DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

IMPLEMANTATION OF INDUSTRIALIZED BUILDING SYSTEM

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

DECEMBER 2018

It is recommended that the report of this practical training provided

By

AHMAD HAFIZ HIZRI BIN ZULKEFLI

2016618316

Entitled

IMPLEMANTATION OF INDUSTRIALIZED BUILDING SYSTEM IN MALAYSIA

accepted in partial fulfillment of requirement for obtaining the Diploma In Building.

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SERI ISKANDAR, PERAK DARUL RIDZUAN

DECEMBER 2018

STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at Aman Selama Sdn. Bhd. for the duration of three months starting from 9th September and ended 7th December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fullfillment of the requirements for obtaining the Diploma in Building.

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ACKNOWLEDGEMENT

I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. They are a special group of people who have been so helpful towards me in my internship period. First and foremost, I would like to thank Mr. Husaini Bin Hamzah, project manager of Cadangan Hospital Bachok for the opportunity provided to conduct my internship and be one of the team member in this particular project. His team of professionals comprises of Mr. Tan Jee Tyan, Mr. Shahriman bin Hibabullah, En. Muhammad Fahmi bin Mustafa and Mr Goh Gee Nan has been an integral part in my learning process. They have always been happy to share their knowledge so I could learn and develop more thorough understanding of feel for real time projects and theories involved in structures, buildings and civil works analysis and Quantity Surveying. To be a part of an amazing team with all of you has been very eye opening and an invaluable experience.

I would also like to thank all Universiti Teknologi Mara (UiTM) lecturers in UiTM Seri Iskandar, Perak that have nurtured me in becoming a better student and person. My deepest appreciation goes to the lecturers directly involved during my internship, Mrs. Noor Rizallinda binti Ishak as my Supervising Lecturer, Ms. Azizah Talkis and Mr. Muhammad Naim Bin Mahyuddin as my Practical Training Coordinator and Dr, Dzulkarnaen Bin Ismail as my Programme Coordinator, I appreciate the time, effort, ideas and encouragement contributed towards the successful completion of my training, the comments on my report and the valuable knowledge shared over the last few semesters.

To close this, I also would not have made it had it not been for my friends whom have been a great support system, and my family for their sacrifices over the years.

Thank you so much

ABSTRACT

Industrialized Building System (IBS) is a new construction technique or methods that intended to replace the aging conventional building system. This report particularly will discuss the Implementation of IBS in Malaysia specifically in project Hospital Bachok which currently under construction with 50% completion. The report will comprise the type of IBS being uses in Malaysia together with the advantages of adapting this new technique in modern construction. All the data collected for this report has been done by on-site inspection during the internship session. A few individuals also have been interviewed together with doing mass media and document analysing.

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CHAPTER 1.0

INTRODUCTION

1.0 Background and Scope of Study

Industrialized Building System (IBS) is a new system implement in building construction where every component, mainly structural components are manufactured in factory before being assemble on site. Component such as column, beam, floor slab and wall are common IBS structure fabricated in Malaysia. CIDB Malaysia through IBS Centre have been promoting this new system since 1990's. (Nizar, 2003)

The implementation of IBS technology can increase the productivity and quality of construction projects. Through proper training program, IBS project will increase the productivity up to 50% and reduced the waste product produced on site. IBS construction is less affected by weather as every component arrived on site are ready to be assemble. IBS also guaranty a high quality product as every component is produce in controlled environment (factory) using selected raw material, specific mechanical machine and supervised by skilled workers. The adaptation of IBS also reduces the percentage of neglected project as project took less time to be completed. Usage of IBS means construction company can concentrate on assembling finish product. IBS reduced the amount of raw material needed to be provided by construction company and brought to construction site. (Asri, 2016)

The implementation of IBS technology had proved to be worthy as the result can be seen on some of the nation iconic building. Building such as Petronas Twin Tower, Kuala Lumpur International Airport, Kuala Lumpur Sentral and Kuala Lumpur Tower are the leading step of implementation of IBS in Malaysia. (Asri, 2016)

This study focuses on the Implementation of Industrialized Building System in the construction of Hospital Bachok located at province of Jelawat, Bachok, Kelantan. The study will consist the observation of different type of IBS involve in the project. Other than that, the report will enlist the advantages and disadvantages of IBS and also the different method uses in the construction of IBS.

The infrastructure work of Projek Hospital Bachok has reach 70% completion. The construction consists of finishing the Main Block, Mechanical and Electrical Block, Waste Management Block and Elevated Water Tank unit. The project started on 23^{rd} September 2016 and initially due on 23^{rd} September 2019 with a price tag of RM104, 344, 380.00.

Figure 1.1: Project Mock up

Source: Aman Selama (2016)

1.1 Objectives

a. To study the type of Industrialized Building System currently being implement Project Hospital Bachok.

b. To study the method of construction of Industrialized Building System in Project Hospital Bachok

c. To study the advantages and disadvantages of using Industrialized Building System in Malaysia.

1.2 Method of Study

The study of Implementation of Industrialized Building System has been conducted by following the method below:

a. **Interview**

   The interview has been carried out with personal working on site involving site supervisor, site engineer, contractor, supplier and also site supervisor.

b. **Site Observation**

   Observing works on site involving the product quality check, installation, finishing works and safety step taken during works on site. Further study also conducted on supplier factory regarding the fabrication method.

c. **Document Analysis**

   Analyzing document such as detail drawing, direct order, plan drawing, and mockup detail.

d. **Mass media and electronic media**

   Studying additional information that cannot be obtain on site by searching journal, documentation and product advertisement on site.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Aman Selama Sdn. Bhd. was incorporated on 20th November 1982 and was conceptualized as a business concern to inaugurated its career in developing the State and Nation to through careful planning and consolidation of its objective towards establishing a successful and profitable organization in the Civil Engineering and Construction Industry. The unpredictable market in the private sector has warranted the capital the capital investment. With the relevant experiences under its bell, the corporate strategy of the sectors, such as Oil and Gas, Petrochemical and Chemical Industries.

In the initial stages the company intended to achieve or materialized its objective by providing services in Timber Supply and Minor Civil works in early 1986 with PKK Class F license. With initiative and dedication, the company gradually upgraded and diversified actively on more challenging categories of works. In September 1995 the company achieved its goals after securing in the PKK Class A license. Since it become actively and aggressively involved in the Engineering and Construction Industry. With such accomplishment and success in the Construction Industry, the company was selected amongst the 200 contractors under the special program called "Program Kontraktor Berwibawa" in the recognition of its success, sponsored by the Malaysian Government.

To date, the company has earned the confidence of and recognition by its entire client due to its efficiency and the superior quality of service rendered. The company offers the best engineering and construction service available with the stated requirement of our client.

2.2 Company Information

Figure 2.1: Company Logo

Source: Aman Selama (2016)

Company Name	:	Aman Selama Sdn. Bhd.
Address	:	No. 55A, Taman Taiping Utara Jalan Kamunting, 34600 Kamunting, Taiping, Perak Darul Ridzuan
Phone No.	:	
Fax No.	:	
E-mail Address	:	amanselamasb@gmail.com
Company Registration No.	:	93260-D
Constitution	:	Sendirian Berhad
Commencement Date	:	20th November 1982
Registration	:	Pusat Khidmat Kontraktor (PKK) G7 (Bumiputera) Construction Industry Development Board Malaysia (CIDB) Gred G7 - B (B02, B13, B09, B05, B04, B28)
Nature of Business	:	Construction (Bumiputera)

2.3 Organization Chart

2.3.1 Company Organization Chart

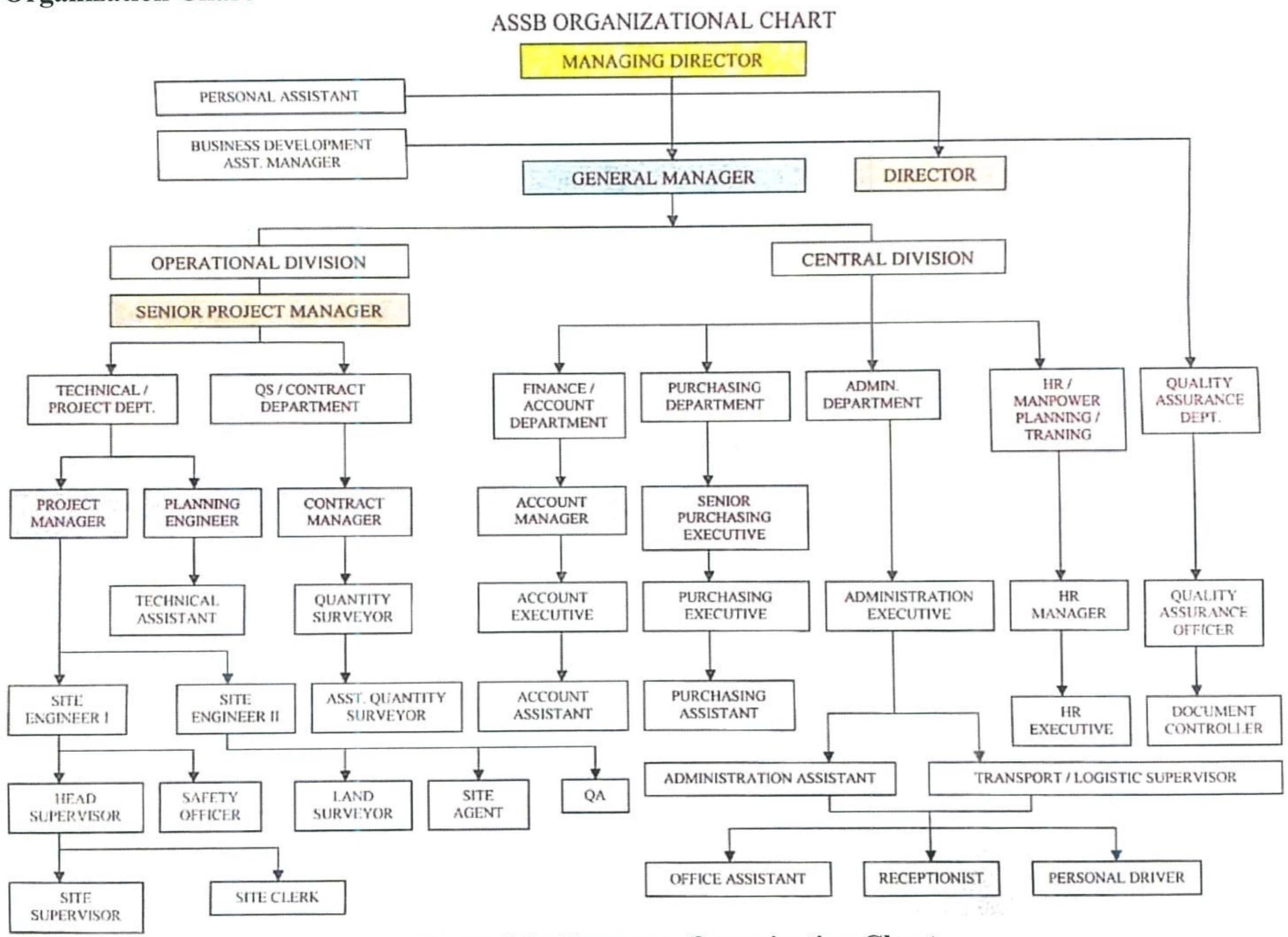


Figure 2.2: Company Organization Chart

Source: Aman Selama (2016)

2.3.1 Project Organization Chart

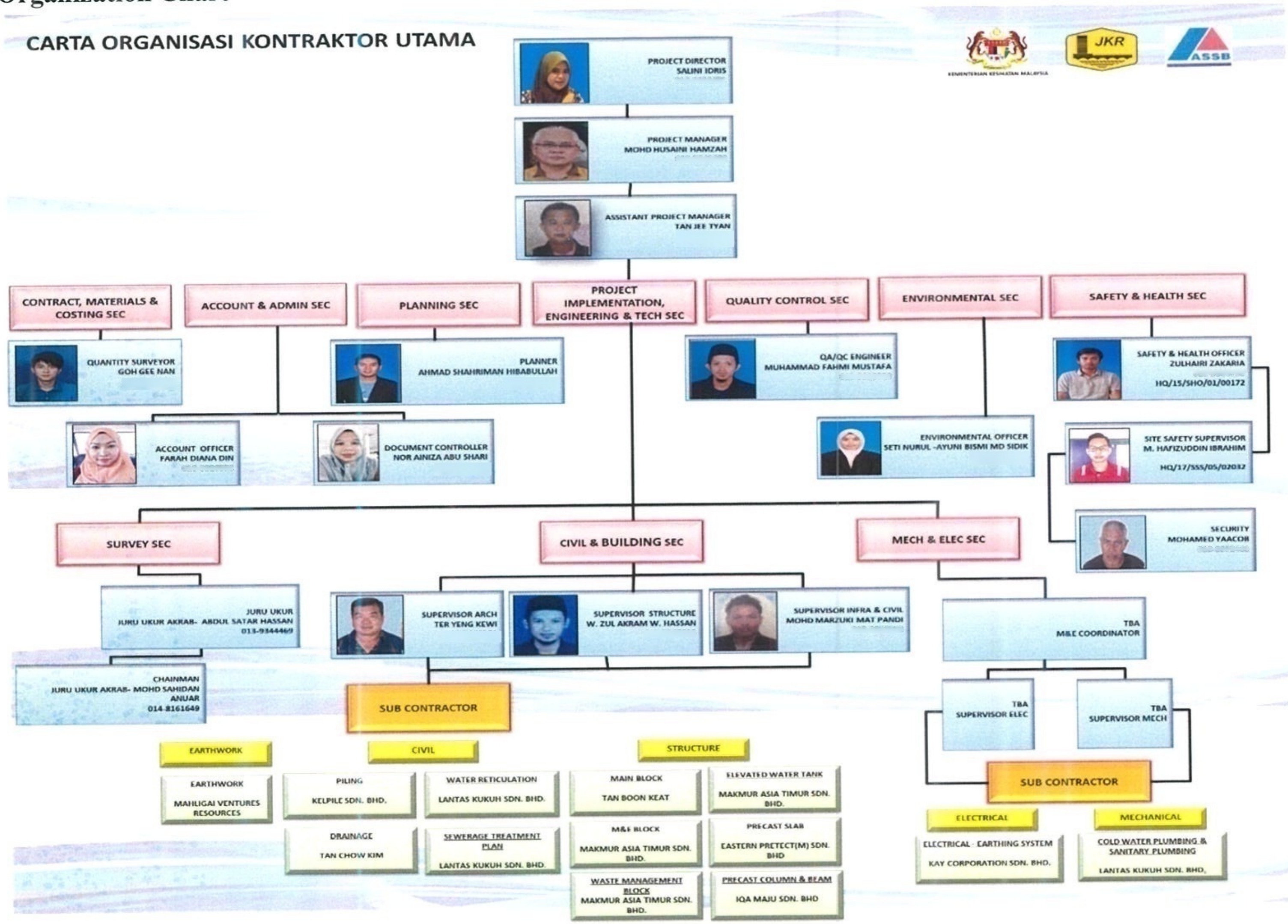


Figure 2.3: Project Organization Chart

Source: Aman Selama (2016)

2.4 List of Previous Project by ASSB

2.4.1 Completed Project

Table 2.1: Schedule of ASSB Completed Project

No	Project Name	Contract Sum (RM)	Contract Period	Agency
1	Cadangan Membina dan Menyiapkan Asrama Anggota Bujang Kapal, Mengandungi 5 Blok 6 Tingkat di Pengkalan TLDM Lumut, Perak Darul Ridzuan.	39,479,569.48	15/01/2007-10/01/2009	Kementerian Pertahanan Malaysia
2	Cadangan Membina dan Menyiapkan Institut Perakaunan Negara (IPN) di Sabak Bernam, Selangor Darul Ehsan.	54,088,000.00	11/12/2000-26/4/2004	Jabatan Kerja Raya
3	Cadangan Pembangunan Kompleks Politeknik Tanjung Malim Mukim Ulu Bernam Daerah Batang Padang, Perak Darul Ridzuan.	157,000,000.00	06/06/2000-05/03/2003	Kementerian Pendidikan Malaysia

4	Membina dan Menyiapkan Balai Bomba 2 Petak Menara Kawad, 3 Unit Kuarters Kelas F & 16 Unit Kuarters G2 serta Kerja-kerja Berkaitan di Bandar Seri Iskandar, Perak Darul Ridzuan.	4,181,510.99	17/01/2000-30/09/2002	JPN & Kerajaan Tempatan
5	Cadangan Pembangunan Maktab Rendah Sains MARA (MRSM) Chenderoh, Mukim Durian Pipit, Perak.	25,400,000.00	01/12/1998-30/10/2000	Majlis Amanah Rakyat
6	Pembinaan Bangunan Kemudahan Kediaman Pusat Latihan Asas Tentera Darat (PUSASDA) di Port Dickson, Negeri Sembilan Darul Khusus.	60,000,000.00	15/06/1997-16/02/2000	Kementerian Pertahanan Malaysia.
7	Cadangan Jalan dari Bukit Sapi/Chepor/Luat/Kg Beng/Raja Intan Suraya, Lenggong Hulu Perak Darul Ridzuan.	8,904,221.50	02/10/1999-31/05/2002	Jabatan Kerja Raya Negeri Perak
8	Cadangan Membina dan Menyiapkan Bangunan Gunasama Persekutuan di Gerik, Perak Darul Ridzuan.	13,448,740.00	21/07/1997-31/07/2000	Jabatan Kerja Raya Gerik

9	Mereka Bentuk, Membina & Menyiapkan Kerja-kerja Menaik Taraf Laluan Persekutuan 76 dari Kuala Kangsar ke Gerik (Pakej 2 – Lenggong ke Sauk) – (Bridge over Tasik Raban)	235,081,519.72	15/10/2000-30/11/2005	Jabatan Kerja Raya
10	The Strenghtening of Track Between Stations Rawang-Seremban, Sentul-Port Klang, NKS Mainline, NKS Yard and Port Klang in Central Region.	10,696,424.00	25/09/2000-24/04/2004	Kementerian Pengangkutan Malaysia

Source: Aman Selama (2016)

2.4.2 Project In Progress

Table 2.2: Schedule of ASSB Current Project

No	Project Name	Contract Sum (RM)	Contract Period	Agency
1	Cadangan Hospital Bachok (76 Katil), Bachok, Kelantan	104,344, 380.00.	23/09/2016-23/09/2019	Kementerian Kesihatan Malaysia

Source: Aman Selama (2016)

CHAPTER 3.0

IMPLEMENTATION OF INDUSTRIALIZED BUILDING SYSTEM

3.1 Type of Industrialized Building System

There are 5 types of Industrialized Building System which are generally being implement in construction around the globe including Malaysia. The listed goes with Panel and Box System, Steel Formwork System, Pre-fabricated Timber Framing System, Block Work System and Pre-cast Concrete Framing System. (Asri, 2016)

Every type of IBS uses different techniques and equipment but the creation of IBS is based on the same concept which is to replaces the conventional construction method to a better and faster method. the conventional method, concreting works requires a numbers of plywood and timber to create the base or formwork to hold the concrete in curing process. Formworks made out of plywood are vulnerable and only last for maximum 3 times of concreting works before the plywood started to compromised. Steel formwork like the Domino Panel by Peri Malaysia (Figure 3.1) uses the same principal as timber formwork which the formwork comes in separated part and will be used to holds concrete during concreting and curing process. The formworks panel which now made out of steel rather than timber now can be used longer for multiple times than the traditional formwork.

Figure 3.1 : Steel Formwork in use to cast concrete wall

Source: Domino Panel Formwork (2015)

Other than formworks, building framing system also can be made into IBS. Steel and timber framing are a faster and cheaper way to replace the concrete column and beam. Pre-fabricated frame gives flexibility to build a structure with more unconventional design while having the same strength as the concrete structure. Steel Framing System (Figure 3.2) and Pre-fabricated Timber Framing System (Figure 3.3) is the examples of IBS framing.

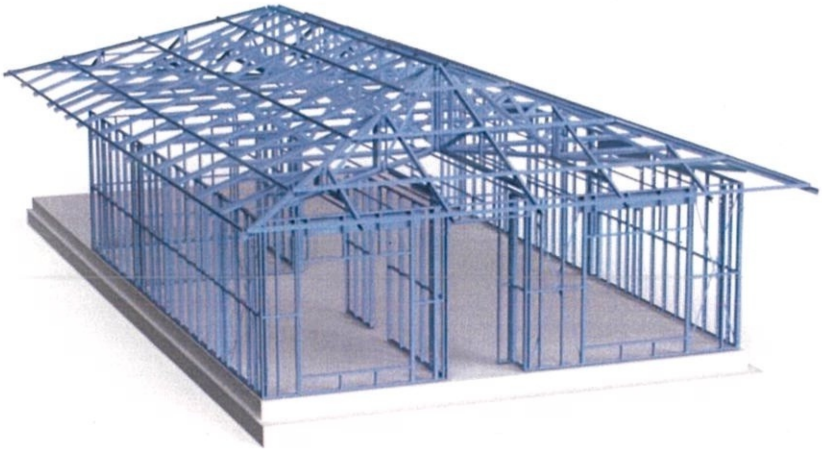


Figure 3.2: Single Storey House Build Using Steel Framing System

Source: The Supaloc (2018)

Figure 3.3:Single Storey house build by using timber framing system

Source: Custom Timber Frame Kit (2018)

The study has been conducted at Projek Hospital Bachok from 2nd September 2018 to 7th December 2018.Out of those few types of IBS, Projek Hospital Bachok currently has implement two types of IBS system for structure framing and wall construction. The main structure consists of slab, beam and column are from the panel and box system while the wall uses the lightweight AAC Block.

a. **Block Work System**

Block work system is a method which use interlocking block as structural components. Blockwork System use a larger a lighter block compared to conventional block. The lightweight block usually hollow in the center to allow the installation of reinforcement bar and also to be concreted on site.

Figure 3.4: A workers handling Starken AAC Block

AAC products are made using slurry mix containing cement, sand, lime and aerating agent. The slurry is poured and moulded to form lightweight blocks, panels and lintels upon which are cured in autoclave. The high-pressure steam-curing mechanism in the autoclave facilitates the curing process of the moulded lightweight concrete, producing physically and chemically stable products that weigh about 1/5 of normal concrete. AAC products contain millions of tiny non-connecting air pockets yielding superior thermal insulation property. AAC products are typically installed to form walls, floors and roofs. (Why ACC, 2018)

Block Work uses in Projek Hospital Bachok is supplied by Starken AAC Sdn. Bhd. with a various dimension to suites the different usage. The largest has the width of 250mm with a smaller version with a width of 125mm. this two sizes of AAC Block are used in externall wall construction while the 100mm width block are used for internall wall and partition wall construction.

Figure 3.5: 100mm Block used for partition wall

Figure 3.6: 250mm Block

b. Panel and Box System

Pre-cast Panel and Box System are the most famous system among the IBS where every part of building such as column, beam, staircase, wall and such are being made in factory or temporary casting area, transported and installed on site. In Project Hospital Bachok, IQA Maju Sdn. Bhd under the consultation of DNP Consult Sdn. Bhd.has been awarded a tender to supply the pre-cast column and beam. Considering the project which located in Kelantan, IQA Maju Sdn. Bhd. has established a temporary working area where the cast their product within construction site. By having the temporary casting area, the automatically eliminated the needs to transport the heavy beam and column from their factory.

Figure 3.7: Precast Column

Figure 3.8: Precast Beam

IBS Beam and column used in this project comes in a varies size depend on the location of the component will be installed. Figure below is a detail drawing for precast beam in installed in Projek Hospital Bachok

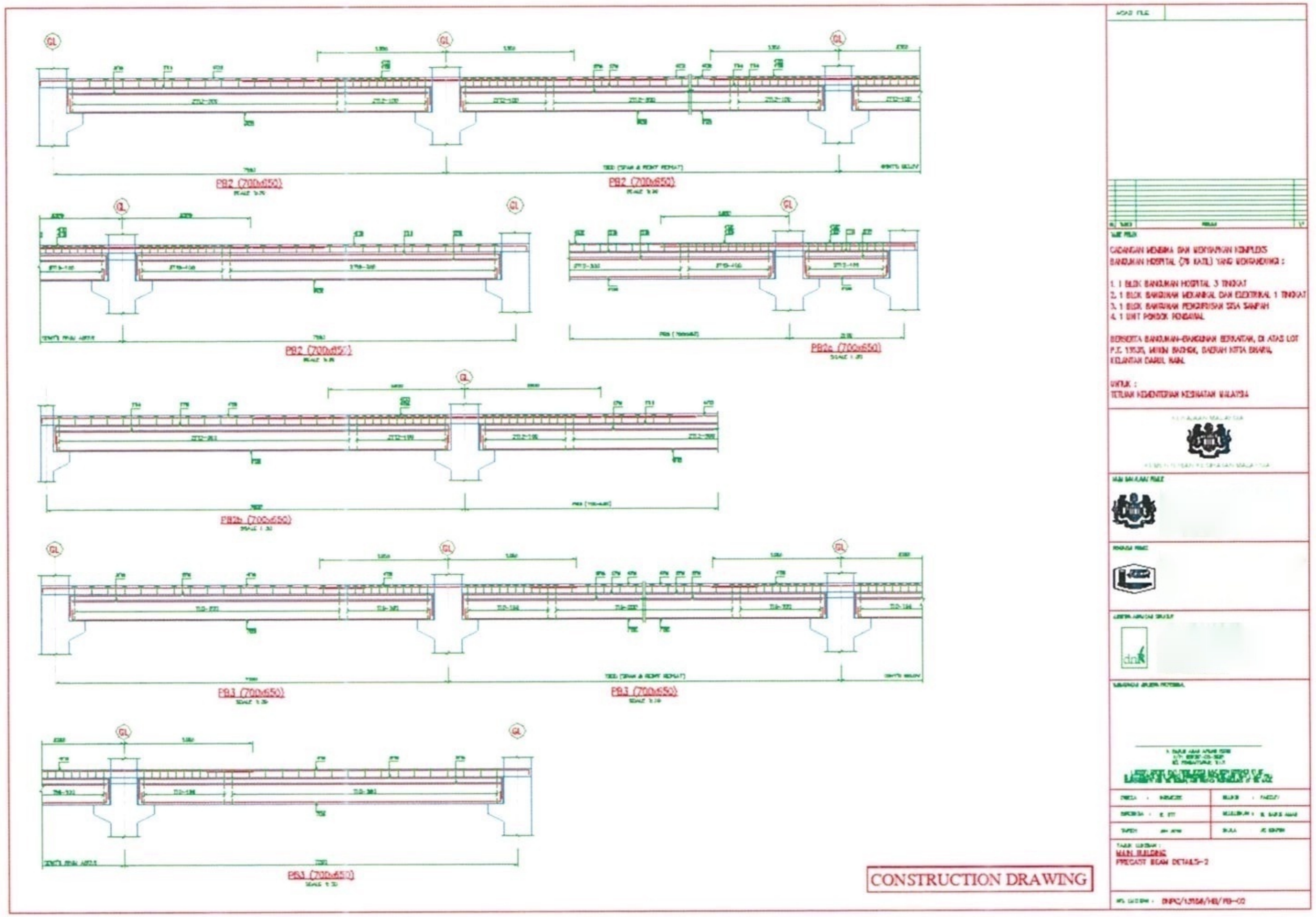


Figure 3.9: Precast Beam Detail Drawing

Source: ASSB Group (2018)

Aside of IBS beam and column, Project Hospital Bachok also has implement the usage of IBS slab which are all supplied by Eastern Pretec Sdn. Bhd. Consist of Hollow core slab and Plank slab. Figure shows the detail of the slab and topping for each of the two slab

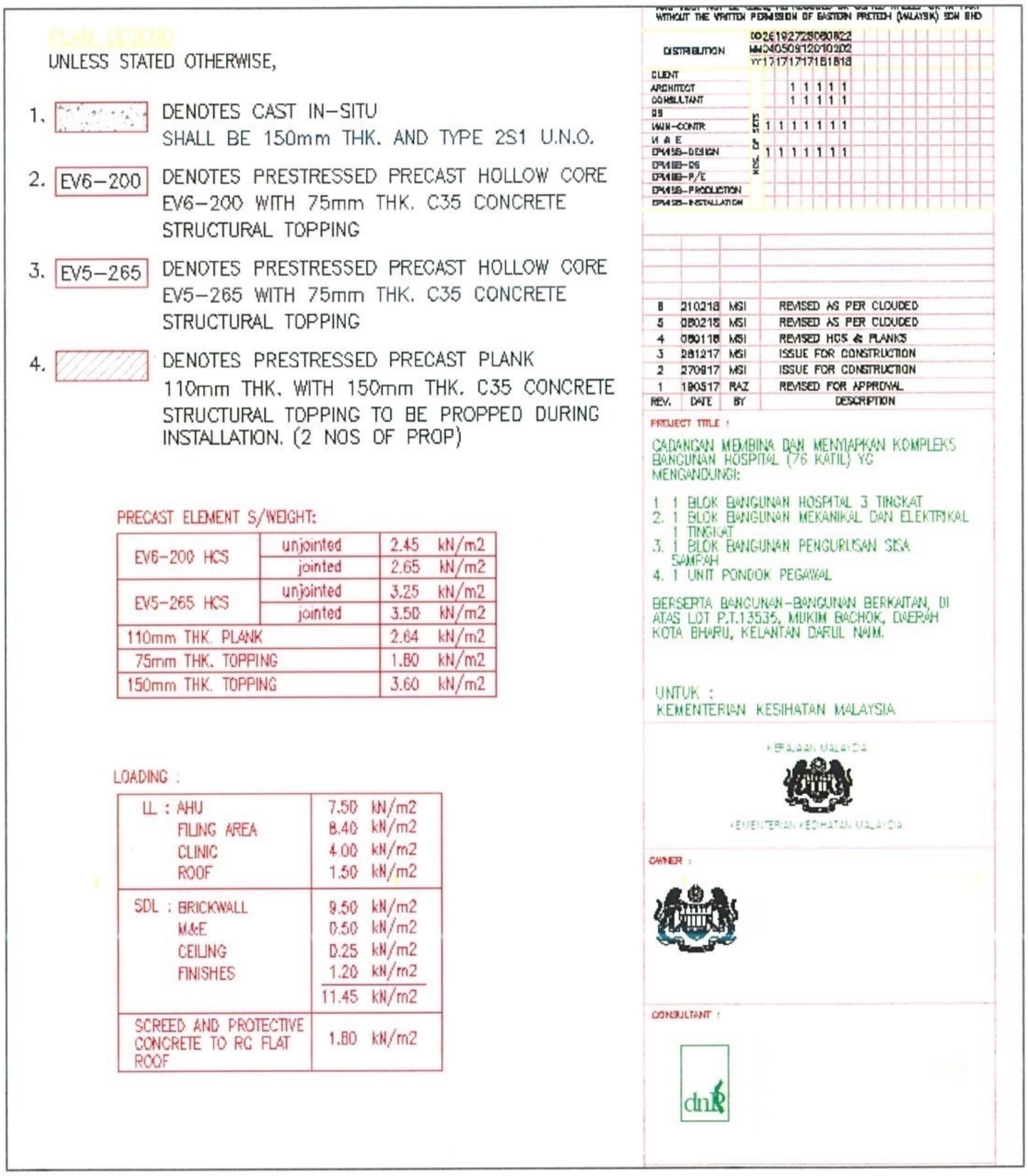


Figure 3.10: Detail Precast Slab

Source: ASSB Group (2018)

Figure 3.11: Plank Slab

Figure 3.12: Hollow Core Slab

3.2 Method of construction of Industrialized Building System In Projek Hospital Bachok

The construction method of IBS in this project are divided into two parts which is first the fabrication method. The IBS will be fabricated in temporary casting area under the supervision of Quality Assurance and Quality Control Officer, Mr. Muhammad Fahmi Mustafa. The finish product will be tested by carrying out slump test and cube test. The second part of IBS construction method is installation process. IBS component will be lifted to their designated location to be install as part of the structure.

The fabrication method of Panel and Box type IBS use the same principal for each component where fabricators will lay down rebar into the steel moulding before concreting.

Figure 3.13: Precast Column Steel Moulding

3.2.1 Fabrication Method

Table below shows the numbers of manpower and machineries involved in fabrication method.

Table 3.1: List of a Manpower and Machineries used during fabricating of IBS

No.	Resources	Numbers
1	Lifting devices	nos / team
3	Skim Coat Material	nos / team
4	Vibrator & Poker	2 nos / team
5	Trowel	1 nos / team
6	Shovel	1 nos / team
7	24/ 45 tons Mobile Crane	1 set / team
8	Trailer	1 nos / team
9	Welding Machine	1 nos / team
10	Grinder	2 nos / team
11	Engineer	1 nos / team
12	Site Supervisor	1 nos / team
13	Site Foremen	1 nos / team
14	General workers	nos / team

a. The cut-to-size rebar obtained from Amsteel Mill Sdn. Bhd. Firstly will be joint together on site with according to the detail approved by engineers.

Figure 3.14: Rebar laid to be tied to engineer specification.

b. Mould preparation: Steel mould will be smoothed out. Extra rough surface due to wielding will be remove by using grinder.

Figure 3.15: Grinding the surface of steel moulding.

c. layer of lubricating oil will be applied to surface of mould before the rebar are laid into.

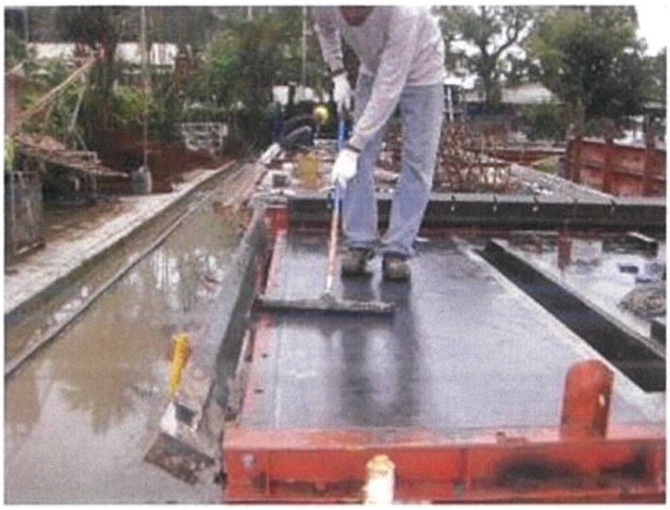


Figure 3.16: Applying lubricating oil onto the mould surface.

d. Finish rebar will be lifted into the mould and every necessary spacer are fixed into achieved concrete cover as approved by engineers. Concrete spacer is used for this project.

Figure 3.17: A worker tying rebar.

e. Corrugated ducts are placed with flexi hose at the required location. Flexi hose are used to spare the space inside the concrete column to be fitted with servicing line such as electrical line.

Figure 3.18: Workers inserting flexi hose in between the rebar.

f. Utility conduits are fixed before final checking.

g. Molding will be inspect by Quality Assurance and Quality Control Engineers before concreting works.

Figure 3.19: Engineers inspecting the rebar before concreting works.

h. Concrete grade 35 obtain from WR Concrete Sdn. Bhd. are then poured slowly and spread thoroughly throughout the mould.

Figure 3.20: Pouring concrete Grade 30 into moulding.

i. Concrete are compacted by using vibrator poker.

Figure 3.21: Vibrating to ensure a balance and evenly spread concrete.

j. After concrete has been set, normally after 1 day. The mould will be allowed to be dismantle after the concrete has reached the minimum concrete strengths of 15 Mpa (refer Standard Industri Pembinaan CIS 9:2008- Section 1: 1.4 Minimum strength).

k. Samples of concrete will be randomly selected and taken in accordance with EN 12350-1. The minimum rate of sampling and of testing of concrete will be accordance with Table D1

Table 3.2: Example of Table D1

7 day	**28 day**
1 numbers of cube for precast column 1 numbers of cube for precast beam	2 numbers of cube for Precast Column 2 numbers of cube for Precast Beam
Send lab for test	Send lab for test

l. The precast elements are then demould and will be store at stockyard for minor touch-up work prior to sending to working area for installation.

Figure 3.22: A finish panel can be raised up from the moulding to be stored before installation.

3.2.2 Installation Method

Table 3.3 shows the list of manpower and machineries needed in installation method

Table 3.3: List of man power and machineries needed in IBS installation.

No.	Resources	Numbers
1	Mobile crane	1 nos / team
2	Drill	1 nos / team
3	Supervisor	1 nos / team
4	Engineer	1 nos / team
5	Worker	6 nos / team

Table 3.4 shows the list of tools and equipment needed in the installation method

Table 3.4: List of tools and equipment needed in IBS installation.

No.	Resources	Numbers
1	Shim Plate	nos / team
2	Wire Ropes	nos / team
3	Shackles	nos / team
4	Ladder	nos / team
5	Scaffold	nos / team
6	Prob	nos / team
7	Survey equipment	1 nos / team

The installation of IBS particularly for the Box and Panel System are done by a quite similar step for each component. The finished cast part will be lifted to their specific location as refers to the layout plan (Figure 3.23) before general workers attached them to started bar. This report highlighted the installation method for precast column as this process are considered as the most time and energy consuming compared to the installation of precast slab and beam.

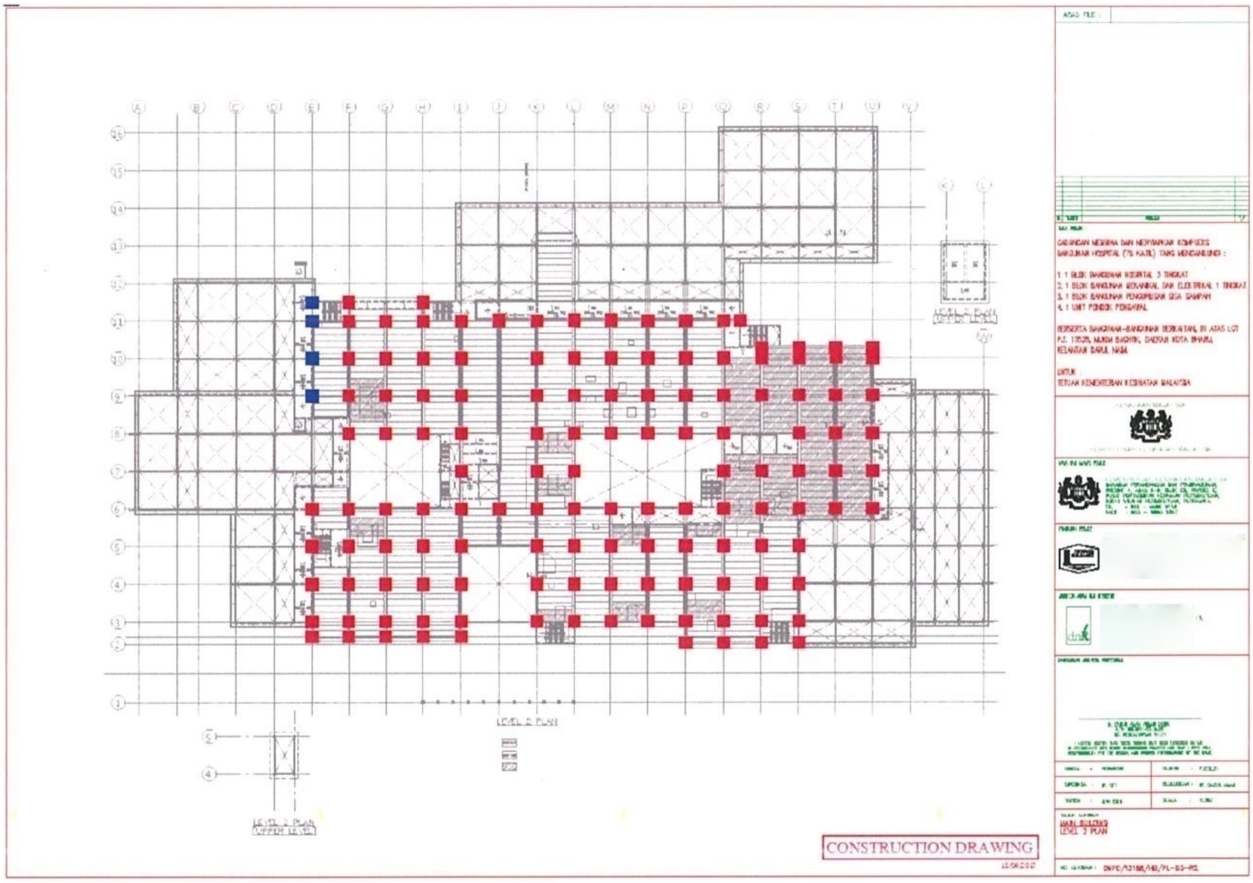


Figure 3.23: Precast Column Layout Plan.

Source: ASSB Group (2018)

Preparation work for Column Installation:

a. The position of starter bars and height will be surveyed whether they are in accordance of drawing. The starter bar will serves as a mark-up point.

Figure 3.24: Measuring height using tape.

b. Shim plate will be fixed as the base for the column.

Figure 3.25: Installing shim plate.

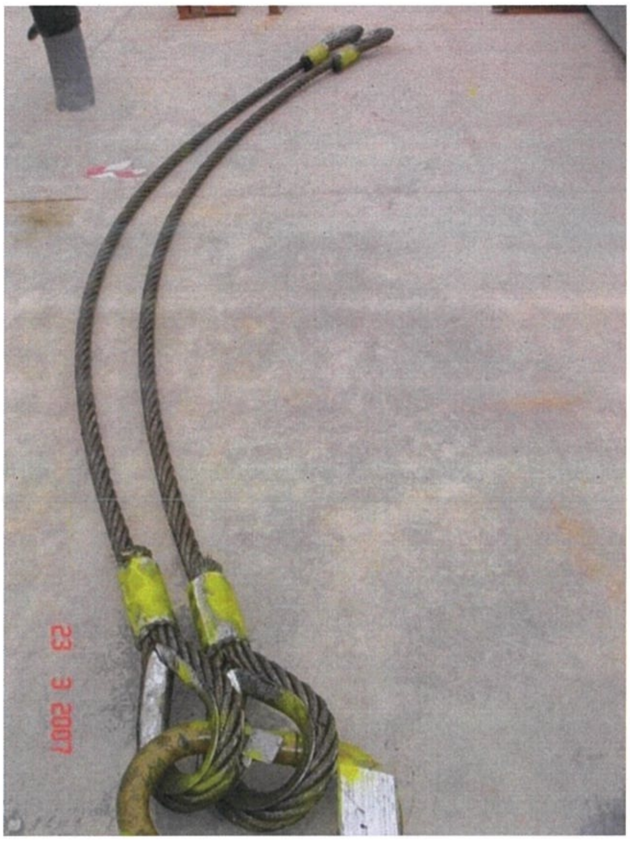
c. Column base will be hacked to remove the slab topping that exceed the base height create a rough surface on the base. A rough surface will provide a sufficient amount of friction for the concrete grouting to hold the precast column in place.

Figure 3.26: Exceeding concrete hacked to level base.

d. The profile of the column will be marked on the base.

Figure 3.27: Column setting out.

e. Lifting and Hoisting gear will be inspect before works started.



Wire ropes

Shackles

Figure 3.28: Equipment to be use during lifting.

f. The finish cast concrete precast column will be move in to the installation point.

Figure 3.29: Column move closer to installation point.

g. Column will be hoisted up from the ground in a vertical position with the provision of protection to base of column to prevent slab from damages, (to minimize working on height, props of column will be attach to column before hoisting).

Figure 3.30: Finish column ready to be lifted up.

h. The precast column will be lifted up to be slot into the started bar.

Figure 3.31: Three workers calibrating column onto starter bar.

i. Once column slotted to the starter bars. A worker will drill and fix the props min of 2 nos. to 2 face of the column.

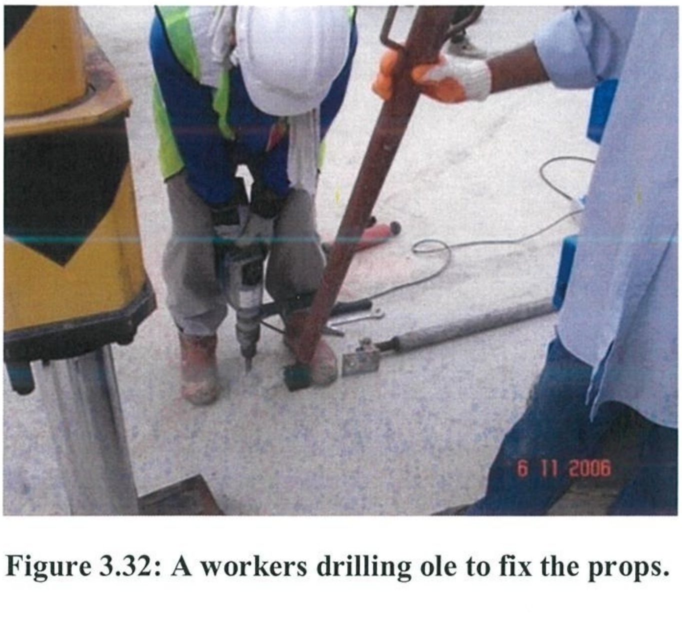


Figure 3.32: A workers drilling ole to fix the props.

j. All the electrical tools to be used are with LEW and wire cable has to suspended from the ground.

Figure 3.33: Props are tied to slab/base using bolts and nuts.

k. The push-pull props will be adjusted by pushing in or out to level the column with the used of Theodolite or 3 metre water level.

Figure 3.34: Minimum 2 props per each column are installed.

3.3 Advantages of Industrialized Building System

a. Quality

Compared to conventional building method, the IBS component are made in a controlled environment which is in a factory or special designated casting and fabrication area which commonly being establish by IBS fabricator in a large scale project. Every worker has been trained well and highly skillful to handle the fabrication equipment. Material used to fabricate the IBS also need to pass various test and quality check before being approved to be used in IBS. Fabrication method in factory are not affected by heavy weather that can compromised the strength and quality of the finished product. (A. Asri, 2016)

Every IBS cast by supplier in Projek Hospital Bachok are required to past a strict inspection by QAQC Department before every component are approved to be install. The quality of every component are not compromised as the IBS will form the main structure of the building which then will bears the building load.

b. Reduce workers

Implementing IBS significantly reduced the number of workers in construction site thus reducing the cost for contractor. Compared to IBS, more workers are needed to complete a casting of a single component by conventional method. Other than that, the safety issues on site can also be reduced as the workers now working in a controlled environment using a proper equipment. (S. Nizar, 2003)

As most of the structural works in Projek Hospital Bachok are IBS, Aman Selama Sdn. Bhd. can reduce the number of general workers and skilled workers such as carpenter, bar bender and concreter. The less demand on the skilled workers stated is caused by the less works of installing formwork compared to conventional building method.

c. Cleanliness and neatness on site

Implementation of IBS reduce the number and amount of material needed on sit thus making construction site less messy. The waste product from the usage of formwork has been long debated as the formwork only last for maximum 3 times of concreting. By using the IBS, contractor no longer needed to handle the formwork thus cutting cost of the material and also the cost of housekeeping work. (Wisam Mohhamed, 2007).

As the number of raw material are reduced in Projek Hospital Bachok, the storage area and warehouse are less needed.

d. Cost

Reducing the labours and material meant reducing the overall cost for contractor. (Wisam Mohhamed, 2007). Reduce the dependency on foreign workers and reduce money outflow and their social problems, low quality works, delays, and diseases. (Peng C., 1986)

The reducing number of skilled workers are now profitable towards Aman Selama Sdn. Bhd as they are now hiring less people while still keeping the pace of the project meaning that they still producing the same rate of productivity but with less workers.

e. Not affected by weather

The installation process of IBS component is rarely affected by weather. As the component come intact in a single piece, workers can work them out easily even in a rainy condition. The integration and strength of the concreted IBS component also will not be affected as the concrete are already cured before delivery and installation. (A. Asri, 2016).

As the Projek Hospital Bachok are taking place in the east coast, they are facing the risk of Northeast Mansoon on December and the rain has already taking place since October. The rain eventually does not stop the progression of IBS installation in this project. The installation of IBS component has reached 100% by the end of November 2018.

3.4 Disadvantages of Industrialized Building System

a. Lack of knowledge

Lack of technical knowledge and experience in IBS and in designing prefabricated component among local professionals and contractors which cause the delay of projects as more time is needed to produce drawing details are another setback that discourage the implementation of IBS (Kamar, 2009) IBS requires high construction accuracy and therefore it is important that the contractors have to be technologically equipped with IBS knowledge. All parties involved, from designers to contractors, must have competent knowledge about the prefabricated components based construction to ensure successful the implementation of IBS (Nawi, 2009).

The skill level of IBS workers is more demanding compared to the conventional construction methods. Under this system, the demand for on-site manual labourers, particularly carpenters, bar benders and concreters becomes less. The system demands more machine-oriented skills, both on sites and in factories. Thus, this leads to a transformation requiring the restructuring of human resource in an organization in terms of training and education. Malaysia still lacks skilled workers generally. As such, more intensive training programmes are needed in the specialized IBS skills like system integrating or assembling. However, this need requires more time and investment (Thanoon et. al., 2003a; and Rahman and Omar, 2006)

b. Project Delivery and Supply Chain

Problems relating to manufacturer"s requirement has been identified as one of the hurdles of IBS adoption in the Malaysian construction industry (Fikri, 2005). In current practice, before a construction starts, the awarded contractor will be paid between 10% and 25% of the total amount of the contract value as an initial payment by the client (Nawi et. al., 2007a). However in an IBS project, the contractor is expected to come out with the initial expenditures, mostly to be paid to manufacturers before any progress payment is made.

However, local contractors do not have sufficient funds to finance the initial phase of projects using the IBS. As highlighted by Nawi (2005) IBS manufacturers are normally required to advance about 75% of the capital to manufacture the IBS components before delivering these components to construction sites. As such contractors are required to help foot this initial bill. The only way for a contractor to be able to do that is by applying for a bond from a financial institution as a guarantee to be deposited with the IBS manufacturer.

c. Negative Perception from Customers and Professionals.

The term IBS is often misinterpreted with negative image due to its past failures (Kamar et al., 2009 and Rahman and Omar, 2006). For example, customer perceptions of an IBS product is still perceived in terms of lack of flexibility, problematic accommodation such as leaks and faults, low quality finish and use of unfamiliar materials (Nawi, 2007b). In architectural design for example, prefabricated elements are considered inflexible with respect to changes which may be required over its life span. This may occur when small span room size prefabrication is used (Thanoon et. al., 2003a). All these factors create a dilemma among clients or developers to apply IBS to their housing projects because of a fear of customer rejection (Kamar et. al., 2009). Some designers are not interested in adopting IBS due to a lack of "ecstatic value" and limited creativity in design (Hamid, 2008). It is undeniably easy and tempting to stay within known boundaries,than to venture out and seek new ideas; thus, the majority of Malaysian housing developers have naturally found it easier to stick to conventional construction methods for their construction projects than to adopt IBS (Kamar et. al., 2009; and Nawi et. al., 2007a).

CHAPTER 4.0

CONCLUSION

The IBS are truly versatile as they come in different type and system. The introduction of lightweight block and Box and Panel system truly boast the productivity and cut all unnecessary expand in Projek Hospital Bachok. The method of fabricating IBS and installing them are simpler and use less manpower compared to conventional building method.

From the finding of this report, it is safe to be said the introduction of IBS in Malaysia has contribute to the construction industry towards a betterment. The IBS has been proved to be a more efficient constructions method. The versatility of IBS can fit any type of construction ranging from residential housing development, commercial building of even servicing building. The cost of constructing massive structure has been reduced slightly which is not only benefits the contractor and supplier, but also the soon-to-be-consumer. Other than reducing cost, IBS are very effective in reducing construction time as they eliminate most of the time to cure concrete on site and the time most of conventional construction waste which is during rainy season.

Regardless of what have been said, there is still a lot to improvise in order for every player in this industry to reach the national target set by the government. The barriers of implementing IBS in Malaysia need to be outcome which by having more conference and talk about IBS can help to reduce the negativity of people towards IBS. The implementation of IBS in government building and niche project is essential as it can be seen and viewed by most of the hidden value of IBS. IBS has a bright future in our construction industry if we can make the full use and manipulate the negative side.

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