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ABSTRAK

Sistem Binaan Berindustri (*Industrialized Building Systems, IBS)* merupakan satu proses pembinaan yang menggunakan teknik, produk, komponen, atau system binaan yang melibatkan komponen pasang siap dan pemasangan komponen di tapak bina (IBS ROADMAP 2003-2010). IBS menawarkan banyak kelebihan seperti mengurangkan pembaziran bahan binaan, pengurangan pekerja kurang mahir dan pekerja asing, mengurangkan isipadu bahan binaan, dan lain-lain lagi. Konsep penggunaan IBS telah diperkenalkan di Malaysia selama lebih empat dekad yang lalu. Bagaimanapun ramai kontraktor masih lagi berdepan masalah dalam pengaplikasian kaedah ini. Oleh itu kajian ini dibuat untuk mengetahui tahap penggunaan IBS, untuk mengetahui proses tender yang terlibat, untuk mengenalpasti masalah yang dihadapi oleh pihak klien dan juga masalah yang dihadapi oleh pihak kontraktor. Kaedah pengumpulan data yang digunakan untuk kajian ini adalah melalui temuramah, soal selidik dan rekod pembinaan yang sediada. Kesemua data dianalisis dengan menggunakan kaedah indek purata. Hasil daripada data yang diperolehi, didapati perlaksanaan projek pembinaan menggunakan IBS adalah lebih rendah berbanding kaedah konvensional. Penilaian tender untuk projek IBS adalah sama dengan penilaian tender untuk projek pembinaan secara konvensional. Masalah utama yang dihadapi oleh pihak kontraktor adalah berkaitan dengan penggunaan mesin dan masalah utama yang dihadapi oleh pihak klien pula adalah berkaitan dengan rekabentuk dan lukisan untuk komponen IBS.

ABSTRACT

The Industrialized Building Systems (IBS) is a construction process that uses the technique, products, components, or systems which involves the construction and installation ready-to-install components in the construction site (IBS Roadmap 2003-2010). IBS offers many advantages such as reducing waste materials, reduction of less skilled workers and foreign workers, reducing the volume of construction materials, and others. The concept of the use of IBS has been introduced in Malaysia for more than four decades. However, many contractors are still doubtful of the application of this method. Therefore a study is carried out to investigate the level of IBS usage, to investigate the tender process, to identify the problem faced by client and the problem faced by the contractor. The data is collected through interviews, questionnaires and also from the existing record. The data is analyzed using average index. From the findings, the project using IBS is much lower from the project using conventional method. The tender evaluation for IBS project is similar to conventional project. The main problem faced by the contractor during construction stage is the usage of machineries and the main problems faced by the client during tendering and construction stage are on the design and drawing on IBS components.

TABLE OF CONTENTS

3 TENDER EVALUATION

LIST OF TABLE

LIST OF FIGURE

CHAPTER 1

INTRODUCTION

1.1 Introduction

The development of the construction industry is an important sector in economy of a country. The average estimated construction industry will contribute up to 5.8 per cent per annum of the gross domestic product (GDP) during the end of 9MP (2008-2010). The importance of this construction industry can be seen when a lot of mega projects like the Kuala Lumpur City Centre (KLCC), Kuala Lumpur International Airport (KLIA) and the Government Administrative Centre in Putrajaya has been successfully implemented. Construction activities and related is expected to increase and enhance the significant contribution to the country's economy.

Despites all these, a skills and new equipment includes a system was introduced, known As Industrialized Building System (IBS). This system has been introduced by the Construction Industry Development Board (CIDB) in collaboration with the government.

The system is seen as a system of efficient, affordable and comprehensive, and this made the construction industry more advanced and competitive. But now the use of IBS is still not encouraging in the construction industry. This can be seen as many contractors still use conventional methods to implement the project despite the many disadvantages of this method and gives impact to the environment. The government has promoting the use of IBS; this can be seen according to speech by Datuk Seri Najib bin Tun Abdul Razak in Malaysia IBS International Exhibition in

Construction Industry Development Board Malaysia (CIDB) Convention Centre in which he who gave the faith of IBS in the construction industry in Malaysia.

Reports from the CIDB shows the use of IBS in the industry construction in Malaysia is only at 15% in 2003 and construction were completed using IBS slightly decreased in 2006 to 10%. Of this decline, it refers to the high cost components of IBS and transportation problem is the root cause of this problem.

Application of IBS in this country is divided into five sections, namely, precast concrete systems; steel framing systems, the steel frame, timber framing system and work system blocks. Use these five components positively impact the construction industry while promoting the implementation of Green Building in Malaysia. Among the advantages of using IBS is decreasing waste materials, reduction of the workforce on site, reducing construction materials on site, better quality control, the site is clean and orderly, and faster construction time as well as better care for the environment clean and safe. This can be seen the use of IBS is an alternative in the construction industry rather than the conventional method.

1.2 Problem Statement

In Malaysia adaptation of IBS started about 20 years ago, but until now its use in this country is still lower than other developed countries. The Malaysian government has played a role in adopting this system through the projects that were planned through the RMK-9, particularly in the residential construction sector. Requests the Government of IBS-based construction has attracted the clients and contractors to switch from using conventional methods to this method

There are many opinions in stating the effective use of IBS in the construction industry today. There are many contractors who argue that the methods or systems are expensive and not economical. This can be seen when many of the contractors who do not want to switch from conventional methods to this system. However, there are also forward thinking contractors who are looking further into the effectiveness of use of this system that is seen to give much advantage to contractors. But in the meantime, there are several problems with the implementation of this

industrialised building system. Among the main problems are related to the procurement and tender evaluation method for this system.

Despite the tender evaluation process is a small part of the work in the pre-contract stage of a project, but the work is what gives the greatest impact of a development project. Bidders or contractors must be correctly selected and competent as the bidders will be responsible for completing the project until completion. The process of selection is important, also the evaluation, and the calling of tenders is must be carried out more systematic, structured and managed to deliver a more transparent tender evaluation can be achieved.

This study will be conducted to find out the problems related to the management and procurement tenders for IBS project. So, what are tender in the management of IBS? How IBS tender evaluation is being done? Is there a difference between the IBS tender and conventional tender's project? Is there a difference in the content of tender documents in both conventional and IBS? What are the problems that arise in the management of IBS tender? Therefore, a study carried out to identify problems related to IBS components based on the objectives below:

1.3 Aim and Objectives of Study

The main aim of this study is to determine the comparison of the construction project in IBS and conventional, and problems that arise in the application of the IBS method. To achieve this aim, these objectives will be implemented:

i. To examine the level of use of IBS in the construction industry and the comparison with conventional methods.
ii. To review the contents of tender documents and tender evaluation in construction projects based on IBS
iii. To identify the problems faced by the client in the IBS-based construction project management
iv. To identify the problems faced by the contractors in the construction phase for construction projects based on IBS

1.4 Scope of Study

The researches were limited to construction project in Kuantan, Pahang and the researches include construction projects, built in 2011 alone. The building involved is under the Kuantan Municipal Council. The study also only touched the tender management factors in the use of IBS components in construction projects.

1.5 Significance of Study

Significance of this study are as follows:

i. To understand the various aspects of the IBS system that to be developed and widely used
ii. To provide an understanding of relevant information and documents related to tender for work on IBS
iii. To help promote the IBS technology in the construction industry in Malaysia

CHAPTER 2

INDUSTRIALISED BUILDING SYSTEM (IBS)

2.1 Introduction

An earlier study in research is a fundamental strength for the study was carried out and completed. The survey covers all basic knowledge necessary to carry out research. In the literature review itself there are many formulations of the research problems. This chapter describes relevant literature review made the cover of subtopics discuss matters related to Industrialised Building System (IBS) and how the tender evaluation and the cost of a project IBS system in housing construction projects.

As we can see now, the development of construction industry in Malaysia is rapidly developing. The level of demand for housing projects is also increased with the increasing of population. Therefore, the government has made a determination of all construction projects, including the housing projects that using IBS system. This is because the system is viewed more favorable than conventional methods. To ensure the smooth functioning of a construction project of course requires management or a better procedure and planned. Affairs related to the construction project are subject to agreement between the customer and the contractor. Selection and appointment of contractors to carry out construction work or work of this contract is made through the system called the tender system. Tender for the work of

IBS is based on some predetermined criteria and the determination of cost-related price per IBS components is also different from conventional methods.

2.2 Definition of IBS

The definition of the meaning of IBS has been adopted even though it is different for each of researchers in each of their previous studies. However, it is a member of more or less the same purpose as lead to a system of easy, fast and simple. According to Rahman and Omar (2006), has defined IBS as a system built construction component-based prefabrication made to manufacture. Making all these components are made with a systematic and orderly manner using machines, molds and mechanical equipment parts. Components made in a factory should be set according to the specifications to avoid problems during the installation process and implementation. D.N Trika (1999) is IBS has been defined as a system where the components of concrete prefabrication construction sites or in factories can be installed or adopted as a structure to minimize construction site (in situ construction). All of the above definition is pointed out that IBS is a prefabrication components produced by plants using specific techniques specifications set by the standards. Among the features of IBS constructions are:

a) The industrial production of building components in situ through the process prefabrication using a special machine
b) Reduction of the use of labor.
c) Use of modern methods in the design and manufacturing process software such as the use of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM).
d) The concept of open building with the use of Modular Coordination (MC)
e) A systematic quality control such as ISO 9000

2.3 Classification of IBS

Construction Industry Development Board, CIDB is a party responsible for classifying IBS. IBS is classified to 5 parts namely:

2.3.1 System of pre-cast concrete frame, panel and box system

Collection of commonly used IBS which are; pre-cast concrete including for columns, beams, walls, slabs, 3D component (stairs, balconies, toilets and lifts passages). Pre-cast concrete is soft and the concrete mold is thick.

2.3.2 Steel framing system

IBS Group which is considered the lowest prefabrication level since it involves pouring concrete at the construction site. Among the components that fall into this category is the tunnel form, tilt-up system, beam and column molds and permanent steel mold (metal Decks).

2.3.3 The steel frame system

This system is often used in conjunction with pre-cast concrete slabs. Columns and steel beams used most often in high-rise building. Recent advances involving the use of components made of yarn and cold form steel portal frame system as an alternative to the use of hot rolled expensive and heavy system.

2.3.4 Timber framing system

The system uses wood as a component in the building structure. The products that fall into this category are wooden frames and roof trusses.

2.3.5 Block work system

The use of new technology replaces conventional bricks has resulted in the use of interlocking concrete masonry unit (CMU) and through this new method it can accelerate and shorten the duration of construction work.

2.4 Advantages of IBS

Adaptation to the use of IBS in the construction industry is seen to provide many advantages. Advantages of IBS are:

2.4.1 The project completion time is shorter.

A completion of the project will be done faster and shorter. This is because all IBS components are made in factories compared with in-situ construction. The production work of structure is done in the factory while the installation work will be done on site.

2.4.2 Quality of construction work.

The products were produced at the plant will be controlled according to the specifications established and this will produce a quality product also can directly minimize the waste of materials.

2.4.3 Reduction of the use of labor.

The work on the site can be reduced and thus helping to reduce the use of labor. High labor utilization will increase costs and reduce the level of safety.

2.4.4 The construction cost is more economical.

Use of materials such as steel and aluminum as a mold for each member of the building structure can be used over and over again and this will cut the cost of a project.

2.4.5 Reduction of construction materials on site.

Building materials can be used at its optimum level due to the use of machines for the production of IBS components that have been made in the factory and continue to be installed on site. Reduction of construction materials on site will make the site more neat and organized.

2.4.6 Improve safety on site.

Improve the safety of construction site by maintain the cleanliness, orderly and neat due to the reduction of building materials, construction workers, and waste and provide more security for workers on site.

2.5 Weaknesses of the use of IBS

Although IBS is seen as a method which has significant advantages but it also has some disadvantages in different contexts. IBS usage weaknesses identified is as follows:

a) Skilled workers needed in the construction site.
b) Require additional costs to train semi-skilled workers to doing a job that requires high skills.
c) Lack of experience in which certain types of construction labor
d) IBS still new in Malaysia.
e) IBS is only suitable for multi-storey buildings that have the same pattern as three to five storeys.
f) Approaches and different prefabricated construction practices between each of the manufacturers and users in the design and construction of prefabricated construction method of its own.
g) Poor management information between the parties – which are involved in the construction industry.
h) Weaknesses in the integration and coordination of good practice in IBS.
i) High capital intensive.

2.6 The development of IBS in Malaysia

IBS in Malaysia began in the early 60's when the Ministry of Housing and Local Government (ministry) visited several foreign countries and to assess of their development program. After this visit, the ministry see their success is the result of very extensive use of IBS are increase and the rapid progress of their country, especially in the construction. The government has embarked on their first pilot project based on the use of IBS is aimed at producing good quality housing with a short construction period. Their first project was built on of land measuring 7.22 acres along the Circular Road, Kuala Lumpur, which includes construction of 7 blocks of 17 storey flats, 3000 units of low-cost flats and 40 shops. This project was awarded by Gammon / Larsen Nielsen using the Danish System of prefabricated panel system (CIDB, 2003b).

After the first project is successful, the next government to make use of IBS as an alternative to conventional methods. This can be seen many projects have been implemented using this system like the construction of Riffle Range Road, Bangkok which includes construction of six 17-storey block of flats and 3 storey block of 18 flats. In the year 1981-1993, the Selangor State Development Corporation (PKNS), through Praton Germany Haus International has been using precast concrete technology on low-cost housing projects and high cost of housing in the state. The use of structural steel which is part of IBS components are also used by the contractor Takenaka Corporation of Japan where they have succeeded in building and completing the construction of 36 storey Dayabumi Complex. Towards the use of other components of IBS was also applied in the national projects such as the use of steel frames used in the construction of national centers such as the Bukit Jalil National Stadium, the Light Rail System (LRT) and the Petronas Twin Towers.

Can be seen today use this system have a place in the construction industry in Malaysia. Many private sector have their own expertise of experts from outside the country such as Australia, the Netherlands, the United States and Japan. Proved that local products based on traditional materials such as reinforced concrete, it is fundamental to today's technology. As a mechanism to ensure that adopted IBS, a standard of manufacturing process to be removed. Components that are made must be approved and manufactured to be certified before it is used to avoid anything that

goes wrong. The CIDB and the government as the body responsible for ensuring that the use of this system is fully applied in all construction projects. Thus qualified contractors to pursue courses offered by CIDB to qualify them to carry out the construction using this system. The table below shows the grades and specialist contractors who are registered as contractors under the CIDB's IBS.

Table 2.1: The contractor is registered in Malaysia IBS, Grade (B01, B02, B12, B15, B19) 2007

NO	GRADE	SPECIALTY	TOTAL
1	B01	Building work and pre-cast	28
2	B02	Building work and Steel Work	516
3	B12	Alluminium, Glass and Steel Work	232
4	B15	Roof and cladding	108
5	B19	Formwork	11
		GRAND TOTAL	895

Table 2.2: IBS Contractor (active) in Malaysia by CIDB (2007)

GRADE	TOTAL
G7	334
G6	52
G5	83
G4	42
G3	191
G2	76
G1	71
GRAND TOTAL	849

2.7 Barriers Against Adaptation of IBS in Malaysia

In general, the advantages offered in the application of IBS are very reasonable and positive impact in the construction industry. Nevertheless the low level of achievement of adaptation and implementation of IBS in Malaysia, barriers to implementation of the Roadmap. Among the barriers identified in the Steering Committee Meeting in early 2006 (IBS Steering Committee 2006) are:

1. Lack of encouragement from the government's efforts for industrialization and globalization of the construction sector.
2. High cost of IBS components in which all manufacturing technology is imported from outside.
3. Knowledge management and installation of IBS less among employees, contractors, designers and clients.
4. Low standard I solution component design-related problems.
5. There is no central R & D (research & development) for IBS.
6. No specific source of expertise in IBS.
7. There is no specific system in product certification, production and installation of IBS.
8. Lack of coordination and cooperation between the parties involved in the construction industry as the client, contractors and owners in the use of IBS in a project.

2.8 Encourage the use of measures of IBS in Malaysia

After identifying the barriers to the construction industry, the various measures taken to realize the use of IBS in this country. Various agencies and institutions are making efforts to promote IBS in Malaysia including the Construction Industry Development Corporation Malaysia (CIDB) and the Ministry of Housing and Local Government (ministry).

2.8.1 The Construction Industry Development Corporation Malaysia (CIDB)

CIDB was established in 1994 has been entrusted to carry out large-scale promotion of the IBS Roadmap 2003-2010.Pihak Ministry of Works has been working on this document tabled at the Cabinet on October 29, 2003. IBS Roadmap 2003-2010 has been approved by Cabinet to serve as the plan document in full for industrialization of the Malaysian construction sector. It will be a reference for all parties in the implementation of programs that can lead to the modernization of the Malaysian construction sector based IBS. Implementation of the IBS Roadmap is guided, monitored and coordinated by a national committee called the IBS Steering Committee has representation from all sectors in the construction industry to ensure that the IBS program being carried out properly and regularly. Working groups for each category was also established to draft the Roadmap and also ensure that programs and fully completed quest for industrialization of the Malaysian construction sector by 2010. This roadmap to a formula based on 5-M strategy (Manpower, Material, Components-Machines, Management-Processes, Methods, Monetary and Marketing).

2.9 Roadmap 2003-2010

IBS Roadmap 2003-2010 is a plan that was discussed and agreed at the national level through the IBS Steering Committee and Working Groups organized by CIDB Malaysia where its members are represented by the government, developers, manufacturers, contractors, professional bodies, higher education institutions, associations and other parties interested in the construction industry. IBS Steering Committee and Working Groups have produced IBS Roadmap 2003-2010 and will also ensure that the program will be implemented to realize the amount of industrial construction industry in Malaysia in 2010. Coordination of Strategic Plan 1999 to develop IBS strategies which include manpower, materials, components, machinery, management, processes, methods, financial (economic or financial) marketing and promotion. "Roadmap" was presented by the Ministers of the Cabinet as a plan to industrialize the construction sector and achieve the "Open Building" in 2010.

2.10 The Policy Use of IBS

Based on the rationale and the research contained in the Roadmap 2003 - 2010 Government, some resolution to serve as a guideline in the use of IBS building projects have been formulated:

a) Enforce the use of IBS in government building projects in stages from 40% (40 projects from the government is using the IBS 100 projects the Government) in 2005 to 70% in the year 2008 onwards up to 90% in the year 2010 as shown in the table below: -

YEAR	2005	2006	2007	2008	2009	2010
%	40	50	60	70	80	90

b) IBS Score expanding content and the use of MC (Modular Coordination) in the building project to achieve a minimum score of 50% starting from 2005. Reference books issued under the CIDB may be used as a guide: -
   i. Manual for IBS Content Scoring System (IBS SCORE)
   ii. Modular Design Guide

2.11 Modular Coordination

Modular Coordination (MC) is an international system that has standardize size (dimensional standardasion) in the building. Based on ISO Standard, Modular Coordination MS1064 standard was created to introduce a certain geometric discipline through a practical and relevant way to adjust the position and size of components and the gaps in the design of the building. ISO standards and national standards has decided that the basic module M = 100mm as the basic unit of measurement for use in modular coordination. All sizes are multiples of M. modular.

Modular coordination has been recognized internationally as a tool to adjust the position and size of components and the gaps in the design of the building. This can be achieved through the following ways: