

## Analysis Building Maintenance Factors For IBS Precast Concrete System: A Review

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### ABSTRACT

Since 1960's, Malaysia construction industry had getting utilized Industrialized Building System (IBS) in some of the project. The most two earlier building which using IBS was Pekeliling Flat in Kuala Lumpur and Rifle Range Flat in Penang. Consequently, following the year after 1960's there are lots of construction development in Malaysia using IBS system in most of the low cost high rise residential building. With the aim to reduce the number of the unskilled foreign labor, Malaysia had encouraged local contractor to used the IBS system. Unfortunately, there are lots of problem in maintenance which affected the building quality and operation when a building was built using the IBS system. Thus, factor which will affect the quality of the IBS precast building should be identify in order to produce a better quality and operation of the IBS building. This particular study will fully focus in low practicing of the civil and construction criteria for precast concrete in IBS building. This two particular main criteria will be seriously analysis and find out the factor which will create the building maintenance issues. This study is importantly to find out the factor which leads to building maintenance in civil and construction for IBS precast building. Eventually from the analysis, hopefully the factor affecting the quality of the IBS precast building will be identify and a good propose of solution which can increase the quality and operation of the IBS building.

**Keywords-Industrialized building system (IBS), precast concrete, civil and construction**

### 1.0 INTRODUCTION

In Malaysia, construction is one of the most important sector which contribute to our country economic. At the same time, construction industry had provided about 800,000 job opportunities. Unfortunately this had cause most of the local contractor had used the foreign labor to overcome the problem of the shortage of workers. Hence, the number of foreign labor increase year by year. The total number of the foreign labor was stands at 552,000 out of 800,000 which was registered under

CIDB in 2007 (CIDB, 2010). This number had revealed that the high population of foreign labor might create social problem for country of Malaysia.

To reduced the number of the foreign labor, government had take many alternative to decrease the dependency of the foreign labor. One of the way to reduce the dependency of the foreign labor was using the Industrialized Building System which known as IBS in our Malaysia construction industry. They are few types of IBS system in Malaysia and this included precast concrete frame, panel and box systems, steel formwork systems, steel frame systems, prefabricated timber systems and block work systems. There are lots of government project implemented using IBS method and Serdang Hospital at Selangor and Teachers Quarters at Negeri Sembilan was the two successful example using IBS in Malaysia construction industry (Diah, 2009).

### 2.0 PERCENTAGE OF FOREIGN LABOR BASED ON STATES

Table 1: Percentage foreign labor in Malaysia

States in Malaysia	Average %
Selangor	97
Wilayah Persekutuan Kuala Lumpur	95
Melaka	86
Pahang	76
Johor	73
Negeri Sembilan	62
Pulau Pinang	52
Sabah	48
Perak	48
Kedah	36
Terengganu	24
Kelantan	17
Perlis	13
Sarawak	6
Average per state	52

Source: Malaysia International IBS Exhibition 2009

### 3.0 REGISTRATION OF IBS MANUFACTURER AND PRODUCTS IN “ORANGE BOOK”

Table 2: IBS manufacturer and product in Malaysia

N O	TYPES OF IBS	MANUFACTURER	PRODUCT
1	Precast Concrete System	39	249
2	Formwork System	23	29
3	Steel Frame System	27	45
4	Timber Frame System	21	21
5	Blockwork System	9	11
	<b>Total</b>	119	355

### 4.0 REGISTERED IBS CONTRACTOR(ACTIVE) IN MALAYSIA BY CIDB GRADE (2007)

Table 2: Statistic number of contractor in Malaysia

GREED	NUMBERS
G7	334
G6	52
G5	83
G4	42
G3	191
G2	76
G1	71
<b>TOTAL</b>	<b>849</b>

Source: Construction Industry Development Board(CIDB) Malaysia

### 5.0 IBS DEFINITION

In Malaysia ,there had different definition for IBS from different author. (Abdulah,2009). IBS can be classified as using pre-fabricated components to construct the building. This component can be either using machine or other forms of mechanical equipment to manufactured systematically. The component was off site manufacturing while assembly and erection through delivered to construction site.(Kamar,2011).Besides, IBS could also explained as offsite or on site producing the building component. The building component was produced according to the specification and requirement further up will be install on site to form a building structure. (Azman,2010). While for Construction Industry Development in Malaysia

classified the IBS as a technique of construction where the process of manufacturing are environmental friendly. Building component are send to the site and install to form a building and this process definitely will decreased the workforce (Abdulah,2009).Warswaki,1999 classified industrialized as a method to increase the building quality and decrease the number of workforce. IBS also could be said as a set of interconnected element which form together to produced a building system.(Azman,2010),. While, according to Nuruddin and Esa, IBS is important to reduce the wastage and encourage to use the manufacturing production of the building component with the aim to reduce the workmanship. From all this definition, it could be concluded that IBS was offsite manufacturing where the building component was produced in factory and send to site to install to form a building structure and this can avoid the wastage and reduce the number of the manpower in construction industry.

### 6.0 PROBLEM STATEMENT

IBS was easy to get negative meaning in the early of 1960's. Generally, IBS building related with pre-fabricated mass construction method, bad buildings quality, water seepage, abandoned projects, and other drawbacks. Most of the IBS building had negative impression from the public to the precast concrete building due to the poor architectural design for the old pre-fabricated buildings. The early two example of IBS building was Pekeliling Flats in Kuala Lumpur and Taman TunSardon in Gelugor Penang. There are lots of maintenance issues in Taman TunSardonbuilding for example where was design and construct by British Research Establishment, UK. The poor design consideration and construct method had give the impact for wet toilets and bathrooms where all this leads to issues of seepage and water leaking (Kamar,2011). On the other hand, the poor of experience in design and knowledgeable in structural analysis for pre early IBS components had given the abundant of issues for the pre early IBS building. The connection between the beam to column and column to base are the most general issues for the implementation of IBS building. The poor of design concept can give lots of problem of install stage for IBS building on site. In this circumstances, the installation building component part may create lots of issues for example comfort and safety after the IBS component had install on site. If the design use the fundamental conventional reinforced concrete method, unfortunately this will leads to structural issues for example like exposed of steel beam and steel column. Therefore, this will encouraging the problem like water seepage for the building. The low connection of the joint in between the rain water was easily seep into the

building joint between the wall and steel beam. When the rain water seep into the building, the high degree of dampness can caused the corrosion and damage to the utilities inside the building. (Kamar,2011). The low knowledge in design for precast building could give the safety issues. Without the proper method of design, this will give the negative impact for the IBS building. Most of the contractor in Malaysia have poor experience in construct IBS building. Therefore, the poor technical knowledge may create a negative impact for the building quality after the building was constructed(Hashim,2009). In fact, there do exits where a project facing many difficulties after awarded to be using IBS to construct. The most common issues fall through are inappropriate installation of the component on site. Due to the unaccuracy in setting out the alignment and leveling, this perhaps may encounter the difficulties in the installation for the IBS component. IBS could have the risk such as technical and quality which cause aesthetic and functional mistake. This included blemishes, cracks, moisture penetration and poor insulation in a completed IBS building(Sazali,2008). Indeed, IBS had caused failure to fulfill the requirement of the operational and quality. Actually this system most of the time rely to the operation of the factory, operator's skills and component. Hence, in order to achieved efficiency, there is need to improved the handling system, storing and transporting of the component(Sekak,2008).

## **7.0EFFECT OF DESIGN ON THE MAINTENACE**

Design and maintenance actually are two very crucial criteria in building process. Building life cycle are much depends on this two criteria apart of shape the building forms. The building design's effectiveness is measured by its aesthetic values in order to how it would serve required functions for better performance and accessibility for good maintenance. In actual practice, this two crucial criteria are always obliterate by the designer the important link in between this two criteria. Maintenance are rarely to take important in the design aspect and maintenance team are seldom invited into the design process. Once the building had completed, the building will left to the maintenance staff to manage. Unfortunately , this leads to common building defect and the difficulties in carrying our maintenance jobs continually exits (Ramly,2006).

## **8.0 CHARACTERISTICS OF BUILDING DESIGN**

Normally, designer just concerned about the client needs and neglected the others aspects. Importantly, designer must suit the others requirement like surrounding environment. Others

then that, characteristic like accessibility, community facilities and interrelationship between the users or resident must be seriously take consider in the design stage. The role of the building and surrounding development must take important especially when the surroundings could give a better information for the local needs and building condition. This should not be neglected by the designer in order to produce a good design with maintenance concept. The uses of the building must be highlighted and this important to ensure the requirement like spaces for and facilities for maintenance to be figured closely. If a building design always based on the the budget, this exactly will leads to building maintenance problem as mentioned. The correct selection of the design, coupled with the correct choice of materials and systems has been proved has long term effects on the performance of a building. Most of the design characteristics of buildings are a direct outcome of design decisions and the quality of the construction that results from design choices. Hence, a good designer must be able consider various factors and categories in the process of designing to ensure the building to become a quality product that consumers can utilized to maximum satisfaction (Ramly,2006)

## **9.0 IBS IN MALAYSIA**

The two very early project in Malaysia which utilized IBS method was Kuala Lumpur Tuanku Abdul Rahman Flats and Penang Rifle Range Road Flats. This two project was the pioneer of the IBS industry in Malaysia and from then government had encouraged local contractor to use the IBS method in the local construction industry. Importantly, the modular design guide give the criteria and requirement to design the IBS building. This modular was set by the CIDB and Ministry Of Housing and Local Government in 1998 in order to standardised all the design for IBS building.(Kamar,2011).The local authority only given the permission to inspect the work after the completion of the project but this was not so practical. The local authority must have the priority by the government to inspect the work in the manufacturing process, construction stage and lastly to the project completion to make sure the quality of the construction is satisfied. Government had set the Malaysia Standard 1064 in order to standardise the IBS components in terms of dimensions in 2001. The MS1064 still need to be improved seems it had some vulnerable point. Type of material, design standard.connection types, construction method and the system implementation are the important specification that are not included. With this few items, IBS components's quality can be improved and the contractor can utilized a standardised system easily and effectively. Consequence this will encourage

our local contractor to utilized the IBS in the local construction industry. Most of the innovations in material and components are made before their application in the building process. Generally, construction firm play the role as the integrators and catalyst for transforming new technologies into marketable products. Importantly, this can modifying and developing new technology. The materials, components manufactures and high quality equipment for production proposes is among the technology adaption into the panels(Kamar,2011).. If the repetition is limited, the most economical way is to cast the façade panel flats and add the features, manufactured separately using materials such as precast concrete, GRC, aluminium or steel (Kamar,2011).

### **10.0 DEFINITION OF MAINTENANCE**

According to BS8210,maintenance can be defined as the combination of all the technical and administrative action which intended to retain or restore it to a state it can perform its required function.BS3811:1964 had defined maintenance as a combination of any actions that carried out to restore, retain and acceptable condition or standard. This combination of any action had included combination of many parties that involved in maintenance work which were contractor, worker, management and other parties. Retain and restore will well defined as there are two process which work are carried out in anticipation of failure and work carried out after failure. While word acceptable condition stand for the person which receiving benefit from the acceptability to the person paying. Each person which paid for the work has it own acceptable condition based on the building, building life budget and workers. From the Oxford Advance Learners's English Dictionary defined maintenance as the action of maintaining something or the state of being maintained. While Majdi(2002) has described maintenance as methods and techniques used to restore a specified level of service and to prolong life by slowing its deterioration rate. While according to Wordworth(2001), maintenance is the action referred to the initiation, organization, and implementation of series of works. There are two processes of works that envisage, retaining and restoring. Retaining is more to the work carried out in anticipating of failure and restoring is the work carried out after the failure. For the further explanation, the concept of maintenance acceptable standard is referred to the person who is paying the work to the person receiving benefit or to some outside body with the responsibility for enforcing minimum standards(Yacob,2005).

### **11.0 IMPORTANT OF MAINTENANCE**

Why maintenance was so important?  
Basically building and structure will last longer

with proper and continuous maintenance. If a structure or building had a poor maintenance, this will resulted the need for reparation, renovation or restoration. Hence, this will increase the cost at the end of life cycle of the building or structure(Yacob,2005). The value of the maintenance is discussed from the aspect of:

#### **i) Time**

If compared the time needed for reparation and renovation, maintenance was totally less time then the reparation and renovation but can produce a better quality result. On the other hand, work qualities for maintenance are also relatively lesser compare to reparation and renovation.

#### **ii) Cost**

Cost required for maintenance are lesser then cost required for repair or renovation. When the maintenance work is carry on, the specific structure can still be running and this saving cost from the economic perspective.

#### **iii) Structure value and performance**

Structure will have high value and good performance during its service life if maintenance works are done according to schedule and plan. The unpropermaintenance will cause the structure will not be able to provide services as its maximum performance all the time.

### **12.0 EXPECTED OUTCOMES**

This study hopefully will successful find out the factors which leads to poor consideration of building maintenance factors during the architectural design stage, structural design stage , M&E design stage, manufacturing and construction stage. This is mainly about the critical maintenance factors in civil and construction in IBS building for precast concrete system. Eventually in the end of the study, a recommendation and the solution models hopefully will be successfully developed. Therefore, this study will be a useful reference and guidance for local contractors, architects, engineer, IBS manufacturer, CREAM, CIDB or even academic to ensure the IBS building is incorporate with maintenance concept in Malaysia.

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