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## MAINTENANCE MANAGEMENT SYSTEM FOR INDUSTRIALIZED BUILDING SYSTEM

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**ABSTRACT:** With the aim to reduce the number of the unskilled foreign labor, government had encouraged our local contractor to use the Industrialized Building System (IBS). They are few type 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. But at the same time, when a building was built by the IBS system, the building also needed a system of technique maintenance of the building to prolong the building life. Hence, this paper will focus on the maintenance management system use for the building built by IBS. The objective of this paper is to identify building maintenance problems in IBS, to explain the development of maintenance management system for IBS. As such, the building need to be identified before the research start. The defect and the problem face by the owner of the IBS building will be collect and note down in a check list. This will be done by questionnaire and distributed to all Malaysia's government IBS's building management office. Interview session and site visit also will be done with the contractor and the building owner to understand the problem that facing by the IBS building that has been chosen. To prolong the building life cycle and prevent the wasting of the money, a systematic of maintenance management system (technique) used for Industrialized Building System need to be developed

**Keywords:** industrialized building system (ibs), maintenance management system, life cycle

### 1. BACKGROUND OF STUDY

In Malaysia, construction sector play an important role in generic country economy. Over the year in Malaysia, 3% to 5 % of the national Gross Domestic Product(GDP) for the pass 20 years was contributed by the construction sector. Apparently this statistic has obvious shows that the construction was one of the important major sector that stimulate our country's economy. A boom construction activities can show that country's economy was in brisk condition while the sluggish construction activities show that the nation's economy was under depression condition. Thus, the construction sector also can serve as an important barometer indicating our country economy condition.

Industrialized Building System(IBS) generally can be known as all building components which are mass produced either in factory or at site factory. All the mass component of the building will be design accordingly to specifications with standardize shapes and dimensions.

Eventually, when all the building component has been successfully produced, all the component will be transported to the construction site to be rearrange with certain standard to form a building(Lim, 2006).Construction industry in Malaysia generally comprise many process and this included many parties and different stages of work. Involvement of various parties from different sectors can effectively ensure the high efficiency of the construction that will be carried out. Only with the high quality of managerial and organizational performance with the effective co-ordination through good teamwork from different parties will create an efficiency and success of construction development and activities. Thus, every team member play an effective roles in their work to ensure the development of the construction industry will be achieved.(Tay,2006)

The concept of using Industrialized Building System (IBS) in Malaysia getting started after the ministry of housing and local government of Malaysia visiting several European country. This became the significant starting point for the IBS in Malaysia although IBS was not so popular at that era. Our

Malaysia construction field achieve another new mile stone when the pioneer of the project Pekeliling Flat at Kuala Lumpur has been successfully built within 27 months which utilized the panel pre-cast concrete wall and plank slabs in the project.

Nowadays, there are lots of local IBS manufacture and yet were mushrooming. Most of the IBS system used in Malaysia are large panel systems, steel frame, precast frame and formwork system. All this system has been largely used for private residential project in Malaysia which included projects in Shah Alam, Wangsa Maju and Pandan, Dua Residency, KL, Taman Mount Austin and Tongkang Pecah, Johor (CIDB, 2006).

In this 21<sup>st</sup> century, IBS is not new to the construction industry. This method had effectively can cost saving and improve the quality through the reduce of the labor intensity and construction standardization. Besides, it minimized the wastage, less site material, more cleaner and neater environment, quality controlled, and reduce the total construction costs. Successful implementation IBS in the world are Sesikui Home(Japan), Living Solution(United Kingdom),Open House(Sweden) and Wenswonen (Netherlands).

IBS should approach to the maintenance management. Maintenance management is a system that orderly and systematically that approach to the planning, organizing, monitoring and evaluating maintenance activities and their costs. Thus, a good maintenance management system could prevent health and safety problems and environmental damage, yield longer asset life with fewer breakdown and result in lower operating costs and a higher quality of life.

## **2. STATEMENT OF THE PROBLEM**

In the 1960's, IBS was often misinterpreted with negative meaning. Normally, IBS building associated with pre-fabricated mass construction method, low quality buildings, leakages, abandoned projects, unpleasant architectural appearances and other drawbacks. Public have bad impression about the precast concrete due to the poor architectural design for the old pre-fabricated buildings. The example of two early pre-fabricated flats were constructed was Pekeliling Flats in Kuala Lumpur and Taman Tun Sardon, Gelugor, Penang. The very basic design for the Taman Tun Sardon by British Research Establishment, UK was create lots of problem. The lack of design such as the need for wet toilets and bathrooms was leads to problems of leakage. Further more, many low cost housings are not maintained properly and this give the negative vision and poor image to the IBS building. (Rahman and Omar, 2006).

However, lack of knowledge in structural analysis and design of pre-fabricated components also contribute to the problem of the implementation IBS system. The most common problem are the connection between the beam to column and column to base. The lack of knowledge of design could cause the poor connection at site work. The poor connection may leads the issued of comfort and safety. When the steelwork structures are design as the conventional reinforced concrete structural system, this concept result exposed steel beams and columns. Unfortunately, this can comes out of many problem such as leakage. The rain water was easily seep into the building joint between the wall and steel beam. On the other hand, the dampness leads to corrosion to the lighting system and the beam (Rahman and Omar, 2006).

## **3. IBS DEFINATION**

Actually there are various definition of the Industrialized Building System (IBS) in Malaysia. This indicated that no agreed definition of the IBS since there have few type of definition from different author (Mohamad Rofzdi, 2009). IBS can be consider as the building built by using pre-fabricated components. The component was systematically manufactured either by using machine or other forms of mechanical equipment. The component was manufacturing off site and delivered to construction sites for assembly and erection (Rahman and Omar, 2006).

Chung and Kadir (2007) has defined that the IBS is a mass production of building components either in factory or at site. It depends on the specification of the standard shape and dimension to transport to the site to be re-arranged according to certain standard to form a building. Construction Industry Development (2003) defined IBS as a construction technique included components which are manufactured in a controlled environment either on or off site, transported, positioned and set up into a structure with minimal additional site works.

Warswaki,1999 defined industrialized as an investment in equipment, facilities and technology with the aim to maximizing the output and minimizing the labour resources and improving the quality. For the building system, Warswaki defined as a set of interconnected element that joint together to enable the designated performance of a building.

Esa and Nuruddin,1998 stated that IBS is a kind of manufacturing process in order to minimize resources wastage and enhance value for end users through continuous beginning from utilizing craftsman for every aspects of construction to a system that make use of manufacturing production.

### 3.1 HISTORY IBS IN MALAYSIA

Since 1960's, IBS was starting used in Malaysia after the ministry of housing and local government of Malaysia inspired the idea from the visiting at several European countries. The pioneer project of building using IBS was Pekelling Flat at Kuala Lumpur and the Rifle Range Flat at Penang. This two project significantly had cause the Malaysia construction field achieved another new milestone in the era of 1960's when IBS which also known as modern method construction had been recognized in Malaysia. Since then, many construction after the year using precast wall panel system. This method became popular when most of the low cost high rise residential building using IBS following the years after 1960's. But unfortunately some of the technique that had been utilized in Malaysia from over sea did not suitably use in Malaysia's weather climate and social practices. In the early of 80's, structural steel component getting using in high rise building in Kuala Lumpur (CREAM AND CIDB, 2010).

The 36-storey Dayabumi complex was successfully completed in 1984 by a Japan company name Takenaka Corporation. In the period of 1981 to 1993, Perbadanan Kemajuan Negeri Selangor (PKNS) adopted precast concrete technology from Praton Haus International based on Germany to build low cost house and high cost bungalow for the new townships in Selangor (Zuhairi Abd Hamid, 2007). The evolution of the construction in Malaysia had encourage many local company involved in IBS construction. To improve the IBS technique, some local company had collaborate with the foreign company from Japan, Australia and US to develop a quality technology in IBS. There are various of project utilized IBS in this modern era and this including Bukit Jalil Sport Complex, Kuala Lumpur Convention Centre, Lightweight Railway Train, KL tower, KLIA, and Petronas Twin Tower (Zuhairi Abd Hamid, 2007).

### 3.2 CLASSIFICATON OF IBS

Generally, there are four categories in construction method and this including conventional method, cast in situ, composite method and fully prefabricated. Basically cast in situ, composite method and fully prefabricated was classified as non conventional method. While for the structural aspects, IBS can be divided into five major types:

- a) Precast Concrete Framing, Panel and Box System  
-this including PC columns, beams, slabs, 3D-components(balconies, staircase, toilet, lift chambers, box girders, etc), (MIIE, 2009)
- b) Steel Formwork System  
-Tunnels forms, beams and columns moulding forms, permanent steel formworks(metal decks), etc (MIIE, 2009).
- c) Steel Frame Systems  
-Steel beams and columns, portal frames, roof trusses, etc (MIIE, 2009)
- d) Prefabricated Timber Frame Systems  
-Timber frames, pre-fab timber, roof trusses, etc (MIIE, 2009).
- e) Blockwork Systems  
-Interlocking concrete masonry unit(CMU), lightweight concrete blocks, etc (MIIE, 2009)

### 3.3 PERCENTAGE OF FOREIGN LABOR BASED ON STATES

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

### 3.4 REGISTRATION OF IBS MANUFACTURER AND PRODUCTS IN "ORANGE BOOK"

NO	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

Source: Malaysia International IBS Exhibition 2009

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

GRD	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

### 4.0 DEFINATION MAINTENANCE

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 according to BS8210. 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 its 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.(Mohamed, 2010)

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.(Hashim,2007)

#### **4.1 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 result in the need for reparation, renovation or restoration. Hence, this will increase the cost at the end of life cycle of the building or structure. 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 than the reparation and renovation but can produce a better quality result. On the other hand, work qualities for maintenance are also relatively lesser compared to reparation and renovation.

ii) Cost

Cost required for maintenance are lesser than cost required for repair or renovation. When the maintenance work is carried 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 improper maintenance will cause the structure will not be able to provide services as its maximum performance all the time.(Yacob,2006)

#### **4.2 FACTOR OF GOOD AND EFFECTIVE MAINTENANCE MANAGEMENT**

Maintenance management consists of managing, planning and also controlling. In spite of that. There are four supporting factors that need to be considered in making the maintenance management more effective and efficient when it is executed.

i) The Organization structure and general responsibilities of maintenance management.

ii) The maintenance policies and standard for maintenance.

iii) The maintenance management planning and scheduling

iv) The maintenance management for budgeting and cost controlling.(Yacob,2006)

### **5.0 METHODOLOGY**

#### **5.1 INTRODUCTION**

First of all, this research will start with identifying research problem which cover significance, objective and scope of study followed by exploratory research of the literature. All the information is gathered from two kind of sources which firstly is journals, books, internet and reports while secondly is through preliminary interview to consultants, contractors, architectural firms, IBS manufacturer, CIDB and CREAM and site visit. Questionnaire will develop after all the information that related with the research will obtain from the potential respondents. All the questionnaire which was successfully developed will distribute to the potential respondents with either by post, hand or by email

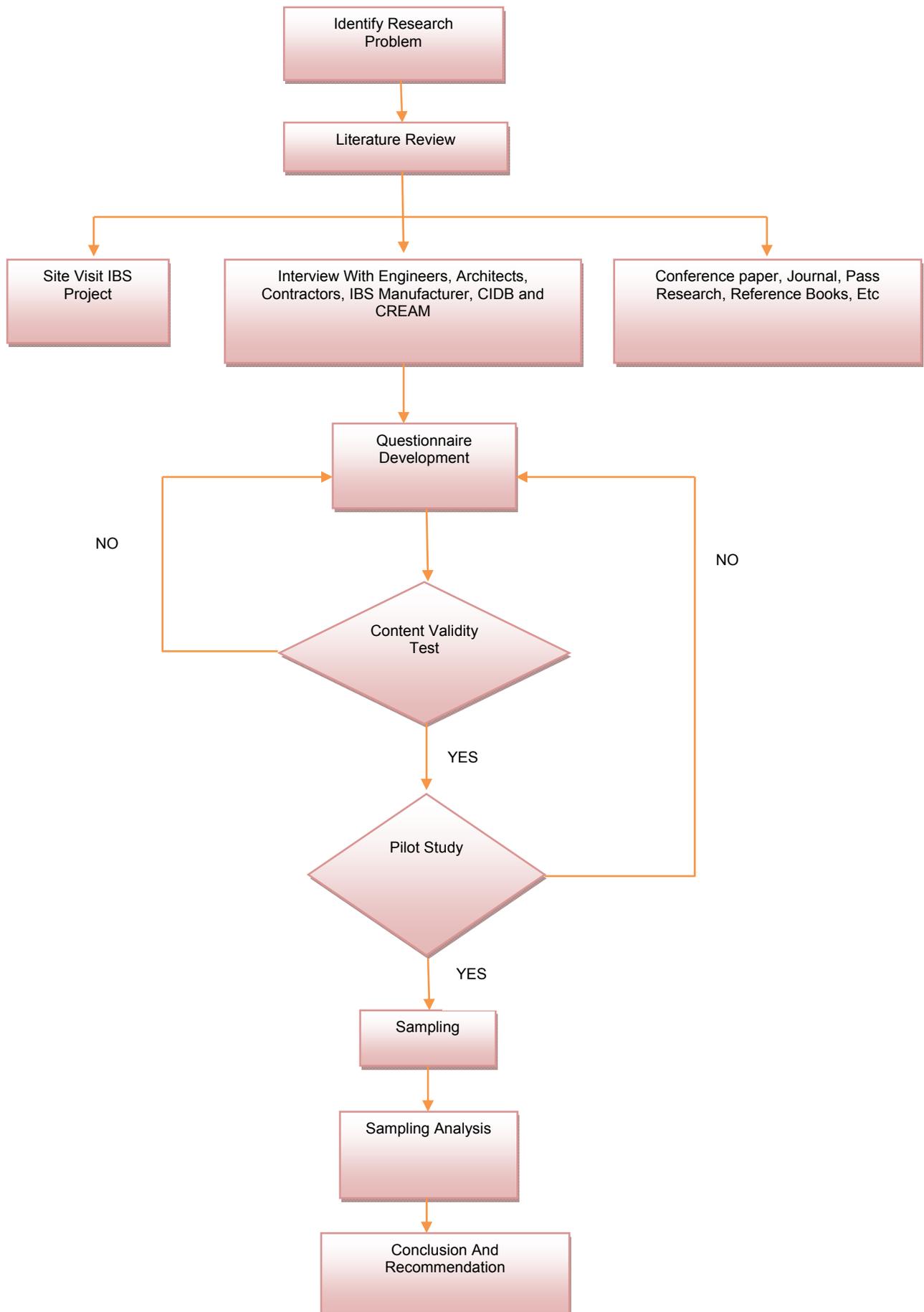
## 5.2 PROCESS OF METHODOLOGY

Process methodology need to arrange systematically to achieve the aim of the research study. This process started from the topic selection followed by identifying issues, objectives, scopes, data, data collection, data analysis, conclusion and recommendation and finally the thesis write up.

To achieve the objective of the research, the following steps were carried out such as:

1. A preliminary research on the maintenance management system for industrialized building system through the study of the literature.
2. Site visit, interview and discussion session with the contractors, engineers, architects, IBS manufacturer, CIDB and CREAM. This will help a lot to identify the datas and to understand the building maintenance.
3. Formulated questionnaires after the preliminary interviews and literature review was obtained.
4. The pilot study need to be conducted before distributed to the respondent. This pilot study are very important to:
  - Test the adequacy of the questions for each question.
  - Test the efficiency of the sampling.
5. After the pilot study has been achieved, the questionnaire was distributed by post, email or by hand to the potential respondent.
6. The questionnaire will be collected after the feedback from the respondent but the uncompleted questionnaire will exclude.
7. The questionnaire will be examined weighted overall factors that affect IBS building maintenance.

### 5.3 METHODOLOGY FLOW CHART



## 6. EXPECTED OUTCOMES

IBS maintenance management system will be developed and to be used by the contractors and the administrators of the building. This maintenance management system is important to prolong the building's life cycle and avoid the wasting of the money.

## 7. CONCLUSIONS

This paper significantly revealed the importance of developing the maintenance management for IBS building in Malaysia. All the review that has been highlighted for example history, issues and problem of IBS in Malaysia hope will be an important information and reference to develop the maintenance management system for IBS building.

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