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Implementation of Blockwork System in Malaysia

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Abstract

Industrialised Building System or IBS is a method to accelerate the process of construction through prefabricated concept where each component will be built first in the component manufacturing plant. There are six categories of IBS introduced by CIDB and one of them is a system block work. The block system has several types of components under this category include the interlocking block-concrete masonry unit (CMU) and lightweight concrete blocks. Block work system introduced to replace the use of conventional bricks to accelerate the construction process and reduce construction costs. However, acceptance of the system to be less favorable than the use of conventional bricks. Statistics show there are only 31 manufacturer across Malaysia. Therefore, this study aims to identify the extent of implementation of the system of block work in Malaysia to contribute in the construction sector. This study used qualitative methods, namely through interviews and focus groups. The findings revealed that there are differences between the application methods IBS system block and conventional brick in terms of type of work performed, the number of working days and the cost of construction. Implementation of the system blocks are also influenced by three factors: the skills of workers, quality of components and component types in use. With a wide exposure is expected to expand the implementation of the system blocks in Malaysia.

Keywords: Industrialised Building System; block work system; brick; Construction Industry Development Board; Concrete Masonry Unit

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1. Introduction

The economic sector in Malaysia continues to grow in the quest for a developed nation. The first quarter report of 2016, the Malaysian economy has recorded a growth of 4.2% in the first quarter of 2016 (4Q 2015: 4.5%). This modest growth largely reflects the external rise to the economy and the prudent spending of the private sector [1]. This has indirectly increased Malaysia's gross domestic product (GDP). Figure 1 shows GDP from

the construction sector increased to RM12,558 million in the first quarter of 2016 from RM11,992 million in the fourth quarter of 2015 [2]. Looking at this development scenario, it is clear that the construction sector continues to grow rapidly and will contribute to national income. One of the key factors in the development of the construction sector in Malaysia is due to foreign investment and new infrastructure projects that have stimulated development for commercial and residential real estate [3].

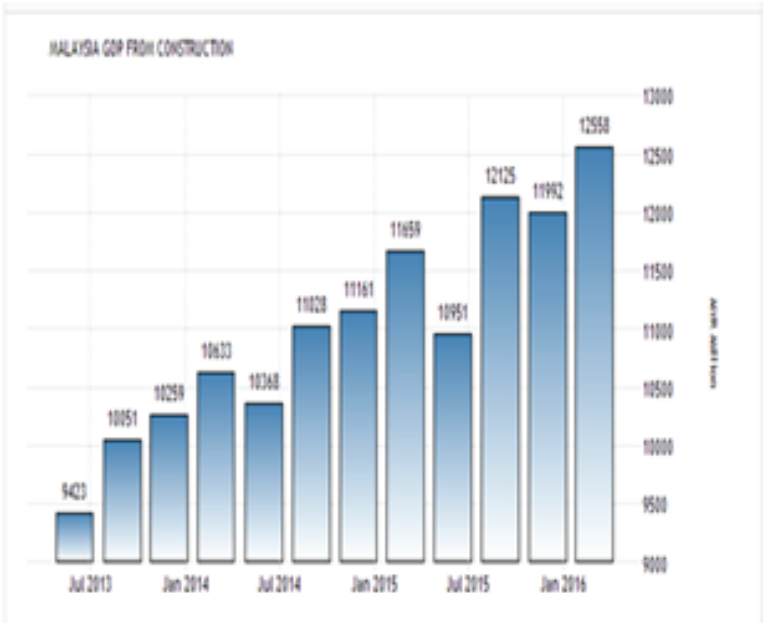

Figure 1: FKDNK construction sector [a] (Source : Jabatan Statistik Malaysia (2016)).

The use of modern technology and methods such as Building Information Modeling (BIM) and Industrialised Building System (IBS) is important in improving the efficiency of construction projects [4]. The revolution of the construction system, especially the use of the Industrialised Building System (IBS), has started in Malaysia since the 1960s. The first project using this system in Malaysia was a circular road house project in 1964 and the second project was housing on the island of penang [5]. To disseminate this use, the government has taken its own initiative. Through bill circular. 7 (2008) states that it is necessary to improve IBS content for each government project at a level of not less than 70% [6]. Under this policy, there are 9,423 Industrialised Building System (IBS) contractors in Malaysia in 2016. Of these, only 74 contractors are implementing the project and the rest is a registered management contractor with CIDB [7].

This system is a comprehensive solution to improve performance in the construction industry sector in terms of labor, cost, quality and maintenance. According to [8], the construction industry encompasses sectors that plan, design, conserve, demolish and repair various types of buildings as well as all types of civil engineering, mechanical and

other fields of engagement involved. The construction industry is an important economic measure of government management. [9] also refer to the construction industry as potential job makers. The government is advised to allocate more expenditure in the construction industry to stimulate private sector investment.

According to [10] explains that industrial processes are an investment in equipment, facilities, and technologies with the objective of maximizing production, reducing labor resources, and improving quality while building systems are defined as a set of mutual elements that together to enable the performance of the building. [11] states in his study that the IBS system is a system or method of construction in which its components are manufactured in controlled condition (at the factory or at the site of construction), transported and installed in construction work by employing minimum site workers. [12] states that the IBS methodology in the construction industry is very important to see its use in Malaysia in the private sector. Assessment of the existence of IBS methodology, helps major players in the construction industry understand the concepts of various aspects of IBS to be developed and widely used. The application of Industrialised Building System (IBS) is beneficial to the Industrialised Builder System (IBS) practitioners. According to [13], the IBS method also reduces the wastage of construction materials and minimizes the storage space of building materials at the site. [14] stressed that IBS was the start of leveraging on the carpentry work for every aspect of construction for systems utilizing manufacturing production to reduce waste resources and increase value for end users.

In Malaysia, there are six categories of Industrialised Building System (IBS) under the Malaysian Construction Industry Development Board (CIDB), namely 'Pre-cast Concrete', 'Reusable Formwork System', 'Steel Framing System', 'Prefabricated Timber Framing System' 'Block work System' and 'Innovative System' [15].

Blockwork system which is an evolution of the use of conventional brick [16]. Block-work system is a construction of concrete or concrete blocks larger than standard clay or concrete bricks. The block system is to make them lighter and easier to work with they have hollow cores that also increase their insulation capacity [17]. The block system consists of 'lightweight block', 'concrete masonry block'. CMU blocks are used to build load-bearing wall pile and wall components. While light blocks are used to build walls. There are two types of light blocks, namely 'Autoclaved Aerated Concrete' (AAC) and 'Cellulose Lightweight Concrete' (CLC) [6].

Block concrete brick units are rectangular made of concrete with hollow cores. It is manufactured in an automated manufacturing process consisting of mixing materials, laying the material in the mold and then transferring the unit to the curing operation

[18]. Block categories are somewhat synonymous with brick-based methods but their sizes are adapted from ”Guide To Modular Coordination In Buildings” (MS1064: part 8 co-ordinating sizes and preferred sizes for masonry bricks and blocks). Tables 1 and 2 show the difference in brick size and block [19].

Table 1: Dimension of brick [a].

Length (mm)	Height (mm)	Wide (mm)
190	90	90
290	90	90

Table 2: Dimension of block [b].

Length (mm)	Height (mm)	Wide (mm)
290	190	90
290	190	140
390	190	90
390	190	140
390	190	190

The use of block work systems is different from conventional bricks because they do not use mortar in the process of binding bricks. The blocks are different from conventional bricks as they do not require mortar for brick application work. The amount of rats used was calculated and determined to be less than 7.5% of the mortar used in conventional stones [20]. The Block System is a type of IBS based on pre-cast concrete technology. The system includes hollow, interlaced and foaming pre-cast concrete blocks. Because of its small size if compared relative to other IBS components, it also allows installation to be done easily without the use of a lot of manpower and machines. This shows that it can be easily managed and has a high degree of tolerance.

Statistics in 2016 show that 31 companies in Malaysia have been registered under CIDB to use and implement block work systems [21]. Figure 2 shows the distribution of IBS block manufacturers in Malaysia. Therefore, this article will discuss the implementation of the IBS block work system in Malaysia to see the application of this system to be widely implemented by industry players and the acceptance of the consumer.

2. Methodology

In this study, the research method used is a literature review to see the progress of the block work system to ensure that the studies conducted have the correct basic information through previous studies.

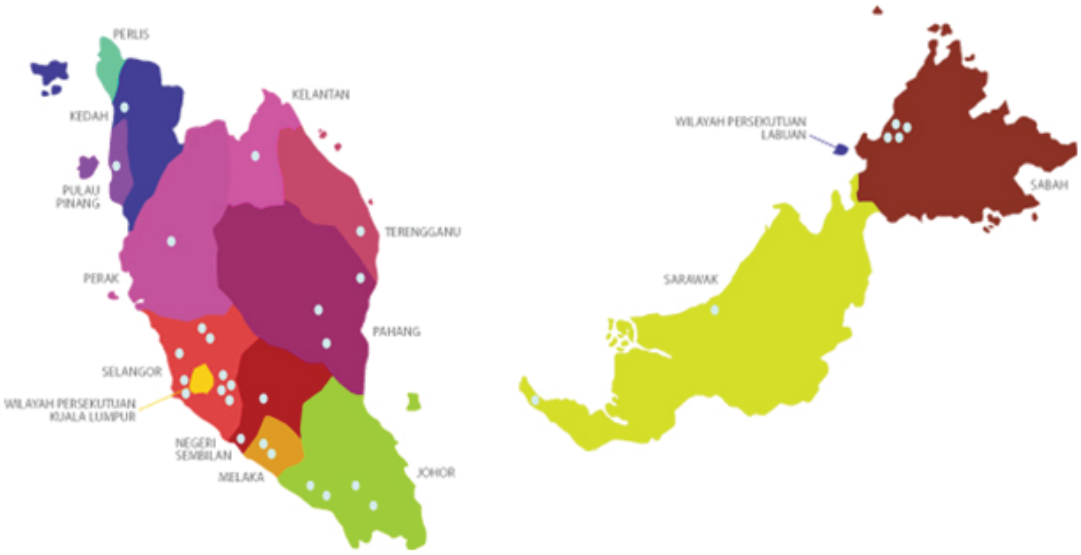

Figure 2: Distribution of block manufacturers in Malaysia, 2016.

This study also uses qualitative methods in the form of interviews. Interviews were conducted against IBS block contractors and conventional brick contractors. All the result from interview and focus group analised using content analysys. The results of the study were discussed through a focus group method to validate the results of the study so that it could benefit the players in the construction industry. A total of 14 panels comprising academics, engineers, IBS block manufacturers and CIDB officials were involved in this discussion (Table 3).

The focus group discussions have been conducted to discuss current issues regarding the implementation of the IBS block work system in Malaysia in ensuring that this system is more widely embraced by industry players and users.

3. Discussion

The study of the application of the block system in Malaysia is to see the extent of the acceptance of this system from industry players and users in replacing the use of conventional bricks. Comparison of conventional and block system applications is selected to see the difference. The results show that there are five types of block system components used in Malaysia namely Interlocking Block, Hollow Block, Autoclaved Aerated Concrete (AAC), Cellulose Lightweight Concrete (CLC) and Interlocking Soil Block / Brick.

TABLE 3: Profile respondent.

POSITION	EXPERIENCE IN BLOCKWORK SYSTEM
Project Manager	12 Year
Manufacturer	12 Year
Manager	6 Year
Manager	> 20 Year
Engineer	> 10 Year
Contractor	> 10 Year
Technical Director	> 5 Year
Engineer	> 10 Year
Engineer	> 10 Year
Engineer	> 10 Year
Lecturer	5 Year
Lecturer	8 Year
CIDB Officer	> 5 Year
CIDB Officer	> 5 Year

Based on the interview data coded from IBS and conventional block installation contractors, analysis findings show that there are differences between several aspects of installation application for both methods used. From the analysis, there are three important aspects identified as differences in the implementation of IBS and conventional block methods ie the type of work performed, the number of working days and the cost of construction. This average difference only involves a section called 'super structure' ie from the walls to the roof only.

Table 4 shows the different types of work done and the number of working days according to the type of work carried out for the 100sft area. Using the block work system as one of method for construction, there a few work of construction will not do it like conventional method for construction. Process for build column and upper beam will be skip in building process because interlocking block are built as a load bearing wall. The block will use as column and beam in construction. Using the interlocking block as component for building, super structure work will reduce the time of construction work. Meanwhile, the difference in cost of construction is seen from the two identified difference factors i.e. reduction of wages by number of working days and building materials. Construction workers will be paid a wage according to the number of days they work on a construction site where the use of modern construction methods can speed up the construction process.

This is because some of the construction works are carried out by different workforce that operate in factory conditions [22]. Reduction of building materials as IBS blocks are mostly motar less concepts. The reduction in the use of cement and sand in the IBS block installation process compared to conventional methods has saved the cost of construction for each project.

In addition, interview findings on respondents identified several advantages in implementing block work systems as shown in Figure 3. The results of interview findings show that three factors that are the issues in implementing block work system in Malaysia are block product quality, employee skills and type Components. This three factors are the most important in manufacturing the component. Every manufacturer must focus on quality of product from their factory for make sure to get customers trust. For make sure the quality of product in the best production, employee skills are needed as a controller for produce the component in a best quality. Besides that, type of component become as one of factor to make sure the implementation of block work in Malaysia. Every contractor must know about block work system and all the type of component in block work system. Knowledge about block work system is one of important thing to make sure the building to build are suitable with component are use. The frequency of this relationship also attempts to explain the basic measurement of the implementation relationship for the widespread dissemination of this block work system.

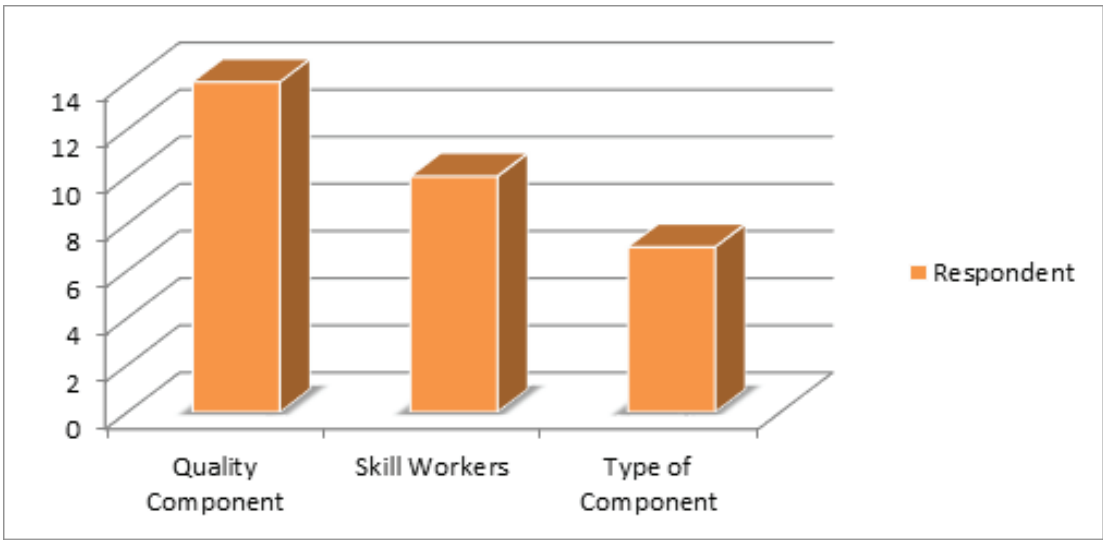

Figure 3: Frequency of block work system implementation.

Table 4: Comparison of conventional methods and IBS blocks.

	Convesional		Blockwork	
Item	**Work**	**Day**	**Work**	**Day**
Column	Steel Bar	1		
	Form work	x	x	
	Concrete	1	x	x
Beam Truss	Support	1	x	x
	Form work	2	x	x
	Steel Bar	1	x	x
	Concrete	1	x	x
Wall	Wall	7	Wall	10
	Plastering	4	Column	
			Roof Beam	
			Finishing	2
Roof	Roof Truss	2	Roof Truss	2
	Roof	2	Roof	2
Total		**22**		**16**

4. Focus Group

The findings of the study also produced through discussions in the form of focus groups. The focus group discussion was attended by 14 panel members comprising academics (2), engineers (4), IBS block manufacturers (6) and CIDB officers (2). All the respondents have the experienced of IBS blockwork manufacturing for more than 5 years. The focus group was conducted at Shah Alam Selangor and running from 9.00 am until 1.00 pm with a varied combination of questionnaires, discussion and plenary feedback. The results of interviews show that there are several advantages in implementing and implementing block work systems in the construction process in Malaysia. The findings of the focus group discussions discuss the necessary and important criteria in implementing the block work system as follows. The results of the interviews show that there are three factors to implement the block work system in Malaysia discussed below.

- Usages such as Autoclaved Aerated Concrete (AAC) as well as lightweight and foaming concrete as well as concrete-related blocks as load-bearing structures are increasingly being used as it can accelerate construction and save costs [23]. However, component quality has become a major issue in the implementation of the block work system in Malaysia. This is because many users assume that the use of IBS blocks is of no quality because IBS block components are light and hollow. Less exposure is a contributing factor in educating the public to switch

using the block work system. This factor causes the use of block work system to be at a minimum in every state in Malaysia.

- Analysis of interview findings suggest that block system usage is simple and requires only semi-skilled workers to build walls. The use of blocks for building walls is faster and requires less skilled labor. Discussion discusses the use of block systems is easy and easy to handle in the construction process. Installation mainly involves intersecting blocks or interlocking blocks is easier by using the correct technique than conventional brick use. Hard work put bricks, more so as a tendency by using bigger and heavier bricks, turns into a job that does not require any hard manual work anymore [24]. However, the skills of the workers are seen as necessary in the construction of this block system. This is because the arrangement of each block needs to be done accurately and straight to avoid any built-in walls that will bend and will impact such fractures and collapse in the future. Skilled workers need to be provided by training institutes such as the Academy of Building Malaysia to help expand the use of this block system. This can directly reduce foreign workers when this skill is applied to Malaysians especially. It is in line with the goal of the Industrialised Building System (IBS) itself to reduce dependency on foreign labor.
- The third factor is the type of component used in a construction project. The correct component selection is important to ensure the construction is quality and safe for occupancy. For component selection block work system it is important to make sure it is suitable for use and does not require additional work. Most contractors do not have the skills in block work and this will cause water penetration on the walls. This is a factor of rejection of use of block work system.

In addition, the focus group analysis discussion also adds to the block system implementation factor in terms of design before the construction process. The use of block work system is based on Modular coordination where each project design with M & E drawing needs to be done at startup stage. This method reduces the error during the construction process. However, knowledge of the contractors on this matter is limited and makes it difficult for them to use the method of block work in Malaysia.

5. Conclusion

In a view of implementation of block work system in Malaysia, there a few thing should we focus in order to increase of using block work system in construction for all building.

Knowledge about block work system need to separate to all contractor and customer to make sure they known about the advantages using block work system compared to conventional brick. In this research we found three factor as a key factor to increase the number of using block work system in Malaysia. In order to increase of players using block work system, every manufacturer must be increase their quality of product. Besides that, employee skill must be develop time to time for good future using block work system.

Overall, this block system can provide a good impact in the construction sector although it is still at a moderate level in Malaysia. The implementation of the block system requires the skills of the workers who wish to carry out the installation process in ensuring the quality of the construction is ensured. This is seen to have a strong influence in practicing block systems. With the initiatives given by the government in developing the Industrialised Building System (IBS), especially in the block system through institutes such as the Malaysian Academy of Sciences, it can disseminate the use of the block system and produce skilled workers in Malaysia in a move to reduce the dependence of foreign workers.

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