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FORMATION FOR HOUSING CONSTRUCTION

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**SIMULATION OF INDUSTRIALISED BUILDING SYSTEM
FORMATION FOR HOUSING CONSTRUCTION**

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A project report submitted in partial fulfillment of the
requirements for the award of the Degree of
Master of Science (Construction Management)

**Faculty of Civil Engineering
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*To my beloved wife, my son,
All my family members,
My course-mates and friends.
..THANK YOU FOR EVERYTHING..*

*Special thank to my supervisors,
And everyone who had involved
in this study.*

*..MAY GOD BLESS ALL OF YOU..
Thank you*

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ABSTRACT

Industrialised Building System (IBS) is a construction method that offers economisation of design, site work and materials, provides shorter construction time, saving in labour, better quality control, immunity to weather changes and the most importantly, the cost factor. It has been proven successful in some countries such as Finland, Denmark, Netherlands, Singapore, England and the United States (CIDB, 1998). In our country Malaysia, the shorter construction time offered by IBS may seem to be the solution for the housing demand in Malaysia. The aim of this study is to determine the process flow of housing construction that are applying Industrialized Building System (IBS) components for its main structure. For that purpose, sequence process of installation activities for construction of IBS houses has been identified. Witness 2001 simulation software has been applied to model a construction of 300 IBS houses. The most achievable completion time has been examined and at the same time optimum resources for the construction has been identified during the simulation analysis. It is hoped that the widespread understanding on the Industrialised Building System (IBS) can further help to develop and promote IBS as an innovative construction method in Malaysia.

ABSTRAK

Sistem bangunan berindustri atau *Industrialised Building System (IBS)* merupakan satu kaedah pembinaan yang menawarkan rekabentuk, kerja-kerja tapak dan bahan-bahan pembinaan yang ekonomi, membekalkan tempoh pembinaan yang lebih singkat, menjimatkan dari segi tenaga kerja, menawarkan kualiti yang lebih baik, fleksibel dengan cuaca, dan yang paling penting adalah dari segi faktor kos pembinaan keseluruhannya. Penggunaan IBS telah terbukti amat berjaya di beberapa buah negara seperti Finland, Denmark, Belanda, Singapura England dan Amerika Syarikat (CIDB, 1998). Di negara kita Malaysia, kelebihan IBS yang menawarkan tempoh pembinaan yang lebih singkat seolah-olah menjadi penyelesaian kepada permintaan rumah yang semakin meningkat. Matlamat utama kajian ini adalah untuk mendapatkan suatu senarai proses kerja bagi membina 300 rumah teres dua tingkat yang mengaplikasikan komponen IBS untuk struktur utamanya. Untuk tujuan itu, susunan aktiviti-aktiviti yang lengkap dalam pemasangan komponen IBS telah diperolehi. Dengan menggunakan perisian simulasi *Witness 2001*, masa pembinaan yang terbaik yang mampu dicapai telah dikaji dan pada masa yang sama penggunaan sumber yang paling optimum untuk kerja pembinaan telah dikenalpasti. Diharapkan dengan bertambahnya pemahaman tentang pengaplikasian IBS, secara tidak langsung ia akan membantu dalam membangunkan dan mempromosikan IBS sebagai satu kaedah pembinaan yang sangat inovatif.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In the 7th Malaysia Plan, Malaysia planned to construct about 800,000 units of houses for its population which is 585,000 units or 73.1 per cent were planned for low and low medium cost houses. Nevertheless, the achievements are somewhat disappointing with only 20 per cent completed houses in this category despite numerous incentives and promotions to encourage housing developers to invest in such housing category (Kadir *et al.*, 2006). In the 8th Malaysia Plan, almost another 800,000 units of houses are planned to build but the result still unsatisfactory.

With the announcement of the 9th Malaysia Plan, the country continues to embark on the development of affordable and sustainable low and medium cost housing. However, the country is facing a difficult task to accomplish the target of 600,000 to 800,000 houses during this period because the conventional building system currently being practiced by the construction industry is unable to cope with the huge demand (Kadir *et al.*, 2006).

In essence, the demand for construction labour usage varies as the project progresses from structural work including basement construction, architectural and finishing work and mechanical and electrical (M&E) work. Furthermore, the proportion of foreign to local workers also differs considerably through these stages because of different skills required to accomplish the task. Currently, we can see that

our country's construction industry is still very comfortably using labour intensive and low technology methods of construction. The intensive use of foreign unskilled workers and low technology equipment and out-of-dated construction methods, has eventually caused low productivity and efficiency of work at construction site (Tay, 2006). As a result this has lead to unproductive practices and initially contributes to the late delivery of work.

The highly dependency on unskilled and cheap foreign workers has definitely contributed to low productivity of work, because although they may be cheap, but they are not efficient and cause high wastage. The quality of work has also been terribly affected due to unskilled working method. After completion defects, structural failures and design inadequacies are some of the tell-tale sign of the current construction scenario in our country. According to CIDB (2000), complaints made by consumers through national media and to the authorities are some of the numerous indications of low quality of work. At the end, these will lead to decreased quality of life in uncomfortable and unfriendly environments.

Therefore, according to those problems, the industry must find an alternative solution such as the industrialised building system (IBS) which has a lot of advantages in term of productivity, indoor quality, durability and cost. The introduction of the Industrialised Building System (IBS) with the promise of improving productivity rate, lowering construction costs and meeting the growing demand for affordable housing is indeed welcoming news to the country's construction industry (Richard, 2005). In other word, the awareness of current trends and latest construction technology and innovation is essential in order to survive in the competitive market.

1.1 Problems Statement

Although the long-introduced Industrialised Building System (IBS) has promised to solve and improved the current construction method and scenario in our country, but the IBS method has been low in gaining popularity, partly due to lack of awareness and coordination among the relevant parties. Currently, the level of usage of IBS method is very low as compared to the conventional methods in building construction (CIDB, 2005). In spite of its many benefits, the different perceptions among the construction players and practitioners towards its application in construction industry has led to the low usage of IBS components in the construction industry.

Dulaimi (1995) believe that considerable research efforts have been directed toward the “hardware elements” of the IBS technology which are concerned with the structure itself (the strength of the concrete and steel, the share forces, the bending moment of the structure members, etc) but to date, the “software elements” of the IBS, which are concerned with the data and information available on the system, users, clients, establishment of manufacturing and assembly layout and process, and allocation or resources and material, have received little attention. Therefore, there is a dire need to overcome the shortage in the “software elements” of the building system research (Badir, Kadir, and Hashim, 2002).

1.2 The Objective of the Study

The aim of this study is to determine the process flow of housing construction that are applying Industrialized Building System (IBS) components for its main structure. Accordingly, there are three specific objectives towards the main goal:

- (i) To identify the detail sequence activities of housing construction using IBS construction method.
- (ii) To examine the most achievable completion time for IBS housing

construction by using simulation software.

- (iii) To determine the optimum resource utilization such as tools, machineries and labours in IBS construction by using simulation software.

1.3 Scope of the Study

The scope of work is mainly focused on the installation of IBS components including footings, beams, slabs, columns, walls, toilets, stairs, roofs and fences. It is required for the construction of 300 units of double storey house. The installation process that will be highlighted in this study is starting from transporting IBS components to the site, lifting and delivery, assembly process, fixing and adjusting IBS components until finish the whole structure. Some assumptions that have been made in this study are the installation will not be interrupted due to any delay, machine breakdown, lack of labours and insufficient supply of IBS components from the supplier.

1.4 Significance of the Study

The study is attempted to propose a better alternative method for housing construction. As the construction industry now is facing the challenges of four aspects of time, cost, quality and safety, besides the demands of hundred thousands houses development in Ninth Malaysia Plan, it is vital to have a systematic system or method to be used in this industry. Therefore IBS used in double storey houses has been introduced.

Other than that, this study will be used as a guideline model for the developer or the contractor of IBS projects in the future to construct houses using IBS components with detail information especially on time and resources usage. Besides,

this study will show them on how to manage IBS construction method at site by considering the best sequence process whereby it will offer the optimum resources utilization with minimum construction time. Finally the idea gathered and simulation model produced from this study may help all parties involved in IBS construction to prevent unnecessary problems.

Yet, it is hoped that the widespread understanding on the Industrialised Building System (IBS) can further help to develop and promote IBS as an innovative construction method in Malaysia.

1.5 Methodology of the Study

This study consists of five stages towards the final aim as shown in figure 1.1. As far as the title of research is concerned, the main goal together with the objectives of this study has been identified as discussed in previous topic. Then the scope and limitation has been determined to concentrate on the aim of the study. Literature review has been taken place after all preliminaries stage has completed. The purpose of this stage is to strengthen the background knowledge of this study and moreover to achieve some of the objectives fixed in the early stage.

The climax of this study is on the collecting data and the discussion of findings stage. Detail description of procedures to collect data, findings and discussions has been made in chapter 3. Construction simulation approach has been used in this study to replicate the IBS construction of housing in real-time virtual modes. A final finding is to determine the optimum resources utilization in IBS construction by using simulation software. The study ended with conclusion and some recommendations to further develop the result of this research.

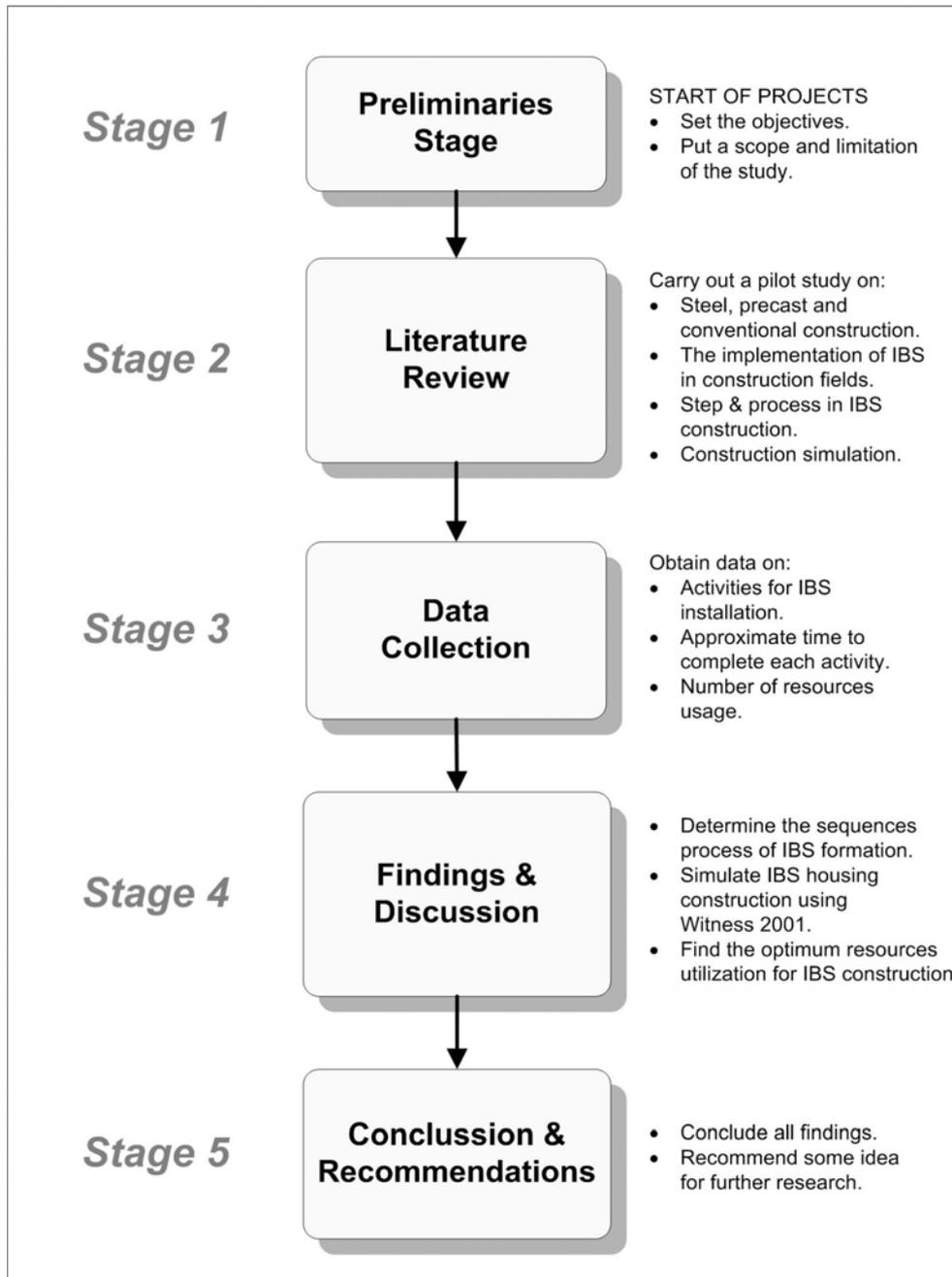


Figure 1.1: Methodology of the study

1.6 Summary

First chapter was explained to introduce and elaborate the background of this study for further understanding on the problems that has been solved. Such that issue on the long-introduced of Industrialised Building System (IBS) still has been low in attaining popularity in construction industry, partly due to lack of awareness and coordination among the relevant parties. By considering the demands of housing development and the need for construction industry to make changes, the introduction of the Industrialised Building System (IBS) with the promise of improving productivity rate, lowering construction costs and meeting the growing demand for affordable housing is definitely welcoming news to the industry. This study is prepared to provide some information of IBS technology that can be implemented by all parties in construction project. With the extensive knowledge on the Industrialised Building System (IBS) may further expand and promote IBS as an innovative construction method in Malaysia, at the same time prevent all the barriers to the adoption of IBS technology in construction Industry.