



**DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)**

LIGHT WEIGHT CONCRETE PANEL WALL

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by

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LIGHT WEIGHT CONCRETE PANEL WALL

be accepted in partial fulfillment of the requirement for obtaining The Diploma in Building

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DECEMBER 2019

STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references are stated herein, prepared during a practical training session that I underwent at AZ Mega Plus Group Sdn Bhd for a duration of 20 weeks starting from 5 August 2019 and ended on 20 December 2019. 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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Last but not least, my special thanks to my beloved parents for their sacrifices over the years.

Thank you so much.

ABSTRACT

Nowadays, the construction of the building can be said to be vary rapid. All the construction emphasizes the time aspect of getting a project done in a timely manner. Therefore, the IBS method is used to save construction time. Therefore, this report discusses the IBS system for housing projects. The objectives of this report is to know how to install the IBS panel and the problems it encounters and the solution. It will focus on installation of light weight concrete panel that give a good housekeeping at site. The observations, interview session and also document reviews are used for references and to gain more knowledge. According to the project housing that started in 1960 by government using IBS , IBS system is not new things in Malaysia but this system not more emphasis, but the government already set in 2020, all government project especially will involve in IBS system. So that, all contractors should involve in IBS projects before 2020.

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CHAPTER 1.0 INTRODUCTION

1.1 Background and Scope of Study

The simplest form of the industrialized building system (IBS) was found in the United States of America, where steel beams were combined with precast slab panels and used in rapid construction of skyscrapers during the early part of the previous century. In Europe, after the devastation that resulted after the Second World War, several European countries adopted prefabricated system due to the intensive shortage in materials and human resources.

The prosperity and tremendous increase in the Malaysian population after the independence had resulted in increasing demand for housing. The conventional construction method was not enough to meet these demands due to the slow pace of construction and high cost (Agus 1997). Therefore, the Malaysian government took great efforts to adopt the IBS. The start was in the sixties of the last century, when the Minister of Housing and Local Government traveled to many European countries to study from their experience in the housing field. Subsequently, the government adopted two pilot projects. The first project was in Kuala Lumpur and the second was in Penang, both using precast concrete elements to build these high rise low cost flats (Din 1994).

A number of studies have written in the definition of industrialized building system. According to (CIDB 2003a), IBS can be defined as a construction system through which components are manufactured in a factory, on or off site, positioned and assembled into structures with minimal additional site work. Rahman and Omar (2006) mentioned in their study that industrialized building system (IBS) is a construction system that is built using pre-fabricated components. The manufacturing of the components is systematically done using machines, formworks and other forms of mechanical equipment. The components are manufactured offsite and once completed is delivered to construction sites for assembly and erection.

On the other hand, industrialization process in construction can be defined as mass producing all building components such as walls, floor slabs, beams, and columns and staircases either in factory or at site under strict quality control and minimal on site activities (Triksa 1999). (Warszawski 1999) have defined the industrialization process as an investment in equipment, facilities, and technology with the purpose of increasing output, saving manual labor and improving quality. (Sarja 2005) mentioned the IBS of buildings means the application of modern systematized methods of design, production planning and control as well as mechanized and automated manufacturing processes.

According to CIDB (2003b), from the structural classification point of view, there are five main types of IBS system used in Malaysia. The first type is a precast concrete framing, panel and box system which includes precast columns, beams, slabs, 3-D components (balconies, staircases, toilets, lift chambers), and permanent concrete formwork. The second type is a steel formwork system which contains tunnel forms, beams and columns molding forms, permanent steel formworks, and metal decks. The third type is a steel framing system which includes steel beams and columns, portal frames, and roof trusses. The fourth type is a prefabricated timber framing system which includes timber frames, and roof trusses. The last type is a block work system which includes interlocking concrete masonry units (CMU), and lightweight concrete blocks.

There are many types of IBS system. However, the aim of this is to discover the construction of the IBS light-weight concrete panel.

The study was at Kampung Kok Serai, Tumpat, a project with Program Perumahan Rakyat Termiskin (PPRT). PPRT is a program that helps repair Malaysian homes that live in poor and poor rural areas. The light weight concrete panel was used in this project. In this project, the installation of light weight concrete panel were studied. For example, before install the concrete panel, mark out the center line of the wall position then fix top metal track to structural support and bottom metal track onto the floor. Moreover, the duration of installation ibs system differently between conventional system. This is because conventional system used many materials than ibs system. In additions, the problems and solutions using ibs systems such as cracks were studied. Instead of it, the methods of conventional were not studied in this project.



Figure 1 Location of Pengkalan Kubor, Tumpat.
Source : Google Map

1.2 Objectives

- To determine the tools needed for the installation of wall.
- To investigate installation of light-weight concrete panel wall.
- To identify the problems and solution of light-weight concrete panel wall.

1.3 Methods of study

- 1) Observation – Observation were made by studying on how installation the light weight concrete panel, the tools and equipment needed and the problems of light weight concrete panel wall. The time taken to finish the installation was for 5days for house 660sqft. All the result of the observations were captured.
- 2) Interview – The interview had done by approach the labors by asking them how was ibs method, and the installation of light weight concrete panel. The interview had done at 10 September 2019 (Tuesday) at 5.00pm with Mr Saifudin, Project Management of UAC Berhad. It takes about 35 minutes for this interview session. All the interview session that had done been taken by taking notes. All the question have been prepared before the interview session.
- 3) Document reviews – The plan of the construction drawing and architectural drawing were used for references of this project.

CHAPTER 2.0 COMPANY BACKGROUND

2.1 Introduction of Company

AZ Mega Plus Trading began operations in August 2009 based in Kota Bharu. The start-up capital is only RM30,000 but with efficient marketing activities, since 2011 more than 200 projects involving various types of jobs have been implemented without any records left. Among the projects carried out include the supply of various types of goods, office and home renovation, contract house construction, steel-based work, aluminum and similar. The success of this project, with just 2 years of AZ Mega Plus Trading, stands strong in line with the core of sustainable infrastructure, technology and design development.

AZ Mega Plus Trading is owned by Mr. Mohd Zulhusni Bin Mohd Zamri.

Main Services of AZ Mega Plus :

Wood Based Furniture Work

Woodworking furniture, interior decoration, kitchen cabinet, wardrobe, cupboard and wall-drobe.

Aluminum and Mirror Works

Works include sliding, sliding door, partition, ceiling, PVC Door, roller shutter, curtain wall, railing, whiteboard.

Welding

Make grill, awning, railing, stainless steel, roof truss, iron warehouse etc.

Contracts Supply of various Goods and Contracts to the Department

Provides various goods and contracts especially to government departments such as MARA, Kelantan Air, HUSM, KADA, Ministry of Agriculture & Agro-based Industry, Department of Customs, Industrial Training Institute (ILP), National Housing Corporation (SPNB), Kota Bharu District Education Office (PPD) etc. We also supply various types of goods to the private sector.

MISSION & VISION

Company Vision :

- Become a leader for IBS approaching 2022 for construct bungalows.
- Is known as a contractor as the IBS leader.
- Targeted revenue will reach RM20,000,000.00 by 2022.
- Helping many contractors turn to IBS.
- Assist and appoint quality control vendor contractors with AZ Mega Plus.

Company mission :

- Reach 1000 house supply year with average cost RM15,000.00 with revenue RM15,000,000.00
- Housing project in construction & development RM5,000,000.00.
- Helping 10 consumer to have house RM300,000.00 revenue RM3,000,000.00.
- Ensuring the quality of the goods or products is enhanced and guaranteed.
- Open branches in Terengganu, Pahang, and Kuala Lumpur to help other contractors.

2.2 Company Profile



Figure 2 Company's Logo
Source: Courtesy of Az Mega Plus Group Sdn. Bhd.

Company Name : AZ Mega Plus Trading
Company Status : 100 % Bumiputera
Registration No. : KT 0264666 – M Syarikat
No. Gst / Cbp : 00311783488
Founder : Mohd Zulhusni bin Mohd Zamri
Business Address : Lot 1529 – A, Kampung Tapang, Jalan Hospital, 15200, Kota Bharu,
Kelantan.
Email : hr.azmegaplus@gmail.com
Contact no / Faxes :
Contact No :

Primary Bank : 1) Maybank, Cawangan Kota Bharu, Kelantan.
2) Bank Islam Berhad, Kubang Kerian, Kelantan.
3) OCBC Bank Kota Bharu, Kelantan.

Account No. : 1) 553104412765 (MBB)
2) 03018010163234 (BIMB)
3) 7551062476 (OCBC)

2.3 Organization Chart

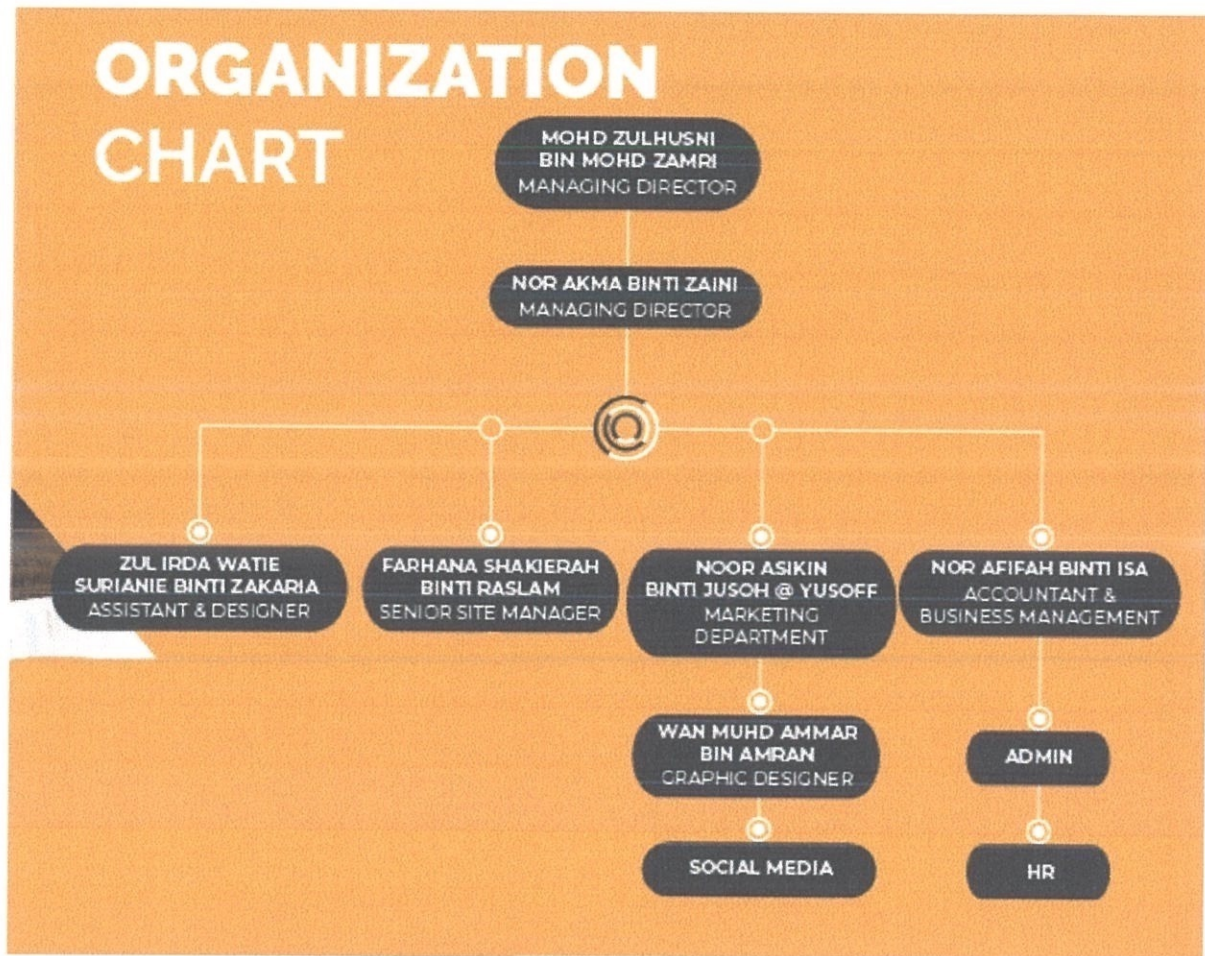


Figure 3 Organization Chart
Source: Courtesy of Az Mega Plus Group Sdn. Bhd. (2019).

2.4 List of projects

2.4.1 Complete Project

No.	Project Title	Contract Value(RM)	Date of Commencement	Client
1.	Projek Membaik pulih dan Menaik Taraf Loji – Loji dan Tangki Air Negeri Kelantan, LRA Kg Chap dan Air Tandak Jeram Pasu, Pasir Puteh, Kelantan.	1,700,000.00	2/01/2014	MMN Bina Sdn. Bhd
2.	Kerja – kerja Renovasi Pejabat Baru AKSB Kuala Krai serta lain-lain Kerja yang Berkaitan Dengannya..	125,000.00	25/05/2014	Stimbal Enterprise
3.	Projek Membina Dan Menyiapkan 2unit Rumah Penyelia (Berkembar) Panggung Lalat, Gua Musang, Kelantan Darul Naim	290,000.00	20/04/2019	Nadya Properties Sdn Bhd
4.	Cadangan Kerja-kerja Pengubahsuaian Ruang Dalaman Bagi Penempatan Baru Pejabat KWSP Kuala Krai, Kelantan	430,682.24	13/08/2019	Kumpulan Wang Simpanan Pekerja (KWSP)

5. Kerja – kerja Renovasi Pejabat Baru AKSB KBS, PT. 426, BLOK E, Pusat Perniagaan Bandar Baru Tunjung, Kota Bharu, Kelantan.	140,260.00	16/6/2015	Air Kelantan Sdn Bhd
6. Kerja- Kerja Renovasi Pejabat Baru AKSB Jeli, Desa No 1-A, Tingkat Bawah dan Tingkat 1, Lot Pt 6542, Mukim Jeli, Jalan Sungai, Jajahan Jeli, Kelantan.	120,000.00	15/10/2015	Stimbal Enterprise
7. Koperasi Kakitangan dan Keluarga Air Kelantan Berhad.	101,801.34	23/08/2016	Koperasi Kakitangan Dan Keluarga Air Kelantan Berhad

Table 1 List of completed projects.
Source: Courtesy of Az Mega Plus Group Sdn. Bhd. (2019).

2.4.2 Projects in Progress

No.	Project Title	Contract Value(RM)	Client/S.O
1.	Cadangan Membina dan Menyiapkan 2 Unit Rumah Berkembar 2 Tingkat, di atas Lot 63, Seksyen 17 Mukim Bandar Kota Bharu, Daerah Kota Bharu, Kelantan	395,000.00	Pn Tahirah binti Abd Rahman
2.	Cadangan Membina dan menyiapkan pagar bagi sebuah rumah kediaman Batu 1 Tingkat di atas Lot PT 19894, Mukim Nibong , Jajahan Tanah Merah, Kelantan	5,600.00	En. Arifullah Bin Zakir
3.	Cadangan Membina dan Menyiapkan 1 unit Rumah Kediaman Batu di atas Lot 741, Mukim Gajah Mati, Bachok, Kelantan.	346,466.00	SF Shafa Trade

4.	Cadangan Membina dan Menyiapkan Iunit Rumah kediaman Batu atas Lot 15583, Daerah Melawi, Bachok, Kelantan.	246,114.00	SF Shafa Trade
5.	Cadangan Membina dan Menyiapkan Iunit Rumah Kediaman 1 Tingkat diatas Lot 839, Mukim Jeli, Jajahan Jeli, Kelantan	250,000.00	SF Shafa Trade
6.	Cadangan Membina dan Menyiapkan Iunit Rumah Banglo 1 Tingkat di atas PT 2082, Mukim Machang, Jajahan Kota Bharu, Kelantan	345,000.00	SF Shafa Trade

Table 2 List of projects in progress.
Source: Courtesy of Az Mega Plus Group Sdn. Bhd. (2019).

CHAPTER 3.0 CASE STUDY

INDUSTRIALIZED BUILDING SYSTEM (IBS)

LIGHT WEIGHT CONCRETE PANEL WALL

3.1 Introduction to Case Study

The study was at Kampung Kok Serai, Tumpat. This project was Program Perumahan Rakyat Termiskin (PPRT). Az Mega Plus Group Sdn Bhd as a mentor of IBS (Panel Wall Concrete) for PPRT in Kelantan and Terengganu. PPRT is a program helps repair Malaysian homes in poor and poor rural areas. The light weight concrete panel was used in this project. The main course was teaching the workers how to install the panel wall, the tools that need to be prepared by the contractor before installation, and follow up of the progress work. In figure 4, the location to Kota Bharu (main city) about 30 minutes.

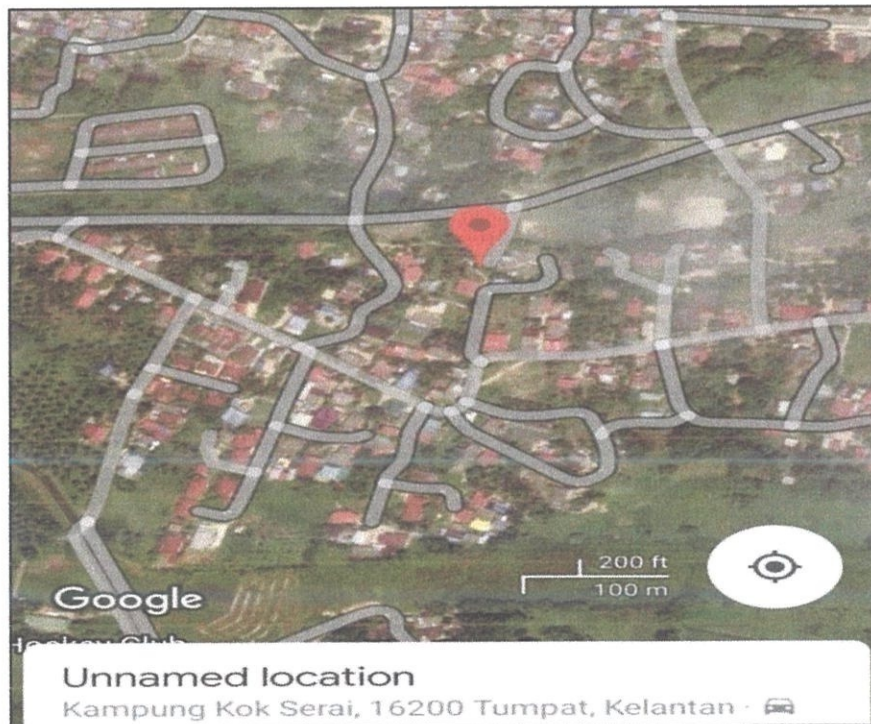


Figure 4 Location of PPRT site
Source : Google Maps

This project for 1 unit house currently RM45,000.00 . It was the cheapest price in construction work for 1unit house with 660sq/ft.

3.2 Installation of Light Weight Concrete Panel

3.2.1 Marking point



Figure 5 Manual Ink Marker.
Source : Google Image

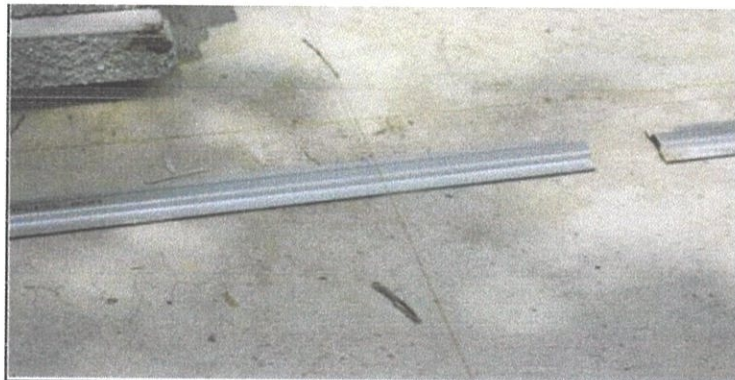


Figure 6 Bottom track.



Figure 7 Nailing the bottom track.

First, in figure 5, start marking the line by using manual ink marker to make sure the permanent marking at floor for easy to place concrete panel wall on the bottom track. After that, install the bottom track and make sure the bottom track is straight with line that already marking before as shown on figure 6. As figure 7, nailing the bottom track using concrete nail with 2.5 inches. At the corner line, cut off the excess bottom track and when at position door frame, the bottom track not installed . The bottom track only installed when there have panel on it.

3.2.2 Apply the sika cream on concrete panel wall.



Figure 8 Apply Sika Cream 288

After that, in figure 8, apply the sika cream 288 at side of panel wall. Before that, blended the sika cream with water using “whisk” to make sure the particles from sika cream can be destroyed that will give strength. Paste full the Sika Cream 288 on panel one side only.

3.2.3 Installation of panel wall.



Figure 9 Installing panel wall.

In figure 9, lift up the panel wall vertically on the bottom track that had already apply sika cream 288. After that, push the panel wall using rubber hammer to make sure there are no gaps between panel to panel. After that, support the panel wall using the wood (1 x 2) . This is because to make sure the panel wall is not fall.

3.2.4 Marking and cutting the panel wall for opening.

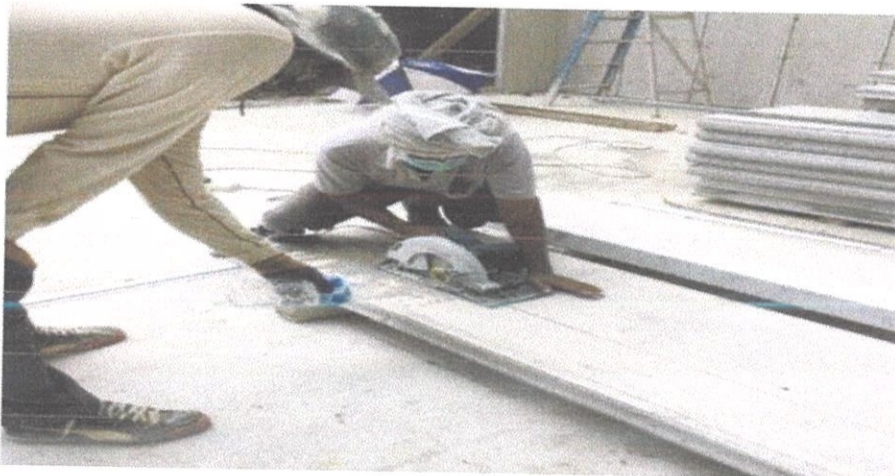


Figure 10 Cut the panel.

Then, cut the panel using circular saw according to the approved drawing size as shown on figure 10. Make sure the size of diamond cutting disc 9 inches to make the cutting process easier.



Figure 11 Fix the panel.

Apply the sika Cream 288 on panel for one side then install the panel that have already cut by following the measuring on plan.

3.2.5 Locking the panel wall.



Figure 12 Drilling the bottom track.

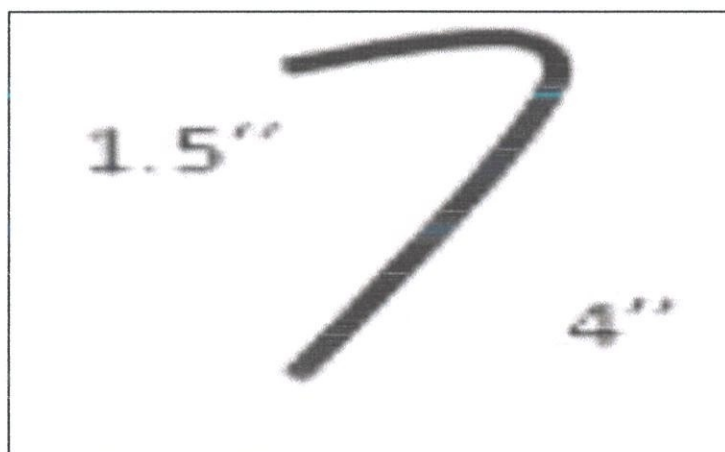


Figure 13 High Tensile Steel.

Source: Courtesy of Az Mega Plus Group Sdn. Bhd. (2019).

In figure 12, drilling the bottom track using power drill impact (4 inches) and locking the panel using y10 that already bend as shown on figure 13.



Figure 14 Locking the panel.

Next, locking the panel using y10 as shown on figure 14 using hammer every each of panel.



Figure 15 Stapling each panel.

Next, stapling the between panel using R6 like figure 15. This to give more strength to the panel when stapling between panel.



Figure 16 Locking panel from top.

Moreover, locking the top panel using Y10 as figure 16. When locking at the top, the probability to have crack can be decreased.

3.2.6 Skim coating the panel.



Figure 17 Skim coating the jointing.

Lastly, skim coating the jointing between the panel using skim premium grey as shown on figure 17. Skim-coating can rescue a wall with numerous hairline cracks.

3.3 To determine the tools and that needed before starting installation panel wall.

All the tools needed to be prepared. It is important that correct tools are available to carry out the works, otherwise there may be delays, or attempts to carry out the works with an inappropriate tool which can cause damage, improper installation or safety issues.

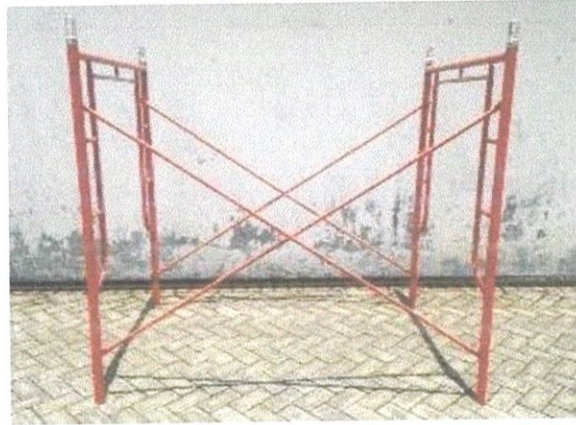


Figure 18 Scaffolding
Source : Google Image

Firstly, set up two sets of scaffolding. Scaffolding used for providing support on height and provides materials during a construction process for locking at the top panel.

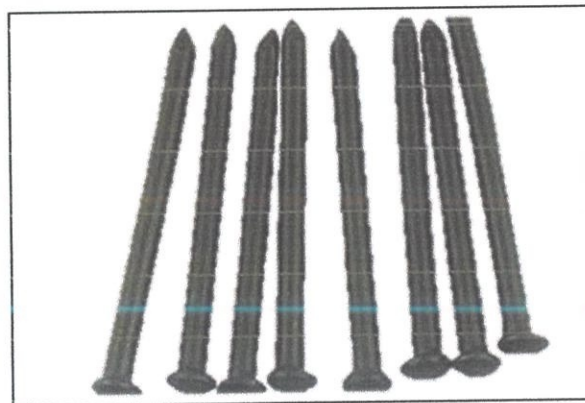


Figure 19 Concrete Nail.
Source : Google Image

Secondly, 2 boxes of concrete nail 2" was used to nail the bottom track. The size of the concrete nail was 2 inches. The nog was not used because cannot penetrate the bottom track.



Figure 20 Power Drill Impact
Source : Google Image

Next, 1 sets of power drill impact was used to screwing the hole between the bottom track and the beam about 4 inches (depth).



Figure 21 Circular Saw
Source : Google Image

Moreover, circular saw used to cut the panel. When using this saw, make sure the size of diamond cutting disc was 9 inches. This to make when cutting the panel, there were no rotate the panel and make it more easier and faster when using 9 inches of diamond disc.



Figure 22 Hand Held Diamond Blade
Source : Google Image

In addition, the hand held diamond blade used to cut the mild and high tensile steel. This cutter was easy to handle besides speeding up the work.



Figure 23 Sika Cream 288
Source : Google Image

Besides, eight bags of sika cream used to bonding between two panels. Blend the sika cream when to use it using powered drill whisk. This to make sure to give effective to the sika cream when applying to the panel.



Figure 24 Skim Premium Grey
Source : Google Image

Last but not least, eight bags of Skim Premium Grey also used to skim coat the jointing panel. The function using this was to reduce the cracks at the panel. Neatly process need to be done at this stage.

3.4 Problems and solution of light-weight concrete panel wall.

3.4.1 Problem

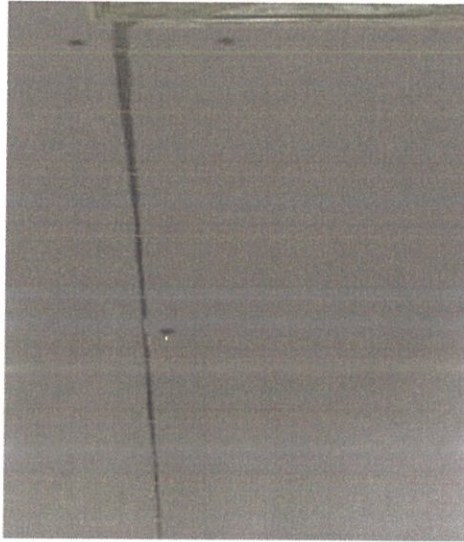


Figure 25 Gap between the jointing panel wall.

Problem installation panel wall concrete was when the labour cut the panel wall in manual cutting it make the between the panel wall have a gap. When installed, it will be not in the smooth surface in figure 25.

Solution



Figure 26 Applying Skim Coat

Use the sika cream 288 to cover the gap because it can protect the panel wall from the cracked. To more cover, used the skim coat after applying the sika cream with three layer of skim coat to make the surface of the gap will be in smooth surface as in figure 26.

3.4.2 Problem

Next, the problem was cracking. Cracking most commonly related to the improper use of raw material with specification or there is lacking of skills and careless mistakes during the procedure for quality control.

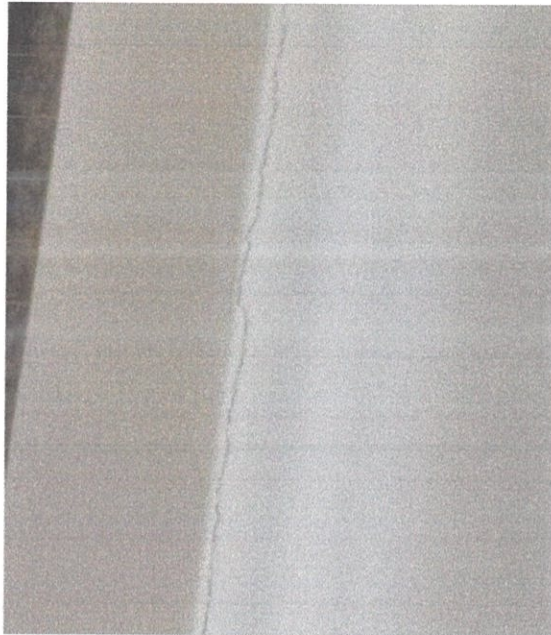


Figure 27 Cracking on wall.

Solution



Figure 28 Filled the crevice with filler

Fill the crevice with a filler compound prior to taping with joint compound. Fill the crack until it is flush with the existing wall. Cover with tape and joint compound, as outlined previously, to achieve a smooth wall.

CHAPTER 4.0 CONCLUSION

4.1 Conclusion

In a conclusion, the concrete panel wall was the one of the method Industrialized Building System (IBS). For Projek Perumahan Rakyat Termiskin (PPRT), method that used was light weight concrete panel. All the process installation must be prepared by the tools and equipment first. The workmanship should follow all the instruction of installation light weight concrete panel.

The aim of using light weight concrete panel wall for (PPRT) was to make sure the duration of the construction can be faster than conventional system. So, budget from government reduced from RM56,000.00 (conventional system) to RM45,000.00 (ibs). Besides, using this method also can make sure housekeeping become more organized. The raw materials such as cement, sand, and aggregate were reduced using this method.

The problems of this method were not truly major because there were solution. The problems such as cracking was common defect in the construction. For this project, the cracking happened because lack of control joints. When the workmanship control the jointing, the cracking will solve.

In a nutshell, a light weight concrete panel wall was completely suitable used for Projek Perumahan Termiskin (PPRT) because give more benefits for contractor in terms of profit, duration of work and budget.

REFERENCES

- Maryam Qays Oleiwi, (2015) Industrialized Building Systems, Master Study in Universiti Tenaga National (UNITEN), Malaysia.
- Trikha, D.N., (1999) Industrialised Building System : Prospect in Malaysia, Proceeding World Engineering Congress.
- Agus, Mohd. Razali (1997) Historical Perspective on Housing Development . In: Cagamas Berhad ed. Housing the nation: a definitive study. Kuala Lumpur: Cagamas Berhad.
- Warszawski, A (1999) Industrialised and Automated Building System, Construction Industry Development Board Malaysia (CIDB), Kuala Lumpur, Malaysia.
- Wee, E. C. (2006) Application of Acotec Industrialized Building System in Malaysia's Construction Industry. Master thesis, Universiti Teknologi Malaysia.

APPENDICES

