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

BRICK WALL CONSTRUCTION OF SINGLE STOREY HOUSE

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It is recommended that the report of this practical training provided

By

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(WALL CONSTRUCTION OF A SINGLE STOREY HOUSE)

Be accepted in partial fulfillment of requirement has for obtaining Diploma in Building.

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(PERAK)

FEBRUARY 2022

STUDENT'S DECLARATION

I declare that this report is my original work, except in the case of extracts and summaries for which the original references are given, completed during the practical training sessions I went through at SPNB KELANTAN for duration 20 weeks starting from 23 August 2021 and ended on 10 January 2022. It is submitted as one of the prerequisite requirements of BGN 310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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ABSTRACT

A wall is a structural feature that divides or encloses a space and, in building construction, forms the room or building's perimeter. Traditional masonry construction required exterior walls to support the weight of floors and roofs, but modern steel and reinforced concrete frames, as well as heavy timber and other skeletal structures, only require exterior walls for shelter and sometimes do away with them entirely on the ground floor to allow easier access. This report will discuss about wall construction. This report was conducted for The Construction of Single Storey House at Kampung Kadok Dalam 16450 Ketereh Kelantan. The objective of this report is to analyze the construction of wall and the way how it carried out. It will focus on the whole process of wall construction. It also investigate the equipment and machinery in the methods of wall construction and to determine duration that have been used for the construction. This report will also look to at the problem and the solution in wall construction that would fulfill the criteria of wall.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF STUDY

A wall is a structure and a surface that defines an area, supports a load, offers security, shelter, or soundproofing, or is aesthetically pleasing.(William Dwight,1901)

A wall which doesn't help the structure to stand up and holds up only itself is known as a non-load bearing wall.(Tanzila Bhuiyan,2020). It doesn't support floor roof loads above. It is a framed structure. The majority of the time, they are interior walls that separate a structure into rooms. They are built lighter. One can remove any non-load bearing walls without endangering the safety of the building. Non-load bearing walls can be identified by the joists and rafters. They are not in charge of the property's gravitational support. It is inexpensive. This wall is known as the "curtain wall.(Hughes, 1990).

Non load bearing walls, used where loads are carried by girders, beams, or other members, are called curtain walls, they are attached to the frame members. Any durable, weather-resisting material glass, plastic, metal alloy, or wood may be used, since nonbearing walls are freed from the limitations of structural requirements. (Tanzila Bhuiyan, 2020)

There are such type of non load bearing wall. The type is Hollow Bricks Wall, Hollow, Concrete Block Wall ,Facade Bricks Wall, Brick Walls. Hollow Bricks, We are enjoying natural life. These will reduce the use of heating and refrigeration equipment. They are well-used and reliable. Hollow bricks are productive on the bill. These hollow clay blocks are an advancement in the building field. (Tanzila Bhuiyan, 2020)

Hollow Concrete Block. The concrete building walls are rendered empty. It has a great power advantage. It gives stability, without any material waste. Concrete blocks consist

of Portland cement and aggregate, sand and gravel can be used in the high-density blocks, whereas low-density blocks use industrial waste instead of aggregate. Lightweight blocks are constructed from aerated concrete. Hollow concrete blocks are created, cured, and healed until they reach the site and are a very durable and strong material. (Tanzila Bhuiyan, 2020)

Facade Bricks. It is strong, robust, and almost maintenance-free. In this brick, shades don't sacrifice their radiance. The bricks on the exterior are environmentally sound and reusable. (Tanzila Bhuiyan, 2020). Brick Walls: It is a block or wall made of brick which is immovable. Brick walls are easy to mount. (Tanzila Bhuiyan,2020.)

Applications of Non-Load Bearing it doesn't fit overloads on the ground-roof. The structural framing method is not an integral part of this. One can remove any walls bearing no-load without losing the safety of the house. The joists and the rafters will classify walls that are non-load bearing. They are not responsible for aiding the gravity of the land. Most of the time, these are internal walls designed to separate the floor into spaces. They are made lighter for taking down the dead load of the structure.(Tanzila Bhuiyan, 2020)

There are many types of non load bearing wall in theoretically. However, the aim of this report is to discover the masonry/brickwall process in the construction

1.2 OBJECTIVE

There are several objectives have been developed from this construction as follow:

- i. To identify the methods of masonry wall construction
- ii. To determine the duration of wall construction process
- iii. To identify the problem and solution in wall construction

1.3 SCOPE OF STUDY

Will covers the wall construction process of a single storey house located at LOT 14898 Mukim Kadok, Kampung Kadok Dalam 16450 Ketereh Kelantan. The project had started in 15 september 2021 and will be completed on 15 december 2021. It is construction of One Storey Building House called RUMAH MESRA RAKYAT and cost RM75000. The project is still under progress. It will entirely forecast on the construction of the brick wall of the building. As a result, the research will cover not only the method of wall bricklaying, but also the benefits of stretcher bond in building, wall finishes, and technology and tools. In addition, this study included the problems and solution. During the construction process the progress also observed the manpower, cost and duration with quick references to document such as construction plan and contract document of the projects. Observation, interview, and document reviews are the three approaches that must be used in order to complete the data. Finally, all further explanations pertaining to the preceding procedure were provided as follows.

1.4 METHOD OF STUDY

1. Observation

Observation is a method of gathering facts through observation. The observation pertains to the wall construction process, which begins with bricklaying process and ends with the wall finishes. The average time spent on this observation is about 2-3 hours, however this is simply for the bricklaying procedure, which varies depending on the length of the wall. Overall, it took 3-4 weeks for the bricklaying process but It depends on the complexity of the build, the design and purpose of the wall, the weather, location, and workmanship. This make it took around 3 to 4 weeks to complete all the finishes process for the interior and exterior wall. A smartphone was used to record the wall-building process, as well as some notes.

2. Interview

The interview is one of the methods for gathering construction data by conducting a structured or semi-structured interview with a project's trusted person. It was completed while making observations and working on the job site. The interview was held with the firm manager, who is also the contractor in charge of managing the project on the job site. Workers who were working on brick ties at the construction site were also interviewed. Every week in the office, semistructured interviews with the contractor in charge of the project were performed, which lasted about 10 - 15 minutes on average. Short notes were taken during the semi-structured interview.

3. Document review

Company profile, construction drawing, standard operating procedures (SOP), progress report, and images taken by other personnel are among the documents reviewed to collect all of the data for the construction. The drawing design will be utilised as a reference at the site where the brickwork process is being monitored. During document evaluations, photos that belong to others are also the finest reference. In most cases,

document evaluations will take 30 minutes per drawing plan per week. This material has been submitted in the office for evaluation.

CHAPTER 2.0: COMPANY BACKGROUND

2.1 Introduction of company

SPNB was established under the Ministry of Finance (MOF) on 21st August 1997. Its establishment is none other than to provide quality and sustainable affordable housing to every family in Malaysia in line with the National Housing Policy. On 2002 SPNB introduces the Terengganu Fishermen's Family House Scheme. The program is designed to help low -income groups, especially fishermen, to build houses on their own land. The government bears a subsidy of 1/3 of the house price to ensure the price is affordable. The program was later changed to Rumah Mesra Rakyat (RMR). Since then, SPNB has completed more than 40,000 RMR units. The National Disaster Management Agency - NADMA (formerly known as the National Security Council) has appointed SPNB as the implementation agent to provide homes for flood and tsunami victims in Kedah, Penang and Aceh on 2004. On 2008 NADMA has appointed SPNB again to develop houses for flood victims in Johor, Pahang, Kelantan and Sabah. Won the Best Affordable Home Developer at the Property Insight Prstigious Developer Award (PIPDA) 2016.MOU with CIDB to implement a Quality Assessment System for Building Construction Works (QLASSIC) to measure the quality of construction projects.

2.2 Company profile

SPNB KELANTAN located at SPNB KOTA BHARU, 5231e, Jalan Hamzah, Bandar Kota Bharu, 15050 Kota Bharu, Kelantan

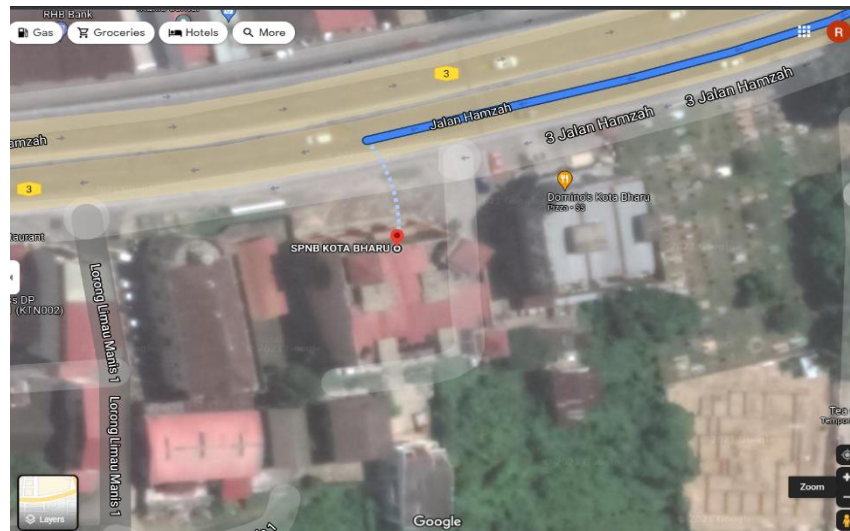


Figure 2.1: location of the company based on the satellite map

SYARIKAT PERUMAHAN NEGERA BERHAD known as SPNB responsible for the Rumah Mesra Rakyat (RMR) and Kediaman SPNB projects. Offering a wide range of housing that prioritizes a sustainable environment for its residents, it has built over 42,000 affordable housing units since 2002. The RMR program was created to help low-income groups such as fishermen, farmers and poor families who do not have a house or live in dilapidated houses but have land to build their own houses. SPNB also has another scheme called "KEDIAMAN SPNB" which emphasizes a sustainable environment and a harmonious atmosphere for its residents with various attractive facilities.

2.3 Organizational chart

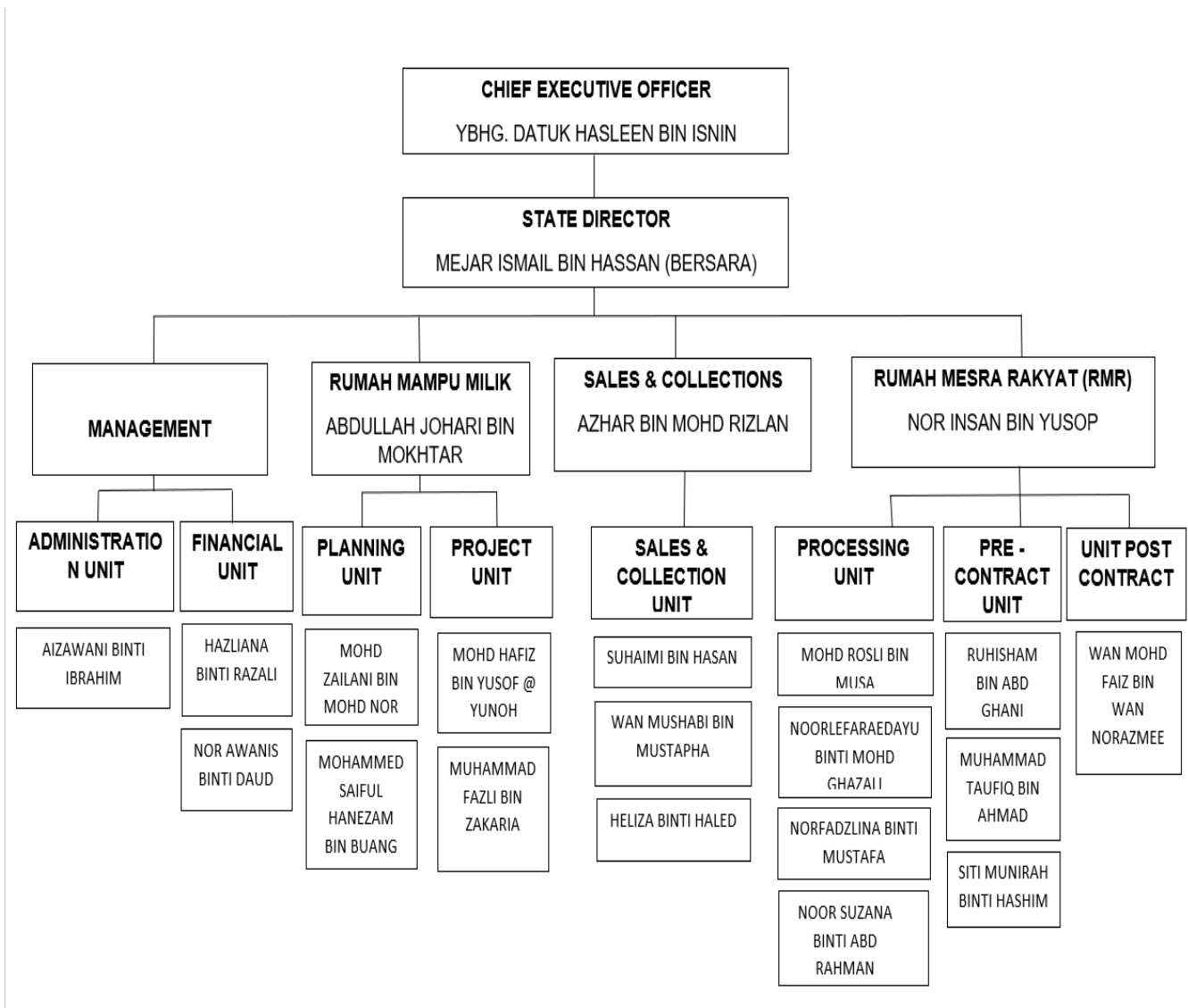


Figure 2.2: SPNB KELANTAN Organizational chart

2.4 List of project

2.4.1 Completed project

list of projects that have been developed by SPNB KELANTAN as shown in table 1 below

Table 2.0: Completed project

NO	PROJECT TITLE	PROJECT VALUE	START DATE	COMPLETION DATE	PROJECT DURATION
1	TAMAN BATOR HARMONI (BACHOK)	Twenty two million Malaysian Ringgit (RM 22,000,000.00)	2 July 2009	18 August 2011	2 years
2	TAMAN PERISAI WIRA (KUALA KRAI)	twenty -four million six hundred thousand Ringgit Malaysia (24,600,000.00)	7 may 2007	18 September 2010	3 years
3	TAMAN BATOR HARMONI (KOK LANAS)	seventy -two million, five thousand three hundred and ninety -nine Malaysian Ringgit (RM72,005,399.00)	<u>Phase 1</u> 18 may 2010 <u>Phase 2</u> 18 march 2013	<u>Phase 1</u> 31 may 2013 <u>Phase 2</u> 10 October 2013	3 years
4	TAMAN SRI BAYU TUMPAT	Phase 1 Forty -four million, four hundred and fifty -three, two hundred and fifty Malaysian Ringgit (RM44,453,250.00) Phase 2 thirty -seven million, three hundred and thirty - nine thousand six hundred Malaysian Ringgit Phase 3	<u>Phase 1 (A)</u> 12 November 2008 <u>Phase 1 (B)</u> 12 November 2009 8 August 2012 25 May 2015	Phase 1 (A) 15 August 2014 <u>Phase 1 (B)</u> 30 Jun 2015 31 December 2015	6 years 6 years 3 years 2 years

		Thirty one million Ringgit Malaysia		21 September 2017	
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2.4.2 Project in progress

Upcoming projects and project under construction as per table 2 below

Table 1.1: Ongoing project

NO	PROJECT TITTLE	PROJECT VALUE	START DATE	COMPLETION DATE	PROJECT DURATION
1	APPARTMENT MADINAH AL-SALAM, ISLAMIC CITY, TUNJUNG	Thirty -three million, four hundred and seventy thousand Malaysian Ringgit	13 December	In construction	
2	RUMAH MESRA RAKYAT	Seventy five thousand Malaysian ringgit	15 September	In construction Seventy five thousand Malaysian ringgit	Should be 3 month

CHAPTER 3.0: CASE STUDY

WALL CONSTRUCTION OF A SINGLE STOREY HOUSE

3.1 INTRODUCTION OF CASE SYUDY

The case study is about bricklaying wall construction. The project where has started the construction in 15 September 2021 and predictions will be completed on 15 Dicember 2021. Construction cost seventy-five thousand Ringgit Malaysia (RM75000). Currently, the project is still in progress. As a result, the study will be presented not only in terms of installation, but also in terms of machinery and tools, time spent on the project, and the construction problem and solution. . Nevertheless, the study do not concentrate on cost matters and manpower. The site location took place at LOT 14898 Mukim Kadok, Kampung Kadok Dalam 16450 Ketereh Kelantan.

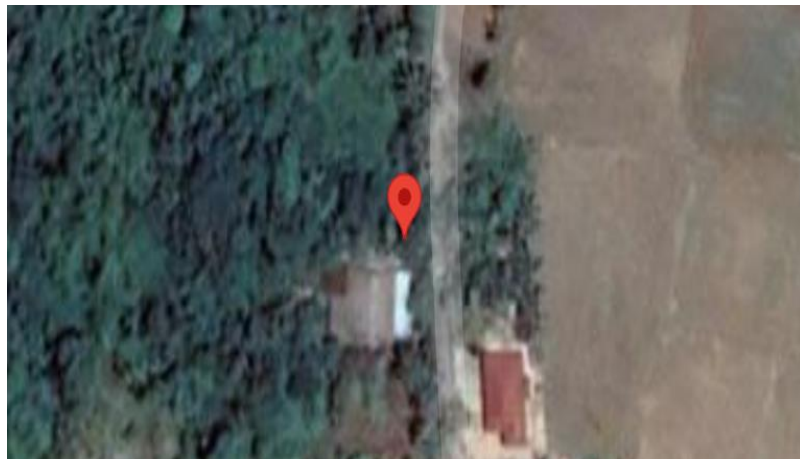


Figure 3.1: site location

<https://www.google.com/maps/@6.0449962,102.2391454,770m/data=!3m1!1e3>

The project construction located at LOT 14898 Mukim Kadok, Kampung Kadok Dalam 16450 Ketereh Kelantan. The area is quite secluded as it is still surrounded by forests. The main buildings close to this construction area are Madrasah, There are also existing residential areas near the construction area.

Bricklaying activity is one of the operations that has taken place on the site. To achieve proper wall bonding, this difficult task must be handled by trained employees. There are also several unskilled workers that help mix the mortar and bring it with the bricks to the construction site to save the time of bricklaying process. The machineries and tools that involved in this construction are wheelbarrow, trowels, hawks, scaffolding, spirit levels, concrete mixers, brick bolsters, bucket, brick line and pins, brick hammer, shovels and measurement tape.

Next, time is very important for the success of a construction. By referring the drawing plan of the building, the length of the building is 13947mm and width was 7297mm. The building of this house has 3 rooms and 2 toilets. Besides, there was also living area, dining area, and kitchen area. The columns and beam must be completed before beginning the bricklaying work.

3.2 METHOD OF MANSORY WALL CONSTRUCTION

PLAN OUT THE WALL



Figure 3.2: cement brick that use in the construction

First, plan out the wall by referring to the floor plan and elevation plan for the length and height of each wall in the building on the drawing plan. The length of the building was calculated based on the value stated in the floor plan. While the height is measured from the top of the ground beam to the roof beam referring to the drawing plan. After planning and calculating the amount of brick required with a calculator, go to the hardware store and purchase the appropriate type and quantity of brick. The types of brick that used in the construction is cement brick with 21cm length, 9.5m width and 6.5m height.

FLOOR CLEANSING



Figure 3.3: the floor that has been cleaned before start the bricklaying process

With a wire broom, the floor was swept, and all extraneous items were removed from the area where the bricks would be fastened. Clean floor surfaces are critical in the tying brick wall procedure because they make it easier for workers to tie bricks on a flat surface and avoid impediments. When the floor was already clean, it was simple for employees to put all of the bricks on it.

LIFT THE BRICK



Figure 3.4: the brick lifted at the construction work

Workers will use a wheelbarrow to transport bricks from the stockpile to the working site, making the bricklaying work easier and saving time.

MIX THE MORTAR



Figure 3.5: mortar are mixed using concrete mixer

Some employees use a concrete mixer to mix cement mortar with a mortar ratio of 1: 3 (cement: sand). These 1: 3 mortars will be used to bind the bricks together. After mixing the mortar with the concrete mixer with a shovel, the mortar was placed inside

concrete buckets and transported to the wall building site. To save time, this worker will mix mortar while another person lifts the bricks.

PIN AND LINE



Figure 3.6: string that pinned together

A thread was fastened in between two columns of the structure to mark the line for the bricklaying wall. Strings are installed at every distance of one meter on column of the building from the floor level to the roof beam. It is a guide to facilitate the work of brick bond either vertical or horizontal

WALL BRICKLAYING PROCESS



Figure 3.7:bricklaying process

Using a trowels and hawks, a small bed or mortar for the first coated bricks is laid out on the floor. Then, using the trowel, a small amount of mortar was applied to the top

of the first brick, and another brick was set on top of it at a downwards angle, guided by the line from the strings fastened in between the wall's columns. After stacking, the bricks are trapped using a trowel handle to level the position of the bricks. Then, using the trowel, a slab of mortar was applied to the end of the brick and pushed against the first lay of brick.

Brick bond, the third layer should be the same as the first layer, the arrangement of the same brick as the third layer. The fifth layer as a layer on the first layer. The sixth layer as a layer on the fifth layer

EXMET



Figure 3.8: exmate wire in the layer of brick wall

(Macro-Mesh: Expanded Metal Malaysia,)

After every three layers of bricks were laid, exmet wire was installed on the layer of the brick wall based on the length of the wall to absorb stress and vibration in the building and prevent the wall from collapsing. The process was continued until the wall reached the roof beam's height. Scaffolding was utilised to aid workmen who were laying bricks at the top of the wall. To make the wall look neater, any extra mortar was scraped away using a trowel. Stretcher bond is the type of bonding that used for the construction of this wall.



Figure 3.9: the window opening part of the wall



Figure 3.10: the door opening part of the window

LINTEL



Figure 3.11: the lintel use for load support for opening part of the wall

A lintel is a horizontal structural support that spans a gap in a wall or connects two vertical supports. It is typically utilised above windows and doors, which are both vulnerable places in the framework of a building. Lintels are typically used to support loads, although they can also be decorative.

After measuring the length of the opening that was indicated inside the design plan, the opening parts such as windows and doors were left empty for the windows and doors frame. To sustain the load from the roof, bricks will be set at the top of the lintel that is fixed at the top of the opening portions.

PLASTERING WORK



Figure 3.12: the plastering work to exterior wall had been taken

Work from top to bottom and right to left when putting plaster to the wall. Spread the mortar evenly around the wall. Start at the bottom of a brick and spread the plaster upwards roughly two to three bricks, using the brick lines as a guide. Continue to plaster the wall until it is completely covered.

The wall was cleaned and free from dust and any loose parts of mortar from bricklaying process. The water were sprinkled over the surface of the wall to ensure better sticking of the plaster

3.3 CALCULATE THE LENGTH OF TIME IT TAKES TO BUILD A WALL OF BRICKS

Construction contracts provide a completion date. Most construction contracts provide a deadline for completing the tasks outlined in the contract. This is not the date by which all obligations under the contract have to be discharged, but the date by which 'practical completion' must be certified. That is, the date by which the works will be completed and the client will be able to take possession of the site, despite the fact that there may be small items outstanding that do not impact the client's beneficial occupancy.

It depends on the complexity of the construction, the wall's design and purpose, the weather, the location, and, of course, the individual. The 'output rate' or 'output' refers to the number of bricks laid every day. In order to provide more trustworthy estimates of durations, outputs can be paired with a unit of time.

The work of laying bricks has been delayed due to rain on the east coast during the monsoon season. Besides, manpower shortages due to the covid-19 pandemic and need to follow standard operating procedure (SOP) set by the government. This project was expected to take two weeks, but it required an additional three to four weeks to complete the wall construction without plaster finishes. This is due to a number of obstacles that have occurred as described

The bricklaying process for The Construction of One Storey at LOT 14898 Mukim Kadok, Kampung Kadok Dalam 16450 Ketereh Kelantan started from November 5 until December 1. The time of bricklaying wall process recorded by observation and the pictures took by a smartphone. Floor and elevations plans used as references during the brickwork process to get the measurement of the brickwall.

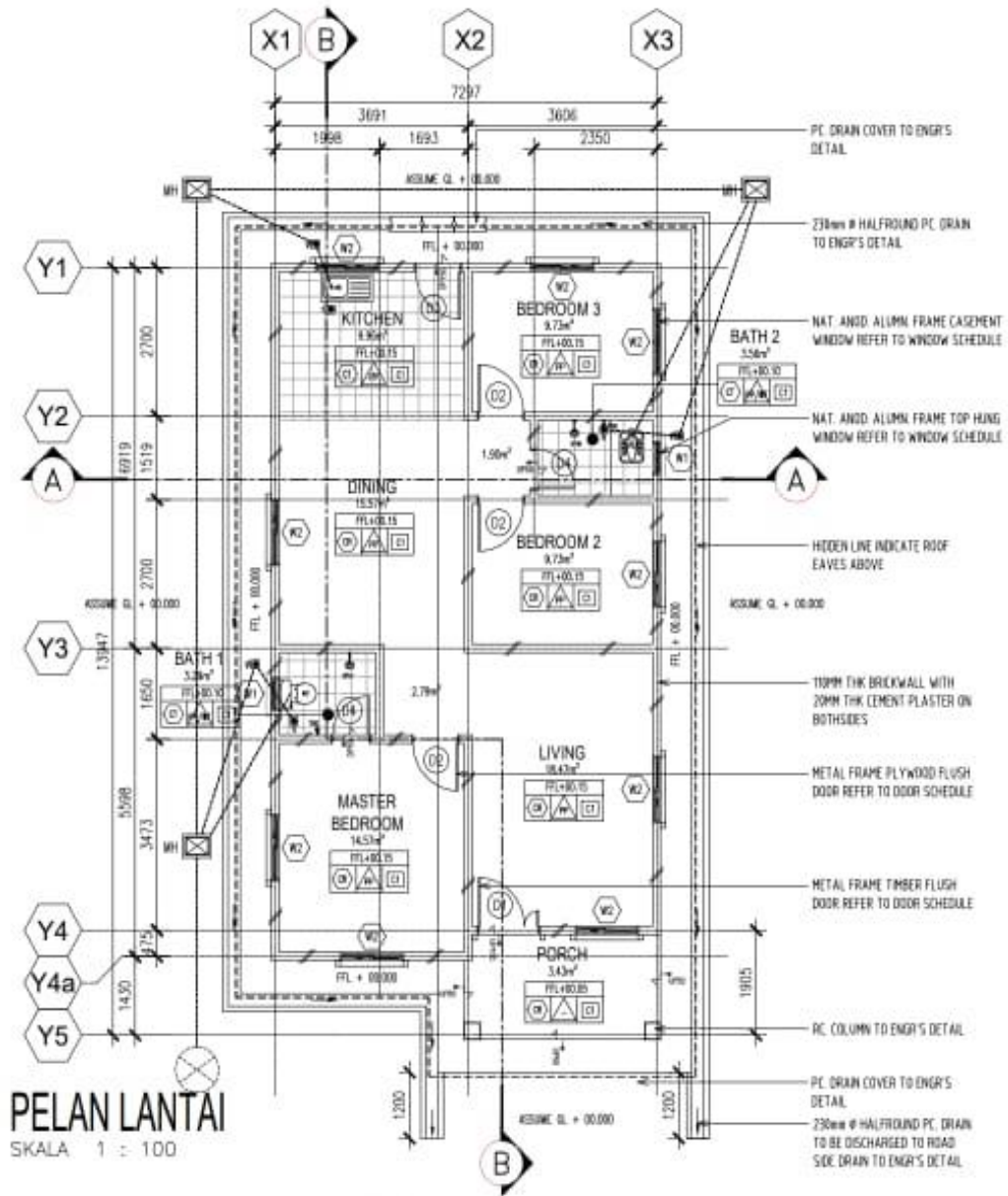


Figure 3.13: floor plan



Figure 3.14: front and rear elevation plan

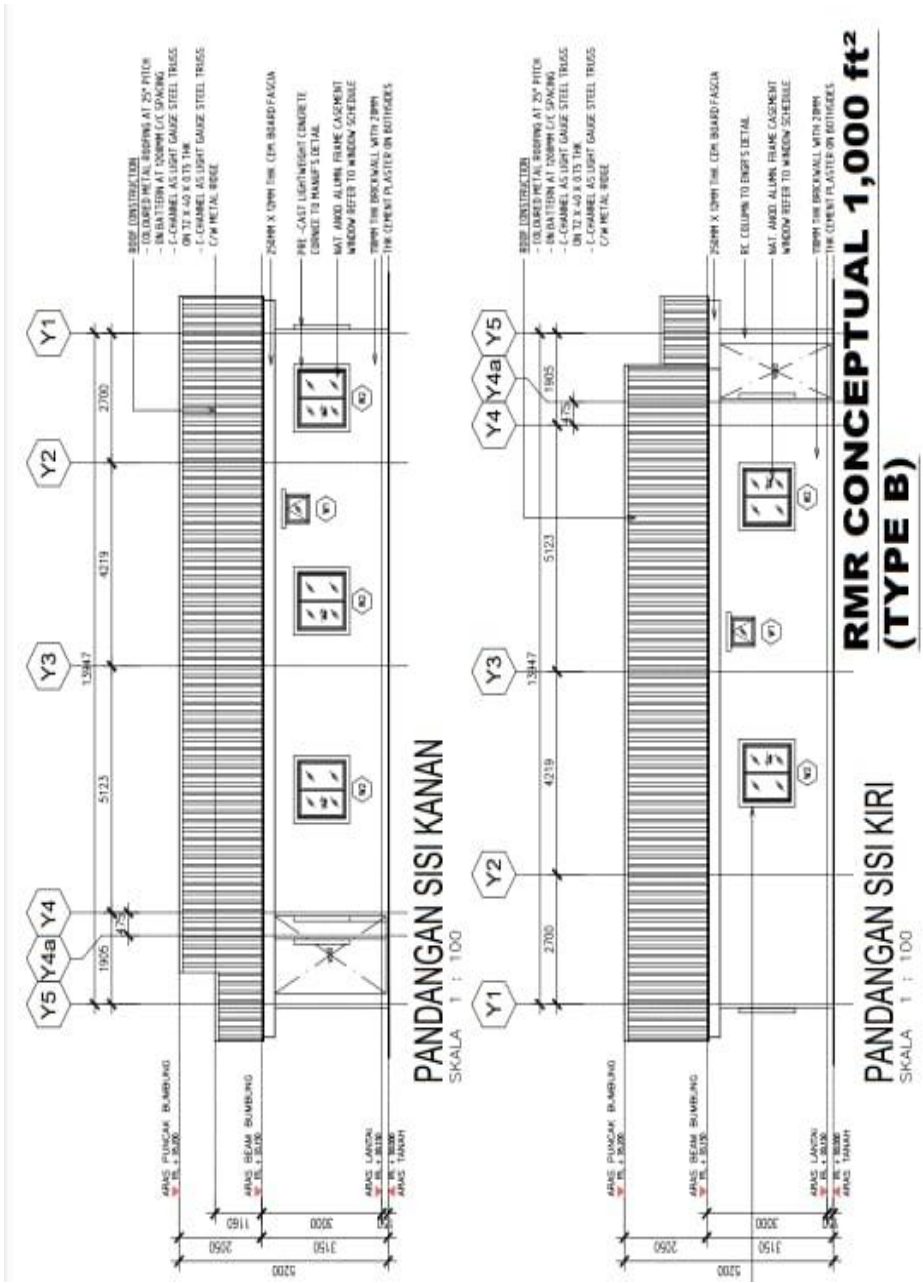


Figure 3.15:left and right elevation

5 November – 6 November

Master bedroom



Figure 3.16: brickwork at the beginning of the master bedroom



Figure 3.17: master bedroom opening section



Figure 3.18: brickwork process of bathroom in master bedroom

7 November – 8 November

Kitchen



Figure 3.19: brick laying at kitchen section



Figure 3.20: brick laying interior side

11 September – 15 September
Bedroom 1 and bedroom 2



Figure 3.21: brickwork process for bedroom 1



Figure 3.22: bedroom 1



Figure 3.23:bedroom 2



Figure 3.24: brickwork process of bedroom 2

16 September – 17 September

Bathroom



Figure 3.25: finishing brickwork of bathroom section

20 September – 23 September

Dining area



Figure 3.26: brickwork at dining area



Figure 3.27: dining area opening part

25 September - 27 September

Living area



Figure 3.28: brickwork at living area



Figure 3.29: opening part at living area

30 September- 1 December

On Roof beam



Figure 3.30: brickwork on the top of roof beam



Figure 3.31: final inspection of brick laying before plastering process

3.4 IDENTIFY THE PROBLEMS AND SOLUTION IN WALL CONSTRUCTION PROCESS

Mortar Joint Cracks

The problem is caused by lateral pressure acting against the foundation walls. This isn't to say the walls are weak; rather, oversaturated earth around the base strains the structure.(Hugo D'Esposito,2015.)

Solution:

Depending on the extent of the damage, an expert must be summoned to stabilise or totally replace the wall. The trick is to alert these professionals as soon as possible so that a radio may be delivered in a timely manner.(*4 Major Problems and Expert Solutions for a Masonry Foundation*, n.d.)Hugo D'Esposito, 2015)

Shrinkage

The brick is a porous material that absorbs water from the ground or the environment, causing it to expand and then contract when the water evaporates. Bricklayer joints break as a result of the shrinking. This has little effect on structural strength, but it does damage to the wall finishes after installation.

Solution

Before the brickwork is started, the damp proof course should be installed on the floor below the bottom of the wall to prevent shrinking. To prevent damp from rising through

the walls, a damp proof course is applied. The damp proof course was placed beyond the breadth of the brick wall to provide better protection against water absorption.

Mold

Mold does not grow on bricks. Brick has no living nutrients like a stone masonry surface, and because it is only minimally porous, it does not naturally hold a lot of moisture. As a result, mould does not have the optimal circumstances for growth that it would have on a drywall panel or a piece of fabric. (Chris Anzalone, 2017)

Solution:

Maintain a clean brick wall to prevent mould from taking hold. By maintaining the wall clean of dirt, you can ensure that it will never become a source of mould nutrition. If mould appears, moisten the entire wall before spraying it with a 50/50 combination of water and vinegar. Rinse the wall and scrub the bricks with a wire or plastic brush. (Chris Anzalone,2017)

Blister

Concrete blisters are exactly what they sound like: tiny lumps on your concrete's surface. They occur when air becomes trapped behind the concrete sealant, which usually occurs during the initial pouring of the concrete. (“How to Spot and Fix Common Concrete Problems,” 2019)

Solution:

Because blisters do not signal or cause structural damage, they do not require repair. As we lay our concrete, a professional concrete contractor will likely discover blisters, and they can adjust their concrete mix slightly to avoid more from forming.(R&M concrete, 2019)

Surface Scaling

Scaling, also known as spalling, occurs when the surface of your concrete deteriorate by 1.5–5.0 millimetres within the first year after installation. Scaling can occur for a variety of causes, making prevention challenging.(R&M concrete, 2019)

Solution:

Before the scaling worsens, our concrete should be treated. To level the surface, apply a light coat of trowel-grade concrete. After that, the surface should be thoroughly sealed to prevent further scaling.(R&M concrete, 2019)

Unstraight Bricklaying Level

The quality of the brickwork of a load-bearing wall is critical because bad brickwork compromises structural integrity. When workers rely on the string line as a guide in brickwork, the level becomes crooked. It's also happened when employees don't take the time to measure the height of the mortar while laying bricks.

Solution:

Because laser is a light, the bricklaying level problem can be solved by utilising a bricklaying laser level. Light travels in straight lines, which aids workers in laying bricks in a straight path. The brickwork will be neater if you use a laser level instead of string as a guide because it is adjustable and portable, saving you time. To get better results, use a spirit level while completing the brickwork and a laser level to check the level of the wall.

CHAPTER 4.0

CONCLUSION

The walls of a building are crucial for creating a suitable and comfortable environment, as well as giving privacy and weather protection. The bricklaying wall method was started from plan out the wall, clean the floor, lifted the brick, mix the mortar, pin and line, wall bricklaying process and lastly plaster as the finishes work for the wall.

The process took around 3-4 weeks starting from 14 September until 1 December 2020 without wall finishes painting work. Because of the weather and the movement control order during the pandemic Covid-19, the bricklaying wall construction was delayed for a few days. As a result, it takes longer than expected.

The method for bricklaying in construction is a standard method that follows the theory. Nothing was done differently during the construction of the bricklaying wall. In addition, the problems that arise such as brick contain dirt, dust and mold and others also be solved easily.

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