DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

CONSTRUCTION METHOD FOR REINFORCED CONCRETE FRAME STRUCTURE

Prepared by:

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DECEMBER 2019

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Syed Ahmad Najmi Shahabudin Bin Syed Nasiruddin 2017206342

entitled

Construction Method For Reinforced Concrete Frame Structure

be accepted in partial fulfillment of the requirement for obtaining the 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 are stated herein, prepared during a practical training session that I underwent at Fast Tech Builders 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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Date : 15 SEPTEMBER 2019

ACKNOWLEDGEMENT

Alhamdullillah, praise to Allah, the Most Merciful, the Most Gracious.

All praises to Allah and His blessing for the completion of this practical report. I thank God for all the opportunities, trials and strength that have been showered on me to finish writing this report. 120 days is very meaningful for me to summarize and sum up all of my experiences and learning progress in one final report that demonstrates the understanding I gained along my practical training.

First and foremost, I would like to thank Encik Hafiz Bin Norizal as a project manager for giving the opportunity for me to conduct practical training for 120days at his construction site at Kulim. Along with him there is also his professional team consisting of Mr. Khoo Kuang Yee, En Uwais Mohd Noor, Mr Rudy Ramli, Mrs Aziemah and En, Hanif MD Said for guidance me to learn lots of new things and skills thus develop my understanding, knowledge and experience to work at real site projects, and the theory involved in analysis of structures, building and civil works.

I would also like to thank my training supervisor, Dr Hayroman Bin Ahmad who have taught and nurtured me in becoming a better student and person and complete the whole report. Also his advice and guidance as well as suggestion and improvements to the report I have made. 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

Reinforced concrete framed structure is a very important thing to elaborate. It was the most common type of modern building internationally. As the name suggests, the type of building in site Kolej Vokasional Kulim consists of a frame structure. Horizontal members of this frame are called beams and slabs, and vertical members are called columns. Including staircase. In this report will discuss about the construction method of those reinforced concrete framed structure which are column, beam, slab and staircase. Another objective of this report was to study the defects that occur and ways to handle the defects efficiently. The methods of data collection are unstructured interviews with no specific set of predetermined questions to site staff. although the interviewers usually have certain topics in mind that they wish to cover during the interview. Therefore, semi-structured interviews were also performed to even more people such as architect and the consultant. Including document reviews and observation that was carried out on site. In conclusion, hopefully this study will gives a lot of important information about the construction process of reinforced concrete framed structure that consist of layout work until curing concrete. Most importantly so that no mistake will occur during the construction of the reinforced concrete framed structure, resulting in the collapse, loss of money to the company and even tragic death.

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CHAPTER 1.0: INTRODUCTION

1.1 Background and Scope of Study

Column, beam, slab and staircase were one of the important parts of a building structure. In architecture and structural engineering, column or pillar is a structural component which transmits to other structural elements below by the weight of the structure above. Column was generally referred to as a part of compression. Columns can be designed to resist lateral forces for the purposes of wind or earthquake technology. Columns are often used to support beams where the upper parts are located

A beam is a structural component that absorbs laterally applied loads on the axis of the beam. At the support points of the beam, the loads applied to the beam result in reaction forces. Both forces acting on the beam have the total effect of creating shear forces and bending moments inside the beam, which in turn causes the beam's internal stresses, strains and deflections.

A slab is a structural element, made of concrete, that is used to create flat horizontal surfaces such as floors, roof decks and ceilings. A slab is usually several inches thick with beams, pillars, walls, or ground support. Off-site concrete slabs can be prefabricated and lowered or poured in-situ using formwork. If reinforcement is required, the slabs can be pre-stressed or the concrete can be poured in the formwork over the rebar.

A stairway, staircase, stairwell, flight of stairs, or simply stairs, is a building b uilt to cover a broad vertical distance by splitting it into smaller vertical dista nces, called stairs. Stairs may be straight, round, or may consist of two or more straight pieces connected at angles.

For this study it has been carried out at Kolej Vokasional Kulim, Kedah. It was a project of upgrading and construction of new buildings for the use of vocational college students to replace old and not modern building. This project was developed by Fast Tech Builders Sdn. Bhd. Even there are many building structures that play important roles for construction of a building, the

building structure that was focused in this study were column, beam, slab and staircase. The methods that has been studied starting from layout, bending reinforcement bar, install formwork, install reinforcement bar, curing and remove formwork. There are also some machineries that was used in order to performed the construction of those following building structure construction which are barbending machine, chainsaw, and hacking machines.

1.2 OBJECTIVES

1. To investigate the construction method for reinforced concrete frame structure.
2. To determine the defects that occur during the construction process and the ways to deal with the defects.

1.3 RESEARCH METHOD

The research methods that used for this study are observation, interviewing site supervisors, Nor Aziemah, project manager, En. Hafiz and executive director, Mr Khoo and document reviews at the site office Pejabat Tapak Kolej Vokasional Kulim.

1. Observation - Observation were made based on the study of the method constructing reinforced concrete column, beam, slab and stairs. It takes about a month to finish the construction of those 4 building structures. The observation was taken by taking notes, observe the surrounding areas, daily inspections and take pictures.

2. Interviews - The interviews that I had with is the site supervisor of site project at Kolej Vokasional Kulim, Kedah with the site manager and site supervisor. The semi-structured interviews have been taken about 30 minutes duration from 3:00 p.m. until 3:30 p.m. in the site office and talk about the questions that has been prepared and more follow-up questions. For example, on the commonly method that has been used on constructing reinforced concrete column, beam, slab and staircase. Unstructured interviews also has been performed by asking some random question to the workers especially their certain leader such as leader of concrete, leader of barbender and leader of wood work at construction site. The ongoing interviews are recorded by taking some notes.

3. Document reviews - Several documents relate on construction of reinforced concrete that has been done. Documents that have been referred to

are the survey architectural drawing, and the pictures that has been taken by the company on site.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 INTRODUCTION OF COMPANY

Fast Tech Builders Sdn. Bhd. (Previously known as Chase-Tech Construction) is a company specialize in Civil Engineering & Building Construction works. Fast Tech Builders Sdn. Bhd. Since its inception in 1999, it has undertaken a lot of construction projects in the government and the private sector. Now, Fast Tech Builders Sdn. Bhd. The project is located at No.305, Jalan Perusahaan 2, Taman Bandar Baru Mergong, Kedah Darul Aman, 05150 Alor Setar.

Moreover, this construction company have an excellent track record, sound management, experience capabilities and strong base of technical expertise. As a matter of fact, the company is in a prime position to offer more and more value-added products and be more sensitive to the requirements of particular customers. They still aim to please the client.

The policy of Fast Tech Builders Sdn. Bhd which is to ensure the continued success of the customers by meeting and complying with their requirement as well as the relevant statutory and regulatory requirements. Secondly, the will keep on updating the continued success by continuously strive for improvement through a continuous review and improvement of the system effectiveness. The last one is to ensure that the service from our company will provide cost effective, reliable, high quality and is delivered on time.

2.1.1: Forms of ssm Fast Tech Builders Sdn. Bhd.

2.1.2 : Forms of CIDB Fast Tech Builders Sdn. Bhd.

Figure 2.1.3: Forms of registration Fast Tech Builders Sdn, Bhd.

Courtesy of Fast Tech Builders Sdn. Bhd.

2.2 COMPANY PROFILE

Table 2.2: Company profile

1	NAME OF COMPANY	FAST TECH BUILDERS SDN. BHD. (COMPANY NO. 1057780-H)
2	REGISTERED ADDRESS	NO.305, JALAN PERUSAHAAN 2, TAMAN BANDAR BARU MERGONG, 05150 ALOR SETAR, KEDAH.
3	TEL	
4	FAX NUMBER	
5	E-MAIL	fastechbuilders@gmail.com
6	WEBSITE	www.fastechbuilders.com
7	CIDB REGISTRATION	0120141104-KD159635 (G7)
8	AUDITORS	POR OOI & CO. (CHARTERED ACCOUNTANTS)
9	PRINCIPAL BANKERS	PUBLIC BANK BERHAD
10	PAID UP SHARE CAPITAL	RM750,000.00
11	AUTHORIZED CAPITAL	RM1,000,000.00

2.3 ORGANIZATION CHART

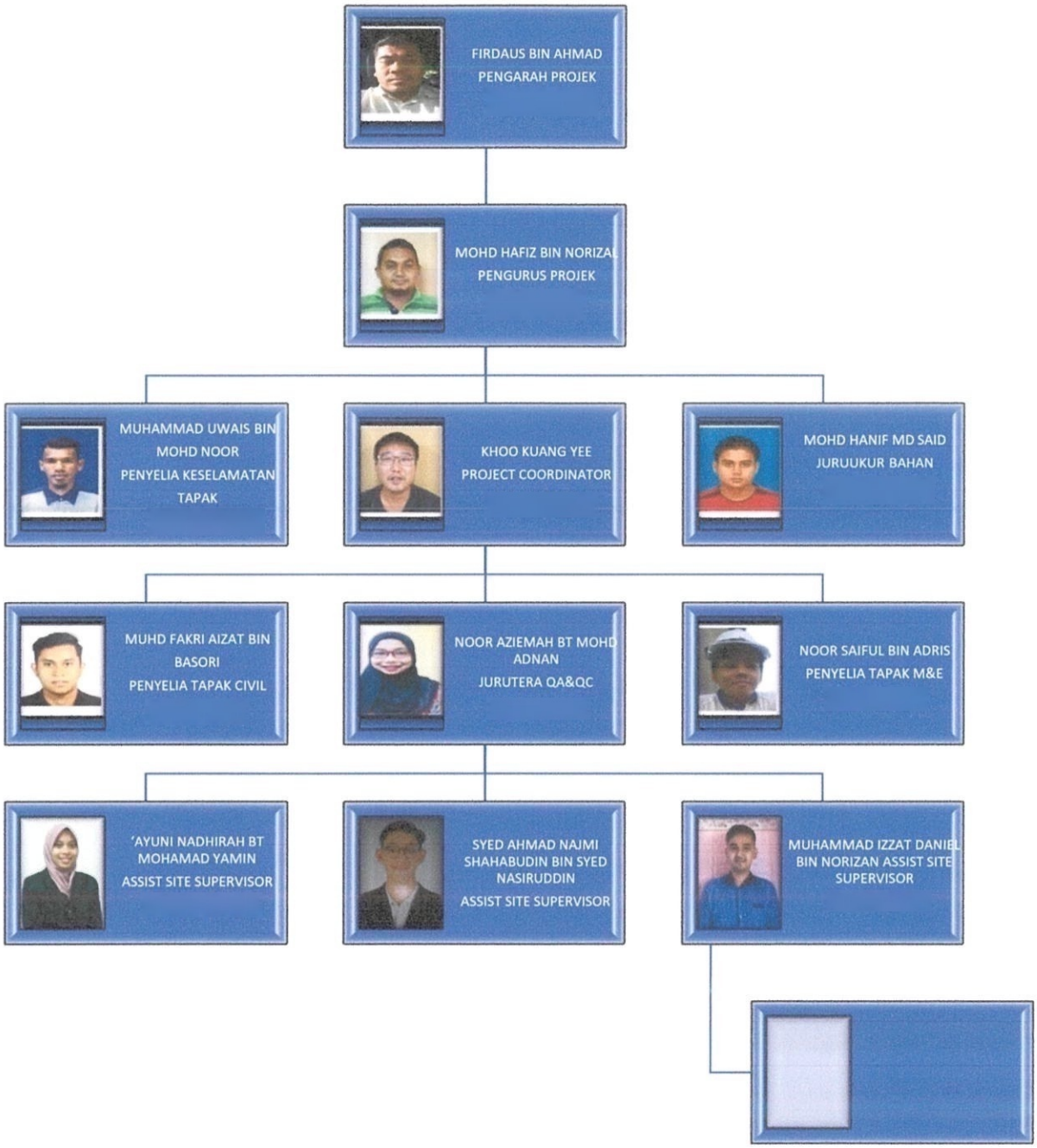

Figure 2.3: Organization chart

2.4 LIST OF PROJECT

Table 2.4: List of Project

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
1	Membina Dan Meyiapkan Blok Tambahan 4 Tingkat Di Sekolah Kebangsaan Pauh Di Mukim Pauh, Perlis. (Structure & Finishing Works)	J.K.R	Guar Teguh S/B	RM460,000.00	2006 - 2007
2	Proposed 22 Units 2½ Storey Semi-Detached Houses At Mukim Utan Aji, Perlis. (Structure & Finishing Works)	Golden Tower Development		RM670,000.00	2007 - 2008
3	Membina Dan Meyiapkan Pusat Pertahanan Awam Di Mukim Seriab, Kangar, Perlis. (Structure & Finishing Works)	K.D.N	Apex Builders S/B	RM1,120,000.00	2009 - 2011
4	University Malaysia Perlis (Unimap) PKK Mikroelektronik, Pusat Latihan Kejuruteraan Dan Bangunan Canselori, Bendahari Dan Pendaftar. (Structure & Finishing Works)	UNIMAP	Bumita S/B	RM1,360,000.00	2010 - 2011

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
5	Construction & Completion Of Permenant Way Depot, Administration Building & Property Department At Bukit Mertajam, Penang. (Civil Building Works)	MMC GAMUDA JV	SP Mega S/B	RM530,000.00	2010 - 2012
6	Cadangan Membina Dan Menyiapkan Kampus Utama Kolej Pertanian Malaysia (KPM) Di Atas Lot 6434, Mukim Temin, Daerah Kubang Pasu, Bukit Tangga, Kedah.	Kolej Pertanian Malaysia (KPM)	Pembinaan Sinar Edar S/B	RM756,000.00	2011 - 2012
7	Tender Semula Cadangan Membina Dan Menyiapkan Maktab Rendah Sains Mara (MRSM) Di Atas Lot Sebahagian Lot 2344, Mukim Kota Lama Kiri, Daerah Kuala Kangsar, Perak Darul Ridzuan. (Structure Works)	Maktab Rendah Sains Mara (MRSM)	Mega Sasa S/B	RM890,000.00	2012 – 2013

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
8	Cadangan skim perumahan yang mengandungi 40 unit rumah kedai, 73 unit rumah teres 1 tingkat jenis 'B' di atas lot 253, 513, 514, 575 & 990, mukim gerik, daerah ulu perak, perak darul ridzuan. (Structure & Finishing Works)	KPM Development S/B	SPK Asas S/B	RM3,750,000.00	2012 - 2014
9	Proposed Construction & Completion Of 1 Unit 3 Storey Office, 1 Unit 2 Storey Office Office & Ancillary Works For OMYA(M) Quarry S/B At Simpang Pulai, Perak.	OMYA (M) Quarry S/B	SP Mega S/B	RM680,000.00	2012 - 2013
10	Proposed Construction & Completion Of Elevated Reservoir And Ancillary Works For Industrial Zone Phase 4, Kulim HiTech Park,Kedah. (Civil & Structure Works)	Kulim Technology Park Corporation S/B (KTPC)	Kumpulan Liziz S/B	RM3,630,000.00	2013 - 2014

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
11	Cadangan Pembangunan Insitusi Pengajian Tinggi Swasta Yang Merangkumi 5 Fasa Di Atas Lot P.T. 13825, Taman Teknologi Malaysia, Mukim Petaling, Wilayah Persekutuan. (Civil & Structure Works)	Technology Park Malaysia (TPM)	Bina Kemuncak Cemerlang S/B	RM1,550,000.00	2013 - 2014
12	Mass Rapid Transit Lembah Klang-Jajaran Sungai Buloh-Kajang. Works For Station Box,Vent Building & Entrance Box At Pasar Rakyat Underground Station. (Civil & Structure Works)	MMC GAMUDA JV	SP Mega S/B	RM6,850,000.00	2014 - 2016
13	Cadangan Merekabentuk, Membina Dan Menyiapkan Projek Perumahan Rakyat 1 Malaysia (PR1MA) Yang Mengandungi 231 Unit Rumah Teres Setingkat Dan Kemudahan Lain Yang Berkaitan Di Atas Lot 8070 MK Padang Siding, Arau, Perlis.	PR1MA	Mega Sasa S/B	RM21,500,000.00	2016 – 2018

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
14	Cadangan Pembinaan Fakulti Teknologi Kejuruteraan (FTK) Di Universiti Teknikal Malaysia Melaka (UTEM), Hang Tuah Jaya, Durian Tinggal, Melaka.	UTEM/ JKR	Mega Sasa S/B	RM21,300,00.00	2016 – 2018
15	Cadangan Membina Skim Perumahan Bercampur Di Atas Lot 8695, Mukim Gerik, Daerah Hulu Perak, Perak.	Asia Bina Idaman S/B	SPK Asas S/B	RM3,080,000.00	2017 - 2018
16	Cadangan Pembangunan Bercampur Bagi Fasa 1 (Plot 3) Yang Mengandungi 93 Unit Kedai 3 & 4 Tngkat, 1 Blok Hotel Bajet 5 Tingkat (102 Bilik) Dan 5 Unit Kedai Di Tingkat Bawah Di Atas Lot 5929, Lebuhraya Cassia, Batu Kawan, Mukim 13, Seberang Perai Selatan, Pulau Pinang. -ASPEN VISION CITY-	Aspen vision city S/B	Daya CMT S/B	RM15,668,727.25	2017 - 2018

No	Description Of Works	Client	Main Contractor	Contract value (Labourage only)	Duration
17	Cadangan Meroboh Dan Membina Semula Rumah Tamu 4 Tingkat (60 Bilik), Dan Sebuah Pencawang Elektrik Di Atas Lot 4050, Sebahagian Lot 4049 Dan 4492, Jalan Denai Intan, Mukim Durian Sebatang, Daerah Hilir Perak, Teluk Intan, Perak Darul Ridzuan.	JKR	Edifice Builders Sdn.Bhd	RM5,260,615.70	1/5/2018 – 2019
18	Pembinaan Mahkamah Baharu Kangar, Perlis.	JKR	SPK Asas Sdn Bhd	RM3,129,073.40	5/11/2018 – (Still in Progress)
19	Menaiktaraf Sekolah Menengah Vokasional Kulim Kepada Kolej Vokasional Kulim, Kedah Darul Aman.	Kementerian Pendidikan Malaysia	Vertice Construction Sdn. Bhd.	RM8,964,178.67	2019 - (Still in Progress)

CHAPTER 3.0

CASE STUDY

3.1 INTRODUCTION TO CASE STUDY

The building that i was focused on was named blok D. it was located at the back of the construction site near the back road. This building is classified as a framed structure because it consist of vertical elements which are columns, horizontal bands which are the beams, flat surface on which we can stand is slab, roof and staircase. The loads such as human beings, furniture and etc were carried by the frame. Thus, the walls have no role expect protecting the inhabitants from weather. This framed buildings are constructed in Reinforcement Concrete (RC). RC is a composite material that is made of concrete and steel. Concrete is obtained by mixing cement, sand, aggregates, water in required proportion. Those concrete was ordered from thier batching plant which is located at Batu Kawan, Penang under Lafarge company. The concrete was first undergoing slump test to check the consistency and workability and also compressive strength test to test hardened concrete before it was approved by C.O.W to use on site. The main building structure that was construct were column, beam, slab and staircase. The priority that was given in this study was the construction method for those building structure.

Figure 3.1.1 : Left side of the building

Figure 3.1.2 : Right side of the building

Figure 3.1.3 : Back side of the building

3.2 TO INVESTIGATE THE CONSTRUCTION METHOD FOR REINFORCED CONCRETE FRAME STRUCTURE

a) Beam and slab

Beam and slab form the horizontal members in a building. They transfer the load coming from the floor above the slab which is in turn transferred to the columns. Beam and slab were constructed by reinforced concrete (R.C). They are a structural component capable of resisting load primarily by bending resistance. The bending force caused by external loads, own weight, length, and external reactions to these loads induced into the beam material is called a bending moment. Varying in complexity strengthening to give additional tensile strength to the member. Steel bars and stirrups was also one of the important parts in this process to provide extra resistance to the building structure.

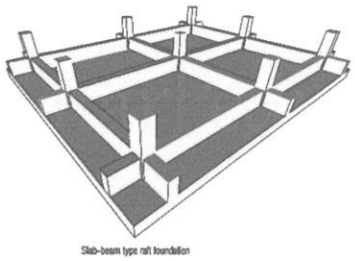

Figure 3.2.1: Graphic design of beam and slab

Top bar was used to keep stirrup in position during concreting. Stirrup main bar was used to take the main loading. Problems that usually occur during the construction was tension cracks that occur if tensile strength of RC beam is exceeded. There are two types of slab which is one-way slab and two-way slab. One way is slabs that primarily deflecting one direction. Secondly, two-way slab. It was slabs that are supported by columns arranged generally in rows so that the slabs can deflect in two directions. Most of the building that used in construction of building in Kolej Vokasional Kulim used two-way slab.

The advantages of using two-way slab were flat ceilings are available in this slab because there is no beam in the middle of the cell. Thus, the height of the room is more available because it was adjustable before construct. Last but not least, the beauty of

the room increases. While the disadvantages are this slab design method is more complex than the one-way slab. Next, skilled workers are needed to perform into constructing this two-way slab.

There are 5 stages of constructing beam and slab:

1. Beam and slab layout beam layout was first explored from the plan as there are some parts of the plan that combine beams and slabs. So, the formwork needs to include both elements combined.

2. Formwork

   Formwork is a temporary structure erected for the purpose of allowing wet concrete to be retained and formed into a desired shape until it is strong enough to support itself and the applied loads. The formwork of the beam and slab must remain in place until the concrete is strong enough to carry its own weight, or the finished structure may be damaged. The formwork structure (consists of a formwork, shores and any tie anchorages, and adjustment devices which are needed to ensure that the formwork structure is stable and rigid.

   Timber was used on top of the scaffold which was laid horizontally then vertically. Both were attached using timber nails 2 inches and a half. Then plywood was installed at both sides. It consists of sole plates, wedges, props, head tree, planks and batten. Horizontal braces were installed if the prop height were more than 8'. wood that was previously used for the previous building was used but cut precisely to the required length and width. For slab formwork, plywood was installed and attached together with the beam.

Figure 3.2.2: Installation of formwork for beam and slab

3. Installation of reinforcement bars

The reinforcement bars were bend and formed at Blok B by the experienced barbender. The reinforcement bar was followed in detail from the plan of the size of stirrups, links, diameter of reinforcement bar and its types. The reinforcement bar was then carried to the site and placed in the formwork. It was then tied to make it static and strong. Make enough space between formwork and reinforcement using spacer blocks under the beam reinforcement. Placed BRC than attached to the beam as well. Then placed spacer block under the beam and slab reinforcement bar and ready to be concrete.

Figure 3.2.3: Installment of reinforcement bar attaches to BRC

4. Pouring concrete

Concrete was pour using concrete and lift using a crane. The concrete was pour simultaneously repeated until the concrete completely depleted. While pouring the concrete, compaction was carried out at the same time using vibration poker to release the entrapped air in concrete so that concrete can achieve its desired strength and density. Then finishing was carried out to give a satisfactory uniform concrete surface using screed board, steel trowel and wood float. Compaction was also performed using vibration poker to get rid of air bubble. Walking way on steel bars by placing wooden plates to avoid disturbance in steel bars.

Figure 3.2.4: Pouring of concrete

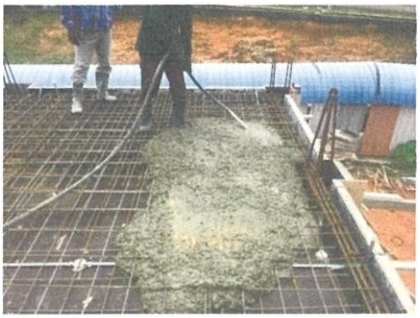

Figure 3.2.5: Compaction of concrete

5. Curing

   To prevent moisture loss and allow concrete to complete hydration process by spray water or cover with gunny sacks or plastic for 3-7 days.

6. Remove formwork

   Formwork is left in position until concrete has gained sufficient strength and will be removed after 3 days.

Figure 3.2.6: Remove formwork

b) Columns

Columns are vertical members constructed above the ground level. Columns can be of two types which are architectural columns and structural columns. Architectural columns are constructed to improve the building's aesthetics while a structural column takes the load coming from the slab above and transfers safely to the foundation. It is a vertical member which transfers loads from slab and beam directly to subsequent soil. A rectangular column must have a t least 4 reinforcements at 4 corners. Rebar is needed as columns are subjected to bending.

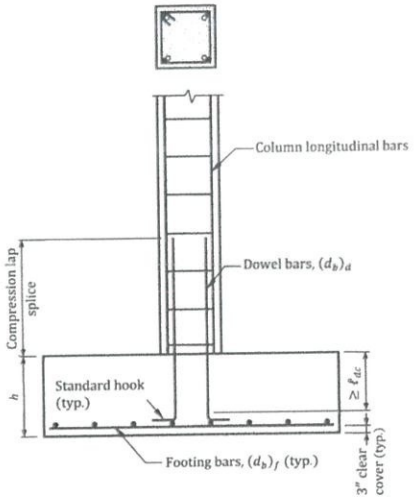

Figure 3.2.7: Detail drawing of column

There are 5 stages of constructing column:

1. Column layout work in this stage of works the location of columns are determined practically in field. It is done by laying rope according to grids shown in the drawing and then mark the location of columns related to the rope.

Figure 3.2.8: measure of formwork

2. Reinforcement bar work

After marking the column locations, they then start to place reinforcement as instructed in the structural drawing. (link, stirrups and reinforcement bar). Footing dowels and column bars were tied together before the formwork of column were installed.

Figure 3.2.9: Cutting and bending reinforcement bar

3. Column formwork

Used to support forms or molds for poured concrete columns. Many pieces of wood were installed vertically until it reached the desired length. The joints of the formwork were in sufficiently tight to prevent wet concrete from leaking. The finished surface of the concrete was installed smooth, even and should achieve the desired texture and appearance of the finished product. Any insufficiently tight joint will lead to the loss of liquid from the concrete. The function is to retain the concrete which also provides the support to the wet concrete until it has gained sufficient strength to be self-supporting.

Figure 3.2.10: Installation of formwork

4. Pouring concrete into column

   For large amount of concrete volume, concrete gred 35 from Lafarge company was poured using concrete bucket that will then be lift up using a crane including the process of compaction using vibration poker used outside of the column formwork. Lastly, level the concrete.

Figure 3.2.11: Pouring of concrete into column

5. Remove formwork

   The formwork was removed after 3 days so that it gains sufficient before entering the next stage.

c) Staircase

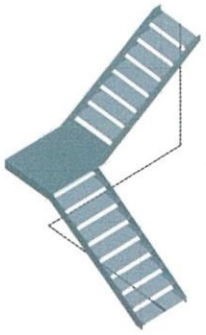

Figure 3.2.12: Graphic design of a L shaped stair

Stair construction now consists of two main areas: one comprises ready-made stairs and their varied possibilities, the other is stairs made in various types and styles by craftsmen. In the hope that this second area, the craft-based group, will recover lost ground and that we will not only be able to speak of a renaissance of wooden structures but also of stairs in the near future (Willibald Mannes, 1979).

The staircase that was constructed in site at kolej vokasional kulim are various but I only focused on construction method of staircase for blok D which is L shaped stair. Stair also can be defined system of steps by which people and objects may pass from one level of a building to another. Stair is to be designed to span a large vertical distance by dividing it into smaller vertical distances, called steps. functional requirements of staircases are stability, protection from fire, suitable dimensions (for normal, elderly, disabled people & children). This type of L shape stair has equal number of flights. It consists of vertical & inclined posts, Inclined members, sheeting, stringer, thread and riser.

There are 7 stages of constructing staircase:

1. Staircase layout work

   The types of stair must be identified and scaffold was prepared to give additional support for the staircase formwork. Besides it was also supported by strong hard formwork that have enough strength to withstand the wet concrete.

Figure 3.2.13: Installation of scaffold to withstand the stair's load

2. Bending and cutting reinforcement bar

   Reinforcement bar were bend and cut according to the desired length.

Figure 3.2.14: Bending and cutting reinforcement bar

3. Install formwork

   The most important step when building concrete stairs is to use a proper formwork. The angle of flight, dimensions of thread and riser are properly checked. While constructing the stairs that was attached to wall, the line of flight, thread and risers are marked on the wall for proper fixing of shuttering or formwork. The boards that was cut using chainsaw was at least 2' thick, as to support the weight of the concrete. The wooden boards are used to create the

steps and are fastened with several screws to the lateral structure of the formwork.

Figure 3.2.15: Installation of staircase formwork

4. Install reinforcement bar

   The concrete steps are to be reinforced with steel bars so as it carries the loads coming upon the stairs and transfer them to the ground. The number of steel bars and size of the bars was calculated by engineer depending upon the loads coming on the stairs. These steel reinforcement bars are placed in the formwork with 25 mm spacing and is tied together.

Figure 3.2.16: Reinforcement bar was installed horizontally and vertically

5. Concrete staircase

   Pouring of concrete into the formworks is started from the below part to above. The concrete mix plays an important role in strength and durability of stairs. Next, concrete vibrator while pouring the concrete to completely fill the gaps of the stairs and to avoid the honeycomb formation. This work was carried out with great care and patience, as any sudden movements can disturb the alignment of the formworks or even collapse the formwork.

6. Remove formwork

   The stairs require at least 7 days to dry out completely, so the removal of formwork is to done only after 7 days. After the 7 days, the formwork was removed by using a hammer and a crowbar. The work of removing formwork was done with patience as to avoid damaging the concrete or the edges of the stairs.

7. Addition of stair's flight

   The stairs bricks are arranged to increase the length of the landing to correct plan errors. the brick is tied with cement and then will be plaster.

Figure 3.2.17: Install bricks to widen the landing

3.3 TO DETERMINE THE DEFECTS THAT OCCUR DURING THE CONSTRUCTION PROCESS AND THE WAYS TO DEAL WITH THE DEFECTS

In this modern era, there are more and more-high rise buildings being developed by the clients or the contractors due to the reason of insufficient land use and high population of people. New buildings mean different thing to different people. In fact, there is not exact definition for what is meant by new building.

However, the definition is center around the age of the buildings. While some might consider building less than five years old as new building some might considered building less than ten years old as new. In this research project, new building is defined as building within the defect's liability period. In Malaysia, the defects liability period is from 12 months to 24 months which is 1 to 2 years. After that, the buildings will be defined as new which is free from DLP.

A building's purpose is to provide people with a comfortable and healthy environment to conduct activities, provide security, sustain load, and protect or control the environment. However, building defects and failures occur due to various causes and building defects are still one of the major issues that need to be addressed by the construction industry.

Generally, honeycombs, hairline cracks at beams, faulty design, construction materials, structural cracks in walls, reinforcement bars of columns became rusty due to expose to sunlight and rainwater and etc. Apart from that, unnecessary effort was needed in order to correct the construction error which is rework. Rework will affect the performance and also the cost for construction industry.

A defect is generally described as deterioration, damages, default or deficiency. There are usually various causes and types of defects that affect the performance of a building. For example, design deficiencies and construction deficiencies. The defects in the buildings also includes dampness, honeycomb, roof defects, erosion of mortar joint, corrosion of reinforced steel, foundation

failure, peeling paint, defective plater rendering, and timber rot. All these causes have given an impact of rework to the construction industry.

In Malaysia, high-rise buildings less than 10 years old would have structural defects that can cause danger to the residents and also to the public. In fact, all new buildings have problems in defects like surface cracks, leakage occur in electrical riser or shortcoming in workmanship. The reason why many defects occur in the new high-rise buildings was due to poor workmanship of the labour, lack of skilled supervision and etc. The most important is many new high-rise buildings have defects from the moment of completion.

There are 2 types of defects that obviously occurred in site:

a) Honeycomb

Honeycomb defects were found at beam and column at blok D which occur when mortar fails to fill voids between coarse-aggregate particles. The defect may be purely cosmetic or, depending on the location and extent of honeycombing, may be structural and require repair. Voids form when concrete fails to fill areas in a form, typically those under large blockouts, in very deep placements, or that are heavily reinforced. Voids are almost always structural defects requiring repair.

Causes of honeycomb and voids include stiff or unworkable concrete, segregation, congested rebar, insufficient consolidation, and improper placing practices.

Figure 3.2.18: honeycomb at beam

Preventive measures include attention to concrete mix proportions and using the proper techniques for forming, rebar placement, and concrete placement.

b) Cracks

Cracks are formed in concrete due to many reasons but when these cracks are very deep, it is unsafe to use that concrete structure. Various reasons for cracking are improper mix design, insufficient curing, omission of expansion and contraction joints, use of high slump concrete mix, unsuitable sub-grade etc.

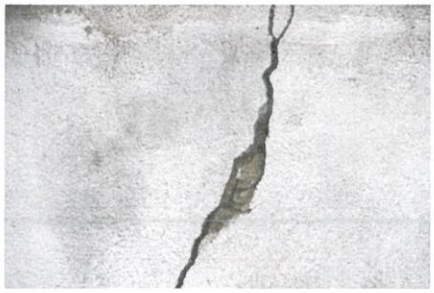

Figure 3.2.19: cracks occur at column

To prevent cracking, use low water – cement ratio and maximize the coarse aggregate in concrete mix. Surface should be prevented against rapid evaporation of moisture content. Loads must be applied on the concrete surface only after gaining its maximum strength.

CHAPTER 4.0: CONCLUSION

4.1 Conclusion

From this whole report, it can be conclud\ that reinforced concrete frame structure play an important roles in strengthening the structure of a building to withstand all kinds of obstacles such as extreme weather, natural disasters and the safety of its residents. Besides the careful construction process, there can be no mistake that can cause disaster in the future. There are also many advantages of reinforced concrete frame structure which is good in compression as compared to most other materials used for construction. Moreover, its resistance to fire is better than steel so capable of resisting fire for a longer time and it has a long service life with low maintenance cost which allows companies to save money in this increasingly volatile economic situation.

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