DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

INDUSTRIALISED BUILDING SYSTEM :
PRECAST CONCRETE WALL

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DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

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(PERAK)

JAN 2022

It is recommended that the report of this practical training provided

By

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Entitled

INDUSTRIALISED BUILDING SYSTEM

PRECAST CONCRETE: WALL

be accepted in partial fulfilment of requirement has for obtaining Diploma in Building.

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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 Ampenan Tech Sdn Bhd for duration of 20 weeks starting from 27 August 2021 and ended on 8 January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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I would also like to thank ALL the UiTM lecturers that have taught and nurtured me in becoming a better student and person. I would also like to extend my deepest appreciation to the lecturers who are directly involved during my training stint. To Raja Nurulhaiza Raja Nhari, Supervising Lecturer, Sir Muhammad Redza Bin Rosman, Evaluation Lecturer, Cik Nor Azizah Binti Talkis, Practical Training Coordinator and Dr. Dzulkarnaean Bin Ismail, Programme Coordinator, I value the time, effort, encouragement and ideas that they have contributed towards the successful completion of my training, this report and the valuable knowledge that have been shared over the last few semesters.

Last but not least, my special thanks to my beloved parents for their sacrifices over the years. Thank you so much.

ABSTRACT

Industrialised Building System is a system that been introduced around 1960s in Malaysia where it is built in sections manufactured from designated specifications within a factory, and then assembled at the point of construction. This report was conducted for the building that involves on using Industrialised Building System. The objective of report is to study on installation, repairs and maintenance on Industrialised Building System as they are important processes on IBS method. The observation and interviews were completed as giving more information on the processes how they install, repair, and maintain the IBS method.

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Introduction

1.1 Background of the study (Tambah citation ikut reference)

Industrialized Building System is a method of construction that components are manufactured in a controlled environment, either at site, or off site, placed and assembled into construction works. Based on website Properly.com.my (2020), it is also known as Pre-fabricated, Modern Method of Construction and Off-Site Construction. Construction Industry Development Board (CIDB) Malaysia have been promoting the usage of IBS to increase productivity and quality at construction sites through various promotion programs, training and incentives.

By using IBS method, there will be benefits that we'll acquire such as quality improve, costs reduced, accelerates constructions timeline, simplify on site management and safety, and also reduce the environmental impact of the construction industry. Based on CIDB IBS SDN, it is determined based on the Construction Industry Standard 18 (CIS 18:2010) which the scoring system has a maximum score of 100. As the IBS score is higher, the percentage of prefabrication will be used in the project. Even though with new technology, it is impossible to achieve perfect IBS score as some projects can achieve an IBS score of 70 which is closer to being a modular structure.

The IBS method of construction can be seen in the streets right now. The first project that used this method took place on Jalan Pekeliling in Kuala Lumpur beginning in 1964, creating 7 blocks of 17-storey flats, alongside 4 blocks of 4-storey flats, as well as 40-storey lots of shops. The project are now known as Tunku Abdul Rahman public flats before their demolition in 2014. The second project of IBS method was launched in Penang in 1965, developing 2 more residential flats at Jalan Rifle Range. The second project not only known as first prefab construction in Penang, but also the first ever low-cost high-rise housing project undertaken in the state.

IBS are classified to 5 types which are Precast Concrete System, Steel Formwork System, Steel Framing System, Prefabricated timber framing system, and Block work system.

Precast Concrete Systems is the most commonly used in IBS as it includes columns, beams, slabs, walls, '3-D components', lightweight precast concrete, as well as permanent concrete formworks.

1.2 Objectives

There are 3 objectives that involves for this study which are;

a) to identify the variation type of wall in precast concrete IBS

b) to study the construction method of installation, maintenance and repairs on precast concrete walls.

c) to provide solutions to a various challenge during the installation of precast concrete walls as problems may be occur on the site.

1.3 Scope of Study

The study was conducted on-site at Bukit Tembakau, Umbai, Merlimau and UiTM Jasin, Melaka. It involves the construction of bungalow house. This study focuses on Industrialised Building System - Precast Concrete Wall where the construction method is easier than the traditional method of construction. Things that had been carried out from this study were to identify the different types of precast concrete walls, the methods of installing, maintenance and repairing for precast concrete wall and also to identify the problems occurs regarding the installation of precast concrete walls. My intentions for these studies also include identifying materials and machineries used in construction of precast concrete walls, The estimating cost of precast concrete walls is the thing I haven't looked into. .

1.4 Method of Study

There are several methods adopted for this study to complete this report. There are 3 types of method that been used in these studies which are observation, interviews and document reviews.

In this study, observation of the surrounding plays a major role to gain new knowledge and information about the method of installation Precast Concrete Walls. Observation is made on the process of installation, types of problems and solution taken in order to run the construction work smoothly. This case study had taken along the installation process to fully observe the required data. The data was collected by taking a pictures and written notes.

Interview session also have been done with the engineers, site supervisors and the contractors are conducted to gain clearer vision and knowledge. Interviews are done during working hours and during site visit. Some questions asked was about the process of installation, the problems and challenges faced, how long the process takes to complete and etc. For document reviews, there are documents that been provided as a references on installations, maintenance, and repairs on Precast Concrete Walls for example standard operating procedures, site log book and architectural plans of the construction to obtain data.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Ampenan Tech or in short form is Amptech was registered under the Companies 1965 with the Companies Registration Office at Malaysia on 16 September 2016 and is a limited company. The company is a stand-alone that is competitive to date.

Ampenan Tech is also a Bumiputera owned company registered with the Ministry of Finance Malaysia. Its main activity is to make the construction of houses as a result of plans designed according to customer criteria based on prefabricated houses namely the IBS system. Not to forget that this company is also a supplier of essential goods.

This company using precast concrete method or it can call as IBS system as a medium to build a single house. Their contractor in this company are highly experience in their works especially in building work, maintenance, and renovation. The staffs or workers in this company had many experiences in civil and structural works. The professional teams have the skill sets such as competency and capabilities to deliver high-quality cost-effective projects customized to client's requirement.

Ampenan Tech is a company that has good feature planning by organizing the company's strategy to expand the scope of business by engaging in the quotation and tender process. The company's goal is to provide the best quality work and service as well as ensure customer satisfaction.

2.2 Company Profile

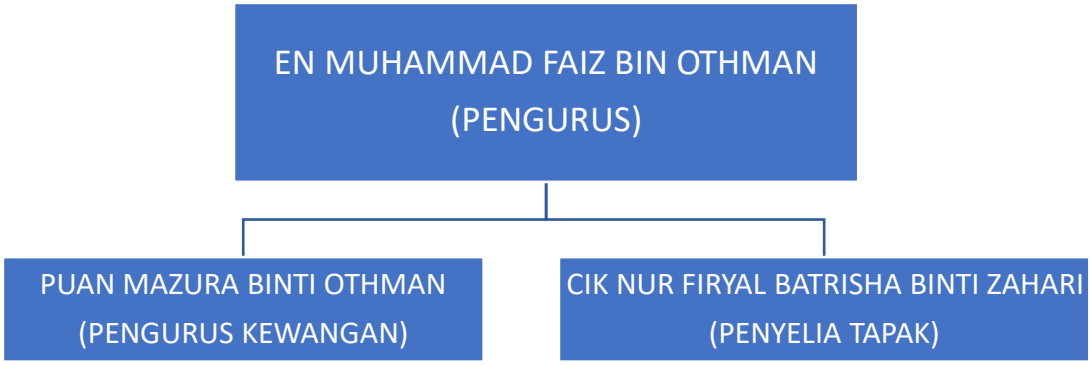
Figure 2.1: Company's logo

Ampenan Tech Sdn Bhd is a construction company for a bungalow house and it covered jobs around Melaka and state near Melaka. This company also provides renovation and maintenance work. This company mainly used the Industrialized Building System (IBS) to build the house and by using this system, it can reduce the time of construction than using conventional methods.

There are several services covered by this company which are architectural studies that involves Comprehensive Architectural Services, concept & conclusion services in design, contract management services, and architectural consulting services. There are also Project Management Services that provides Economic Feasibility Study, Design Formulation, Program Sales, and Project Management Services. Last but not least, other services that the company provides are Construction Services, Construction Supply Services, Installation Services and others.

2.3 Company Organization Chart

Ampenan Tech



Encik Faiz Bin Othman, the General Leader of Ampenan Tech Sdn Bhd arranges meeting with client and inquiries about their dream house with their details. Usually, Encik Faiz usually set time and date at the site they're about to use, as well as the site's size. Puan Mazura Binti Othman, will be in charges of the company's financies. Puan Mazura will be in charges of calculating costs and overseeing all funding of each sites. She is also in charge of all internship funding, as well as the salaries of the staff and workers. Not to mention that the company's site supervisor, Nur Firyal Batrisha Binti Zahari, keeps track of the site's progress and keeps the company's social media up to date. She also serves as a source of information, signing paperwork as supplies arrive.

2.4 List of Projects

2.1 Completed Project

No.	Project Titles	Project Value	Start Date	Completion Date	Project Duration	Client
1.	Serkam	-	24/3/2021	1/12/2021	8 months 23 days	-
2.	Bukit Tembakau	<RM90000	28/8/2021	29/12/2021	3 months 4 days	-

2.2 Project in Progress

No.	Project Titles	Project Value	Start Date	Completion Date	Project Duration	Client
1.	Bukit Kepok	-	13/9/2021	-	-	-
2.	Tehel	-	25/5/2021	-	-	-
3.	Bukit Pulau	-	1/11/2021	-	-	-
4.	Tedung	-	29/12/2021	-	-	-

Chapter 3.0

INDUSTRIALSED BUILDING SYSTEM: PRECAST CONCRETE WALL

3.1 Introduction to the Case Study

Throughout my duration of internship in this company, I was involved in the project of bunglow house located at Jalan Bukit Tasek, Bukit Tembakau, Umbai, Merlimau, Melaka. The duration of this project is 2 years and the overall cost of the project isaround RM 90,000. The size of the site is 28'X 38' feet as the house has 4 rooms and 2 toilets.Figure 3.1 shows Architecture Plan of bunglow house at Bukit Tembakau.The location of the site was surrounded by bushes and houses. The accommodation near the site is accessible because there is a mini market nearby where supplies can be purchased. . There is also a mosque nearby the site. The activities that been carried out on the site were installations of Precast Concrete Walls. Figure 3.2 shows the bungalow house project was 40% completed.

There were also maintenance and repairs that been carried out located at UiTM Jasin. We were reached out by UiTM Jasin through our client's Bukit Kepok. We were shown 5 defects of UiTM Jasin's buildings which were Chiller Plant, Sub Station 2 that was located beside 'Pentadbiran', 'Pentadbiran' building, Sub Station 6 which was located beside library, and also 'Blok Kuliah'.

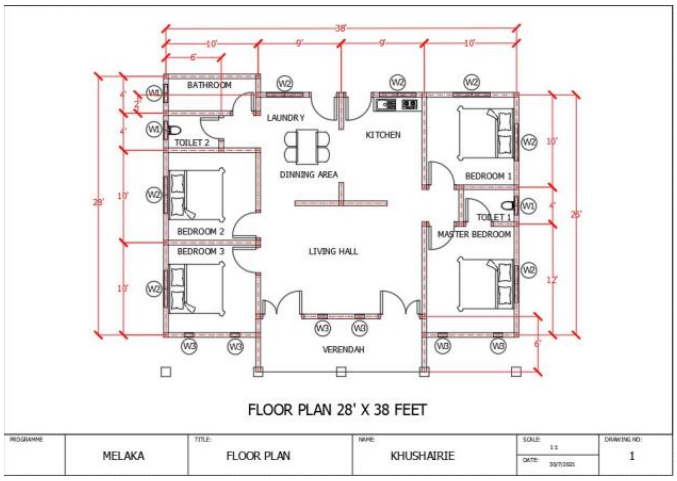


Figure 3.1: Key plan of site Bukit Tembakau

Figure 3.2: Project Bukit Tembakau at 40%

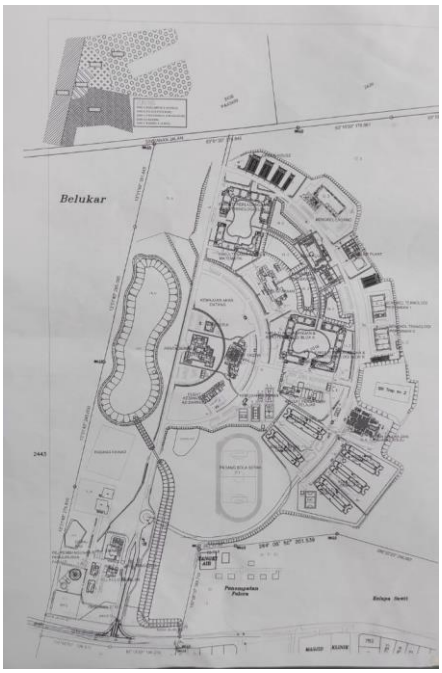


Figure 3.3: UiTM Jasin layout plan

3.2 To identify the variation of wall in Precast Concrete Wall (Masukkan 4 jenis wall dan terangkan)

In my practical period, I discovered that there are various of Industrialized Building System: Wall that were seen. There were 4 types of walls which were Curtain Wall, Load-Bearing Wall, Shear Wall, and formwork for cast-in place concrete. One of them was Precast Concrete as it was the most common IBS type. As Precast Concrete Walls, there were 4 types of walls which were Curtain Wall, Load-Bearing Wall, Shear Wall, and formwork for cast-in place concrete. The Curtain Wall was one of most common use in Precast Concrete Wall as building envelope. This type of walls doesn't transfer vertical loads but purposely encloses the space. Their design was only to resist wind, seismic forces generated by their own weight, and forced that required to transfer weight of the panel to the support. The examples of curtain walls were wall panels, window wall units, spandrels, mullions, and column cover. The load-bearing wall units were resisted and transfer loads from other elements and can't be removed without affecting the strength or stability of the building as load-bearing wall were act as the base for the building. The examples of load-bearing walls were solid wall panels, window wall, and spandrel panels. As for Shear Wall, it was used to provide lateral load resisting system as it's combined with diaphragm action of the floor construction. The effectiveness of Shear Wall was dependent upon panel-to-panel connections. There were also formwork for cast-in place concrete as the panels were act as a form providing the visible aesthetics of the system, while the cast-in place portion provides the structural components of the system.

By using Precast Concrete Walls, there were benefits that can be seen through. As one of the benefits was reducing cost as in construction wastage as the walls were made from simple materials and other cost such as labour costs, equipment costs, and overhead costs. Next benefit that were provided by Precast Concrete Walls was the construction became shorter as the walls were made inside factory while the walls can withstand all-weather. The components of walls were also easy to assemble and erected. The quality were also one of benefits as the walls were provided higher quality and better finishes due to production under sheltered environment and produced massively in the factory as the better quality reduced the maintenance expenses.

Figure 3.4: Installing Precast Concrete Wall required manpower

Figure 3.5: Precast Concrete Wall came in bundle.

3.3 To study the construction method of installation, maintenance and repairs on Precast Concrete Walls.

3.3.1 Construction Method of Precast Concrete Wall (Installation)

I discovered that there are processes required to start the installation. For installation of IBS Precast Concrete Wall, bottom track was nailed to the foundation of the site as a guide for placing the wall. By doing that, the wall will be placed based on the key plan. Next step was putting cement mixture to the bottom track as to make sure the walls stick to the base. The cement mixture contained SikaCeram 288-MY and Adhesive Cement. There were some wood

planks that been used to support the wall too. The wall was checked by using water level to avoid error on installation. Next step that been carried out was nailed the wall to the foundation by using Dowel bar that been shaped into number 7. The foundation was drill through bottom track by using power drill. Then, the 7-shaped dowel bar was nailed into the foundation and the side of wall. The next wall was applied with cement mixture as to stick the walls to each other. There was another type dowel bar that been cut into 7 inches and joint bar which were a R6 that shaped into stapler bullets were nailed into both of the wall as it will reinforce the joints between the walls. After jointing the walls together, fiber mesh was applied on the gap between the walls. There were also UCO jointing compound that was applied after fiber mesh net was applied as their purpose were strengthen the joints between walls. Both of the step can be seen in Figure 3.5 As for the last step, the accessories called top track were applied on the top of each walls as the top track will became the base for truss as it is shown in Figure 3.6.

Figure 3.6: Applying fiber mesh net and UCO jointing compound.

Figure 3.7: Applying top track to the wall

3.3.2 Construction Method of Precast Concrete Walls (Maintenance and Repairs)

As for maintenance and repairs of IBS Precast Concrete Walls, the problems were identified that were located at UiTM Jasin. There were some defects on the walls of Chiller Plant Building and Library which were located inside UiTM Jasin that shown in Figure 3.7. There were also defects that were identified behind 'Blok Kuliah' and behind Administer Building as shown in Figure 3.8 and Figure 3.9 The solutions for defects were carried out by using fiber mesh tape, silicone, and adhesive cement mixture. The purpose of using fiber mesh tape was to seal the crack of the wall while adhesive cement mixture sticks them together. The silicone was used for seal small cracks that can be seen with eyes. There was previous maintenance that been made but it was done properly as the cracks on the wall were sealed by using only cement mixture and doesn't use any binding material such as fiber mesh tape, or silicone. As the results, the defects were happened again.

Figure 3.8: Defects behind Chiller Plant building in UiTM Jasin

Figure 3.9: Defects behind 'Blok Kuliah' in UiTM Jasin

Figure 3.10: Defects detected behind Administer Building

3.4 To provide solutions to various challenge of installation on IBS

Any problems always have solutions. As on site, there were problems that commonly occurs as such the walls wasn't balanced based on water level, and others. Luckily, the workers were experienced as these problems can be solved by using stepping stone and supporting beam that been made out from wood planks. As by the action that been done, the walls will be strong and doesn't fall. There were also problems as the walls doesn't have any space to install windows and doors on the wall. As we know, there were many types of doors and windows such as sliding door, casement window, and others. The only solution that been used were cut the walls using machinery which was called Circular Saw by using figure 3.11 as reference. First, the wall was measured as to position the window or door using given measurement as shown in figure 3.10. But even with the machinery, it can't cut through the walls. The solution was by using Brick Cutting Hand Saw as it efficiently cut through the wall. This process was done before the walls were installed.

Figure 3.11: Worker measured the part to cut it

Figure 3.12: Worker cut the wall using Circular Saw

As for the next problem that always occurs on site were the walls doesn't have electrical holes as electricity is an important need in a house. The solution that been done were drawing the lines of electrical holes on the wall. The next step can be seen in figure 3.12 where the holes were shaped by using machinery called Grinder. As using the machinery, it cut the wall but it doesn't go through as the disk of machinery doesn't have wide diameter. Next was to make the holes as the electrical pipes went into the holes as it was shown in figure 3.13. It was done by using machinery called Hammer Drill as the machinery hacked through the walls. This step was done cautiously as not to overdone the hacking as avoiding to hack through the walls. The wires were protected by PVC pipes as the wires were made by fragile material and dangerous if it was exposed. After the holes been hacked, the wires with pipes were planted inside the holes and covered by cement as it can be seen in figure 3.14.

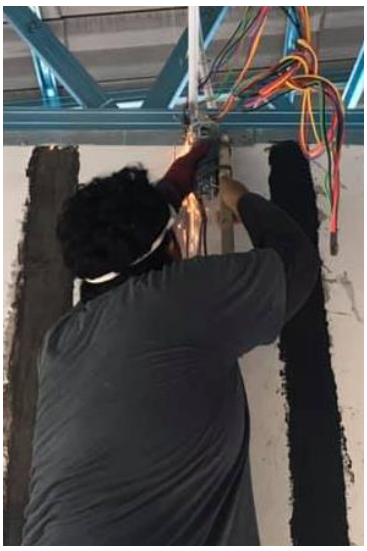


Figure 3.13: The walls were cut using Grinder

Figure 3.14: The holes were made using Hammer Drill

Figure 3.15: Closing the holes using cement

Last but not least, the problem was the walls were needed maintenance frequently as there might have problems on the installation that caused the defects of walls, or others. The maintenance sometimes took high maintenance depends on what type of maintenance have been done such as leaks from rooftops, wall cracks, damp ceilings, and others. Based on the practical learning, I learned the solution from workers. As for the leaks on rooftops, the problems were identified as the source came from either the gap between roof tiles, or there were holes on the roof tiles. The solution that been carried out were to replace the roof tiles as to prevent leaking again. As for wall cracks, the problem was being solved by spread silicone through the cracks and closed the cracks using fiber mesh tape as shown in figure 3.15. The silicones were act as glue between the cracks, and the fiber mesh tape was kept them together and as closing tape. Last step was to paint the wall back as it was shown in figure 3.16. The step was done as a finishing step. As for the damp ceiling, the problem came from the rainwater that been flowing the gap between the rooftiles as making it flowed to the top of ceiling. The solution for this problem was to replace it with new ceiling board. As the first step was to cut out the damp part of the ceiling, then make sure there doesn't other ceiling that been affected. Next step was to cut the new ceiling board as to fit in the damp part or took out the entire ceiling board and replaced it as it was shown in figure 3.17. After the ceiling was installed, the edges of ceiling board were sealed using fiber mesh tape as it strengthens them. After that step, it was shown in figure 3.18 as the sealed part of the ceiling was closed using Cornice Compound mixture as it acted as a binder on the fiber mesh tape. Last but not least, the ceiling was painted back as finishing touch.

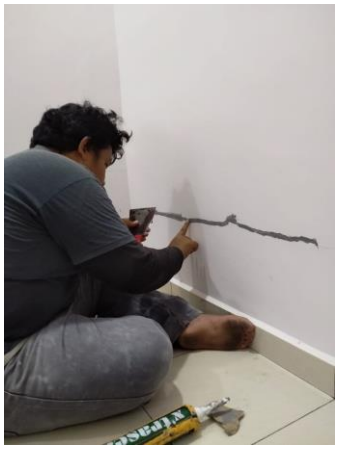


Figure 3.16: The cracks on the wall was closed using silicone

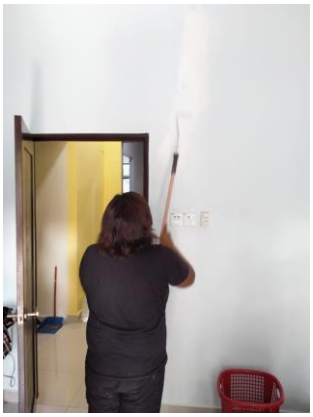


Figure 3.17: Painting the cracks after maintenance done.

Figure 3.18: Worker replaced the damp ceiling with new ceiling board

Figure 3.19: Worker covered the holes using Cornish Compound mixture

CHAPTER 4.0

CONCLUSION

Based on the case study, I discovered that Industrialized Building System is more efficient than Conversional System as the IBS took lesser time to finish, lower cost, less wastage, and better quality. The installation of the IBS walls was different as in the theory as it includes components that made it IBS. The walls that been used in the installation was UCO Solidpanel T75 which were new to construction as the walls were made from light weight concrete mix, metal studs, and UAC fiber cement sheets which is different from what I learned based on theory. The activities that been carried out were different as the installation on the theory was using Telescopic Crane while the installation that been carried out on the site was only using manpower as the projects were only 1-storey houses. As the problems that always occurs on the projects, it isn't too hard to solve as the solution comes with creative thinking. As the problems were also commonly happen such as unbalanced walls, leak rooftiles, damp ceilings and others.

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