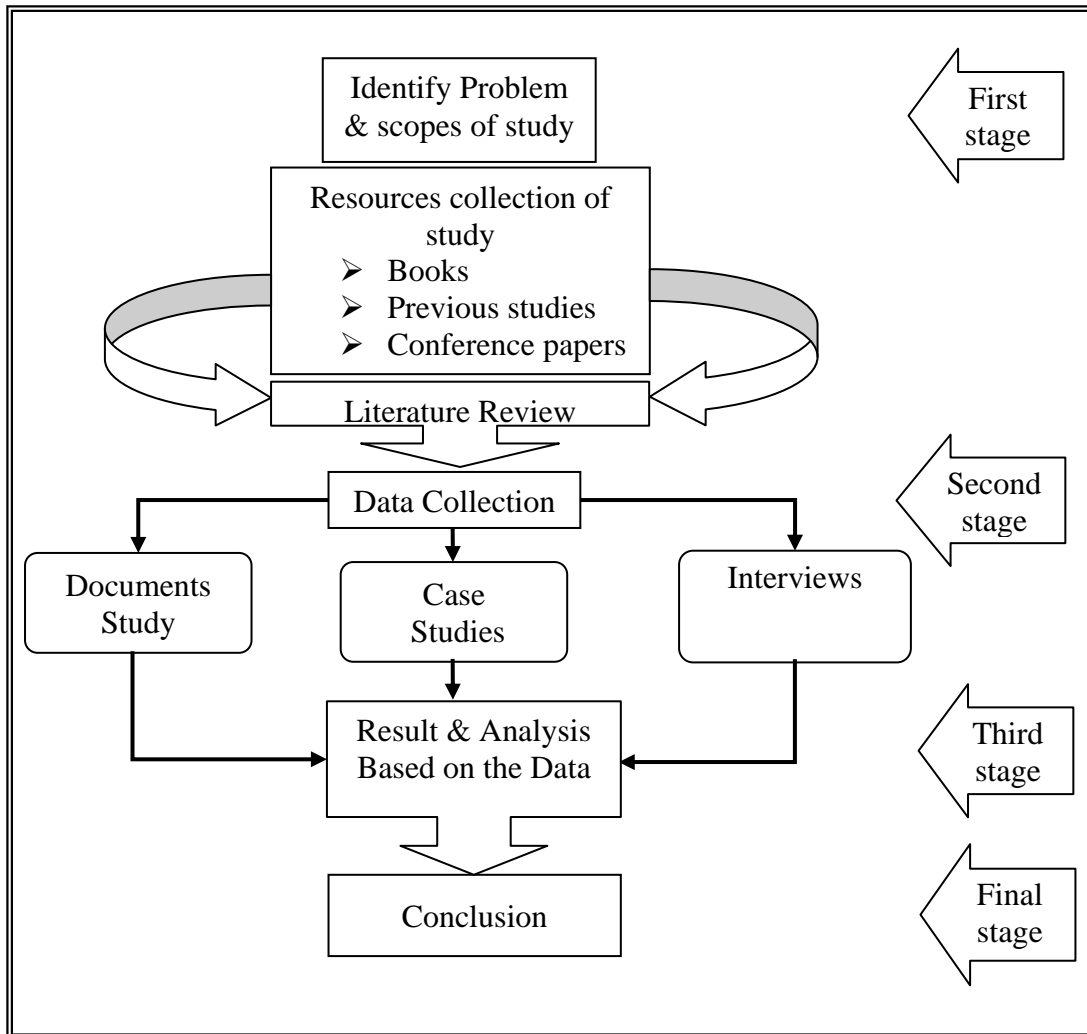


Figure 1.2 flow chart of the research methodology