DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

THE CONSTRUCTION OF REINFORCED CONCRETE BEAM FOR LOW-COST BUNGALOW IN MUKIM NAGA

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PRACTICAL REPORT TITLE

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JANUARY 2021

It is recommended that the report of this practical training provided

By

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entitled

Practical Report Title THE CONSTRUCTION OF REINFORCED CONCRETE BEAM FOR LOWCOST BUNGALOW IN MUKIM NAGA

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

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JANUARY 2021

STUDENT'S DECLARATION

I hereby declare that this report is my work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at MFS BRILLIANT SDN BHD for 20 weeks starting from 23 August 2021 and ended on 7 January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as partial fulfillment of the requirements for obtaining the Diploma in Building.

…….

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Date : 7 January 2022

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Lastly, I want to thank my parents for their contributions and sacrifices over the years. Thank you very much.

ABSTRACT

Because a reinforced concrete beam is necessary for every structure, this paper will outline the best practices for resolving the issue of reinforced concrete beams in residential structures. This investigation took place at the Mukim Naga. The goal of this report was to talk about the best way to build reinforced concrete beams. It will concentrate on how reinforced beams are made and how they are employed during the construction process. This study will also address a prevalent problem that affects the longevity and strength of reinforced beams. To debate the best way to fix and repair the damage on the beam in order to improve the beam's durability in the future.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1.0

INTRODUCTION

1.1 Background of the study

A reinforced concrete beam is a structure that transfers weight from the roof, walls, and columns to the house's base. The beams are built to cover the distance between two foundations or columns. The base beam and suspended beams are commonly made of reinforced concrete. Reinforcement bars (high tensile steel and stirrups) are used in the beams to keep them from cracking while transferring stresses to the foundation. Atif (2006) mentioned because the concrete is brittle when it comes to tension loads, the steel that is put helps the concrete to withstand the stress. The use of the reinforced bar is important to carry the load capacity of the building. The steel reinforcement bars are manufactured with lugs or protrusion to ensure a strong bond between the steel and concrete for composite action. W.F.Chen (2005) mentioned the placement location of the steel reinforcement within the concrete is specified by the concrete cover, which is the clear distance between the surface of the concrete and the reinforcement. Steel bars may be bent or hooked.

According to Atif (2006), in its hardened form, concrete frequently has issues such as cracks. Design faults, construction defects, loading of the structure above the design load, and unforeseeable mishaps, such as impact and inadvertent effect due to fire, cause cracks in hardened states.

Beams come in a variety of shapes and sizes. This paper, however, is just concerned with the reinforced concrete beam. This paper attempts to find a solution

to the problems that arose on hardened reinforced concrete beams and to demonstrate what happens during the building of reinforced concrete beams.

1.2 Objectives of the study

- To analyze the best practice of construction method of reinforced concrete beam's construction.
- To identify the problem that occurred during the reinforced concrete beam's construction.

1.3 Scope of study

This study was conducted in a site of 1246 feet square's bungalow at Lorong Tanah Lot, Kampung Tepi Alor, Mukim Naga, 06200, Kepala Batas, Kubang Pasu, Kedah. All the data for this study was taken along during the construction progress from 24 October 2021 until 31 October 2021. The focus of this study is the method of constructing a reinforced concrete beam and the problems that occurred during the construction, this includes the problem that occurred after the ground beams have done. The study are using two methods, which are discussion and observation during the construction. The reason for this study is to find the solutions for the problem that occurred during this reinforced ground beams construction.

Figure 1.0: The actual building for this report in brickwork process

Figure 2.0: 3D drawing of the front view of the bungalow for Mukim Naga's site

1.4 Method of study

- **Discussion with the staff and subcontractor**

  During the site, some discussion will be done before starting the work and while working. This discussion are including drawing reading and planning the aim of the work. For example, planning about the total formworks needed for the ground beam. The discussion is between the supervisor and the subcontractor. During the discussion, I always take some notes of important things such as the size and the price of stuff, so it's can be used for references if there are mistakes during the work progress.

- **Observation**

  The observation must take place on the job site while the subcontractor is working. This is because it is to determine whether or not what they are doing is correct. In addition to observation, some drawing reading is required to confirm that the progress is being made in accordance with the drawing. A 3D plan, floor plan, and roof plan are used in the drawing

reading. The supervisor does the observation on a regular basis. I always take photos and videos as an initiative to remember the process and as references for me to complete my report.

- **Document review**

  There are a lot of documents that I referred to while making the report. Usually, the construction drawings are often referred to because of their important information. I also referred to JKR and company specifications to get more information because the construction needs to follow the guideline that have been set by JKR specification such as the cement to be used throughout the Work shall be cement obtained from a SIRIM-certified manufacturer. The cement shall be described and complied with MS EN 197-1. I get permission to review the company document from the managing director.

CHAPTER 2

COMPANY BACKGROUND

2.1 Introduction of company

MFS BRILLIANT SDN BHD, situated in Jitra, Kedah, is a construction firm. This business was established in the year 2019. Puan Salmiza Binti Salleh and his husband, Encik Fazli Bin Abu Bakar, started this enterprise. The company's headquarters are at No.2A & 3A,Tingkat 1 Plaza Seri Tunku, Jalan Seri Tunku, Jitra, Kubang Pasu, 06000, Kedah Darul Aman. The working day for this company is 6 days per week. Fridays are off day for the worker. The company operation was from 9 a.m. until 6.p.m.

Figure 3.0: Company's logo

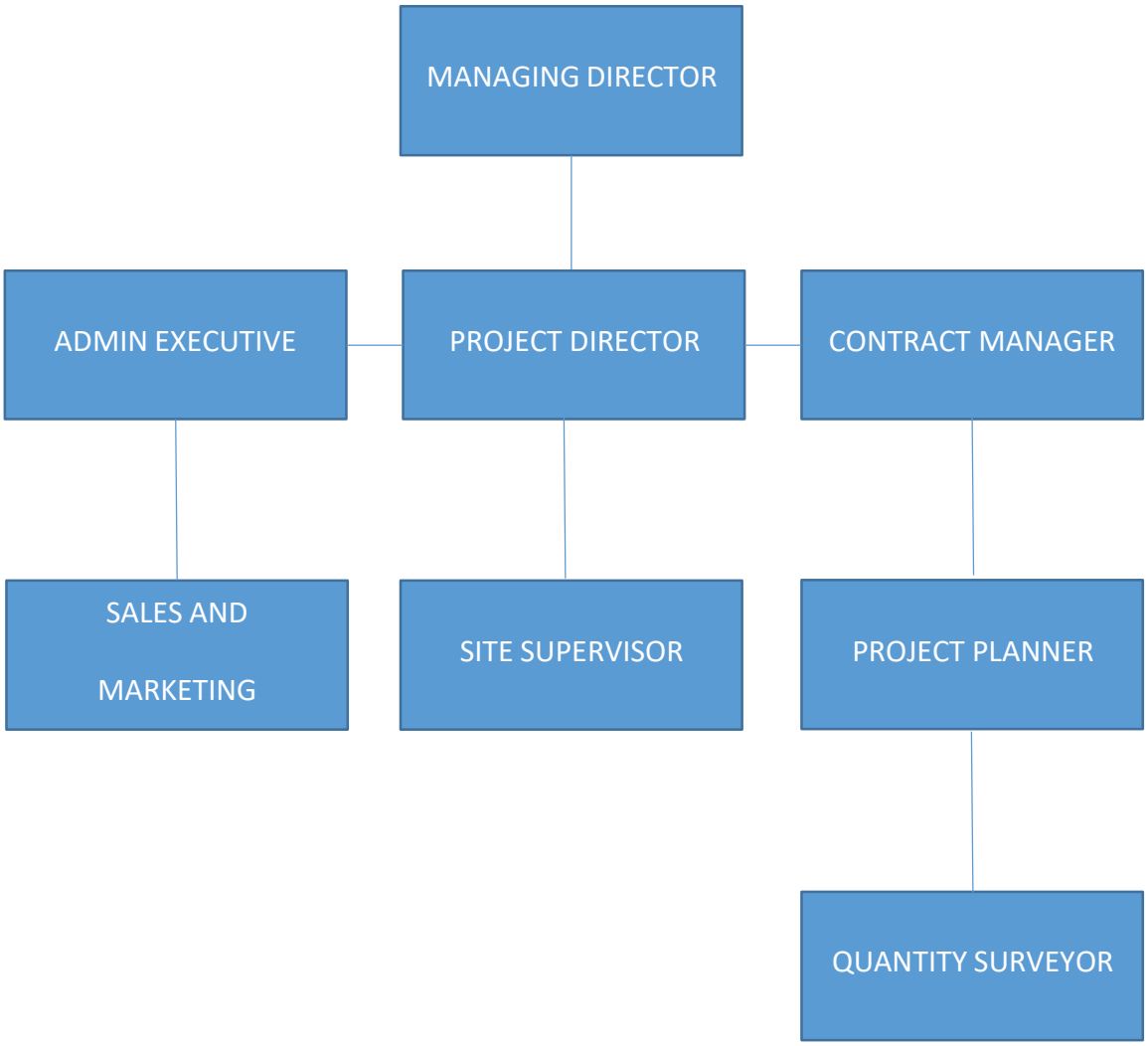
2.2 Company profile

MFS BRILLIANT SDN BHD is incorporated in the year 2019. The company was registered with CIDB as grade G1 for the profession they serve such as providing house construction, especially bungalows, renovation services for houses including interior designs, consultant, and plan drawing. This firm is wholly owned by 100 % Bumiputera. The company is covering a lot of projects in the northern states of Malaysia

such as Perak, Kedah, Penang, and Perlis. There are several ongoing projects that have been handled by this company. This company is led by Puan Salmiza Binti Salleh as the manager and helps by his husband and other experienced staffs

Through the year from 2019 until now, **MFS BRILLIANT** has succeeded in satisfying their client's requests.

2.3 Company organization chart



2.4 List of projects

2.4.1 Completed Projects

Table 1.0: List of the completed projects

No.	Project Title	Project Value (RM)	Start Date	Completion Date	Project Duration	Client
1	A 1694 square feet bungalow in Malau	175,000	9/10/2020	30/9/2021	1 yr	En.Zulkifli bin Mahmood
2	A 1482 square feet bungalow in Padang Sera	160,000	5/1/2021	5/12/2021	1 year	Puan Suhaini binti Omar
3	A 400 square feet house in Changlun	56,000	14/12/2020	7/9/2021	10 month	Puan Fatimah binti Yaakob
4	A 712 square feet bungalow in Alor Mengkudu	80,000	8/8/2020	5/9/2021	1 yr 1 month	En. Ahmad bin Saad

2.4.2 Project in progress

Table 2.0: List of ongoing projects

No.	Project Title	Project Value (RM)	Start Date	Completion Date	Project Duration	Client
1	A 1246 square foot bungalow in Naga	155,000	8/10/2021	-	Expected around 1 yr	En. Aminuddin bin Abdullah
2	A 2196 square foot bungalow in Pauh	260,000	12/8/2021	-	Expected around 1 yr	Puan Sharifah binti Mohd Zain
3	A 1392 square foot bungalow in Arau	189,000	12/10/2021	-	Expected around 1 yr	En. Muhd. Zulfahmi bin Muslim
4	An 1180 square feet bungalow at Utan Aji	153,000	8/11/2021	-	Expected around 1 yr	Puan Siti Khadijah binti Mohd. Noor

CHAPTER 3.0

The construction of reinforced concrete beam in Mukim Naga

3.1 Introduction of case study

The project that will be the focus of this case study is a low-cost 1246 square feet one-story bungalow construction project. This project area is located at Lorong Tanah Lot, Kampung Tepi Alor, Mukim Naga, 06200, Kepala Batas, Kubang Pasu, Kedah. The value of this project is around RM 155000 as stated in the agreement between the company and the client. The construction was started in early October 2021 which is 5 October 2021 and expected will be complete in May 2022. Usually, the project will take around 6 months or 1 year to complete. The project took place on a vacant property that has been available since 2015. The soil is good and firm on the property. The site's elevation is higher than the elevation of the road leading to it. The site's elevation was higher to prevent the excessive water from the nearby river from flooding the area. Every two days, one or two site supervisors have been assigned at this location.

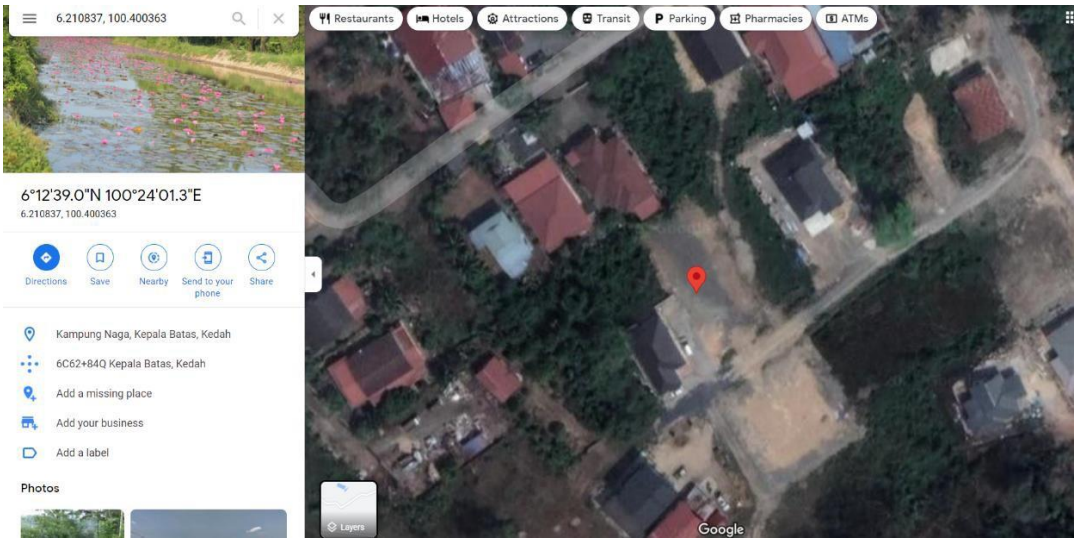


Figure 4.0: Location of Mukim Naga's site

3.2 Method of reinforced concrete beam construction

After the pad foundation construction is done, there are starter bars connected from the reinforced bar in the foundation that will be left after the pits have been filled by soil. The starter bar's length is mostly around 6 feet. The starter bar will be connected with the ground beams first and leap into the reinforced column to provide a lapped connection to another reinforcement in a concrete piece that will be cast against it

The beam construction began on 24 October 2021. Firstly, the supervisor team will discuss with each other where will have the beam for the house. The discussion last for 2 days. The discussion was included the calculation for the concrete for the reinforced ground beam by the supervisors on the site. The calculation was used the meter cube unit. According to the calculation, the total of concrete used for ground beams were 4-meter cube. However, the concrete that will be used for the beam could be less or more than what we calculated because of wastage during concreting work including the concrete spilled from the mixer truck. After the discussion and the calculation were done, the total and the sketch of where should be the ground are rechecked by the quantity surveyor and the project planner. Recheck is a must to make sure the beam of the house is compatible to hold the loads.

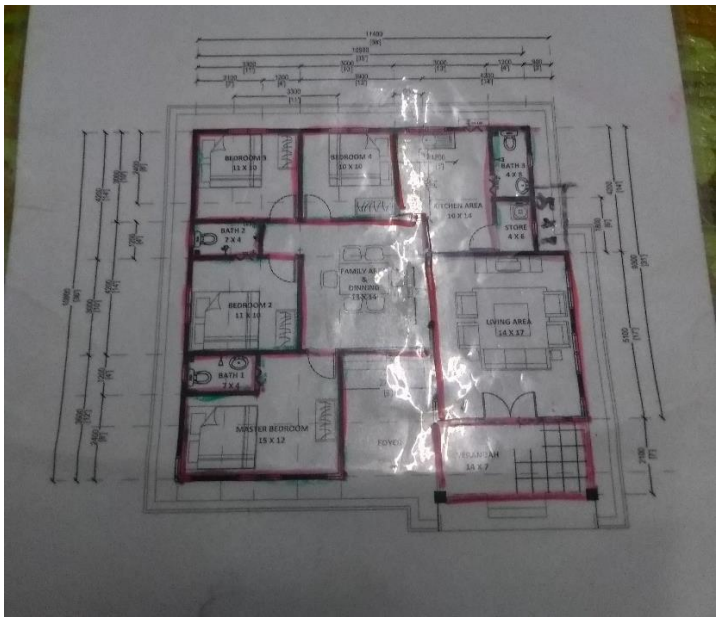


Figure 5.0: The floor plan's drawing with a red marker to show the beam position

The work at the site was also begun on 24/10/2021 as the workers had already begun their works. There are 3 workers on this site and one of them is the leader of the group. They started the work by building the beam formworks which was 16-inch height. The wood and plywood were supplied by a hardware store, Chop Sin Huat (Jitra) SDN. BHD. The list of items can be seen in the table below;

Table 3.0: List items that be supplied for the supplier

No.	Description	Quantity	Price/Unit (RM)
1	4ft x 8ft 12MM WBP(HOK LAI) = BAIK	30 KPG	54.00
2	CEMENT COMPOSITE (LION)	70 BEG	16.50
3	MH UBAT 1 X 2=25/12',30/10	1000 KAKI	0.900
4	Y10MM BESI CUKUP SAIZ	1 TAN	3380.00
5	BESI R5.2MM	100 BTG	6.50
6	TRANSPORT CHARGE	1	50.00

The workers used the 1-inch x 2-inch woods and 12mm plywood to create the beam formwork according to the drawing which is stated 16- inch. Although the beam is stated 16 inches on the drawing, the concrete for the beam will be 2 inches less, leaving the stirrup 2 inches not been concreted. This is because the stirrup needs to hold the reinforcing fabric of steel that is used for slab construction. After making some formworks, the workers were coated the formworks with lubricating oil or black oil to ensure the concrete won't be able to stick to the formwork. The black oil needed protects the formwork and the formwork can be reused several times.

Figure 6.0: The beam formworks has been coated with black oil

The setting out pegs on the site that marked the house position were not removed during the beam's construction. A thread was being pulled from the setting out pegs to opposite setting out pegs. After all the beams' formwork were coated completely, the formwork will be installed carefully. There are two sizes of formwork of reinforced beam such as the 12 inches for the veranda area and 16 inches for other areas. The beam width was 4 inches. The beam's sizes were provided in the architect's drawing. The formworks were also being leveled using the water level during the installation. The formworks were nailed closely to avoid void between 2 formworks and prevent concrete wastage during concreting work. By following the thread that had been pulled before, the formworks were easier to keep it sure straightened. The formworks were also been supported by the wood that had been cut in short. During the construction process, two of the labor would construct the formwork while the other one will cut and bend the reinforced bars of the ground beam. The formwork will be installed and finished approximately in 3 days.

Figure 7.0: All the formwork that been installed.

After the formworks were completed, those workers who made the formworks helped the other one who does the reinforced bars. The ground beams of the house were used Y10mm steel and R5.2mm steel as stirrups to make the reinforced bars. The length of the steel was referred to the floor plan. The size for the links for the house area's ground beams was 2 inches x 16 inches. Only the links for ground beams at the veranda were 2 inches x 12 inches. This happened because of drop at the veranda from the house was 4 inches. Each beam was used 4 numbers of Y10mm steel. The end of the reinforced bar was bent downside or upside 5 inches to connect each reinforced bar. After the steelworks were completed, two workers were installed the reinforced bars into the ground beam's formworks. The reinforced bars were tied with steel wires to the starter bars that connected to the foundation. The end of reinforced bars which been bent before were also tied to another end of reinforced bars with steel wires. This helps loads for the house to flow smoothly to the foundation. The spacer blocks were put inside each formwork by the worker before starts installing the reinforcement bars. During the installation of reinforced bars, one of the workers has locked the formworks using the short 1-inch x 2-inch wood. A measuring tape was used to ensure the formwork's width was 4 inches. The short 1-inch x 2 inch woods that are longer than 1 feet are also used to support the formworks from outside the formworks The formwork needed to be locked to avoid the formworks being

broken during concreting. After that, the worker has closed all the voids below the formworks using the soil to avoid the concrete leaking out from below the formworks.

Figure 8.0: The labors were installing the reinforced bars into the formwork

The concreting work was held on 28 October 2021. The total of concrete used for the ground beam's construction was 4-meter cube. The concrete was ordered from ASM Concrete and Precast SDN. BHD. The concrete was carried by a small concrete mixer truck from the batching plant in Pokok Sena which were only can bring 4-meter cube on its limit because the road lead to the site was unable to hold the large truck's weight and can damage the road. The concrete was ordered 2 days before the concreting work began. This ground beam's construction was using grade 25 concrete. The concreting work began around 11.00 a.m. The workers have used the wheelbarrow and bucket to fill the formworks with concrete. They had pushed the wheelbarrow from the formwork to the concrete mixer truck to get the concrete. While two workers fill the formwork, the other worker was vibrating

the concrete with the concrete vibrator. He vibrated the concrete that had been poured into the formwork many times to distribute solid particles within the poured concrete.

Figure 9.0: The concreting process of the reinforced beam using the ready mix concrete carried by a concrete mixer truck.

After that, the worker used a trowel to distribute the concrete evenly on the surface before making sure the concrete was only 14 inches. Upon of this, there were 2 inches of the links appeared with upper Y10mm steel that tied to the links. The shortage of labor made the progress of concreting slowed and yet there were some of the beam's formworks that had not been filled with concrete. The concrete was not fully used because most of it started to harden. So the truck driver threw the balance of concrete that had not been used around 1m3 yet into the house area. The driver also needs to go somewhere else for his duty. The concreting work can't be continued after that because of heavy rain.

Figure 10.0: The balance of concrete that starts to harden that dumped by the truck.

As the result, some of the beam's formworks were poured with the concrete made by the worker by using the concrete mixer at the site on the next day. According to Hussain (2017), this method was called the construction joint which is be defined as stopping positions in the concrete casting, and they are needed because of the impracticality to cast concrete in one continuous process.

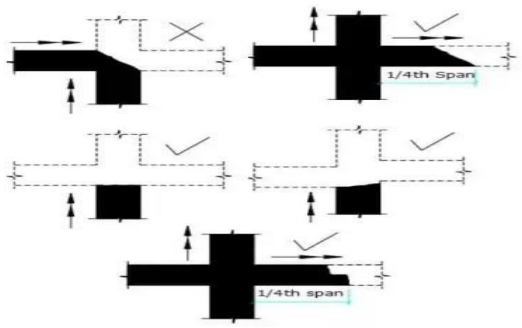


Figure 11.0: Typical construction joint in beams.

Source: Mishra. G

After the concrete had fully cured, the formworks were inaugurated on October 30, 2021. The labors gathered all of the formwork in one location and organized it, including the short woods, after they had opened all of the formwork. There were a few cracks found on the hardened concrete. The honeycombs were also found on the hardened concrete but in small quantity and small size around 1 to 3 inches. All the cracks and honeycombs were repaired and fixed by using the step in subtopic 3.3.

Figure 12.0: All the formworks has been gathered in one place

3.3 Problem that occurred on hardened concrete beam.

After the ground beam's formworks were opened and gathered in one place. The color of the ground beam concrete was brownish. The supervisor teams were checked for any cracks or spalling that formed on the hardened concrete beams. The crack and spalling are the common problems that came after the concrete was fully hardened. There were 12 cracks and 8 spalling found on the hardened concrete beams. Cracks in concrete may occur in both the plastic state as well as hardened state owing to the internal stresses that arise from the response of the constituent's materials to the external excitation as well as their environment. According to Atif (2006) cracks in hardened state occurs due to design errors, construction defects, inadequate cover to reinforcement, incorrectly made construction joints, poor compaction, segregation, poor curing, the loading of the structure

in excess of the design load, due to change in use, unforeseen accident, such as explosion, impact and accidental effect due to fire. Honeycombing in concrete is when the finished concrete has air voids in it or most of the aggregate without mortar between them. The cause of honeycomb in concrete is the mortar not filling the spaces between the coarse aggregate particles. It can be seen right after the formwork is opened, showing the voids between the coarse aggregates and stony concrete surface. Most of the honeycombing in concrete happens because of the over-used reinforcement bars in small formwork and improper vibration of concrete during in formwork.

Figure 13.0: The cracks that been spotted during the inspection

Figure 14.0: The honeycombing in the concrete formed and spotted after the formworks were opened

Both problems that has been stated can reduce the strength and the durability of the concrete. The solution used by the workers and the supervisor for this problem was hand-applied mortar. The workers have used the mortar that mixed with water to patch the honeycombs and the cracks that have been found. This method is suitable for the small and isolated areas that have honeycombs or cracks. The workers were used epoxy which was cement-based by following the manufacturer's instructions. According to Atif (2006) The thickness of the layer built up and application procedure can vary greatly depending upon the material used and the orientation of the surface being repaired. A typical procedure is to apply layers of 25-50 mm thick for vertical work and 20-30 mm thick for overheads areas in each layer. Care should be taken when additional layers to ensure that the previous mortar has gained sufficient strength but has not been set. The hand-applied mortar method was using a trowel, bucket, and the surrounding concrete as a guide.

Figure 15.0: The worker batched the epoxy of cement-based to patch at the crack and honeycombing.

CHAPTER 4.0

CONCLUSION

The project held in Mukim Naga were using the pad foundation and reinforced ground beams for the bungalow substructure. The use of pad foundation will take some duration than the raft foundation because the ground beams are built at different times.Using the reinforced ground beams is a conventional method to build the beams. Most of the contractors used this method to deal with the tension and stress from the weight of the building itself and the method was easy to apply at any condition of the soil. However, this method also has the disadvantages such as taking a lot of time and the excessive use of wood and plywood that cost a lot of money.

Chapter 3 itself are mentioning some of the beams are using the concrete that mixed by the workers on the next day. The cause of this happens is the bad weather and the heavy rain at the site. This problem could happen on any site but what can be learned here are the construction joints and the cold joints. A construction joint is an interface between concrete placements that was designed to make building easier, a cold joint is a joint or discontinuity caused by a long enough delay in placing to prevent material intermingling and bonding, or where mortar and plaster rejoin or meet. In this case, these joints were used for concreting the undone beams on the next day. Some other problems such as the cracks and the honeycombing in concrete already mentioned in chapter 3 are not difficult to solve as the workers had acknowledgment to find the solution for upcoming problems that might happen after the concrete was hardened. However, the fixing work on the reinforced ground still needs to be done under the supervision of the site supervisor. The honeycombing in concrete was easy to spot unlike cracks because some cracks are small and difficult to notice. By using epoxy

which is cement-based to patch to the cracks and the honeycombing on concrete, this solution can prevent any substances from damaging and reducing the strength and the workability of the concrete.

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