UNIVERSITI TEKNOLOGI MARA

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEY

UNIVERSITI TEKNOLOGI MARA

(PERAK)

OCTOBER 2013

It is recommended that the report of this practical training prepared

By

WAN ABDUL WAFI BIN WAN ABDUL GHANI

2011869548

Entitled:

THE CONSTRUCTION OF IN-SITU CONCRETE STAIRCASE

Accepted in partial fulfillment of the requirements to obtain Diploma of Building.

Practical Supervisor	Dr Asmat Ismail
Practical Training Coordinator	Sr. Anas Zafirol Abdullah Halim
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MOHD ROFDZI ABDULLAH

DEPARTMENT OF BUILDING
FACULTY OF ARCHITECTURE, PLANNING AND SURVEY
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(PERAK)

OCTOBER 2013

STUDENT DECLARATION

Hereby, all my work in Practical Training Report had been fully prepared by myself except been stated through practical training for 5 month from 13 May 2013 to 28 September 2013 at Constant Teamwork Sdn.Bhd. It also as one of the requirement to pass the DBN307 course and accepted as part of the conditions for obtaining the Diploma of Building.

.....

Name : Wan Abdul Wafi bin Wan Abdul Ghani
No KP UiTM : 2011869548
Date : 30/9/2013

ACKNOWLEDGEMENT

Bismillah...

First and foremost, all the praises to Allah SWT and peace upon the Messengers, Prophet Muhammad SAW for giving me time and strength to complete this report within the time given. Firstly , I want to thanks En Chong Kok Kin the owner of Constant Teamwork Sdn. Bhd. For accepting me to join their company as the practical student.Besides,highly appreciated and thankful to En Chai Kok Onn, the site supervisor who spend time given guidance, moral support, cooperation and lesson to me in order to prepare this report especially in handling '135 Units Double Storey Terrace House (Plots A12-A124 8 A156-A177) of type Casa and one unit of TNB Double Chamber Sub-Station (Plot 7/1279) at Bandar Universiti Seri Iskandar,Bota,Perak Darul Ridzuan. Also, to our Practical Training Coordinator En Anas Zafirol and practical training supervisor Dr Asmat bt Ismail and, also to Department of Building's lecturer, also my beloved father and mother.

ABSTRACT

This report briefly describes the process and method involved in the construction of In-Situ Staircase. This is the result based on the five months experience at the project site. For your information, this report was divided into several parts and its started with the background of the company and the background of the construction project. The result from the observation was the construction of In-situ Staircase in not as easy as it looks. Its require many parties and the complicated construction process. This report would explained simply about the history and the type of the staircase. Then, the report also explained about the concrete staircase construction which covers the installation of the formwork and the rebar works,followed by the the concreting process and finally the finishes.During, the construction process, a number of problems also occurred.This report also provided with several suggestion based on the problem occurred during construction and implement other method rather that been planned before. As conclusion, this report may explain more detail about the process and methods used in constructing In-Situ staircase.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The title for the report was the construction of in-situ concrete staircase. There were many steps involved in the method of construction for in-situ concrete that will be explain in this report. In addition, this report also explains about the problem that may occur during the construction works. The time given to complete the report was not stated but its must be completed and submitted before the 30 September 2013. The student learns the construction works by field observation. By that time, many new knowledge can be gained which was not learned from theoretical study. Besides that, the visit to the Constant Teamwork Sdn. Bhd. Office headquarters was made in order to gain information about the history and profile of the company. The Interview also were made by site supervisors and workers whose have lots of experience in the construction industry.

1.2 Objectives of study

There are several objectives highlighted in this report of in-situ Concrete Staircase construction, which are:-

1. To study the knowledge on the method of construction of in-situ concrete staircase.

2. To identify the problems that may occur after the construction works.

1.3 Scope of study

The scope of study that involved for the construction works of In-Situ Concrete staircase consist of :

1. Setting out
2. Installation of formwork
3. Installation of rebar works
4. Concreting works
5. Finishing Works
6. Problems occurred after construction

1.4 Methodology of study

1.4.1 Field Observation

The main source for this assignment was field observation. This is because most of the time the student spent was for the site observation. Student will able to see the construction progress and able to know that its follow the schedule or not. By the way, The student that taking part in site work that gain new knowledge and experience.

1.4.2 Interview

The interviews have been held with the person the supervisor of sub-contractor where in-charge in the construction site about the possibility of problem to occur and also how to overcome it. Also the interview from the workers in the site to dig in more information about the method used for the construction of staircase.

1.4.3 Internet

The internet also gives some helps in completion of assignment. It gives the theoretical knowledge about the works that the student studied in the site.

CHAPTER 2

COMPANY BACKGROUND

2.1 Introduction

The Constant Teamwork was the fast growing construction company. The company was joined the construction industry for past 8 years. The company was owned by Mr Chong Kok Kin. He leads the team that specialized in the various field construction industry. The key factors in the growth and stability of the business are its young, aggressive management team. This team has grown up in the industry and applies a cost effective and timely approach to the completion of each project. Our group of energetic and efficient project managers has one primary goal. The company has desire of success by following the policies. Stand by performing quality work. in the safest and most economical manner. The utmost care in the safety and design of the venture and customer satisfaction is the motto of our service.

2.2 Company Profile

NAME OF THE COMPANY	:	CONSTANT TEAMWORK SDN.BHD
BUSINESS REGISTRATION NO	:	70349-U
COUNTRY OF INCORPORATE	:	MALAYSIA
DATE OF INCORPORATION	:	20 JULY 2005
TYPE OF BUSINESS	:	CONSTRUCTION
NATURE OF BUSINESS	:	BUILDING RENOVATION, PLUMBING, BUILDING CONSTRUCTION & INTERIOR DECORATION
REGISTERED ADRESS	:	NO 111 (SECOND FLOOR) JALAN LAPANGAN SIBER 31650 IPOH PERAK
BUSINESS ADRESS	:	NO 12B JALAN LAPANGAN SIBER 10 BANDAR SIBER 31650 IPOH PERAK
TEL	:	
FAX	:	05-3111003
EMAIL	:	admin@w-construction.com.my
PAID UP CAPITAL	:	RM 250,000.00

2.3 Organization Chart

2.3.1 Company Organization Chart

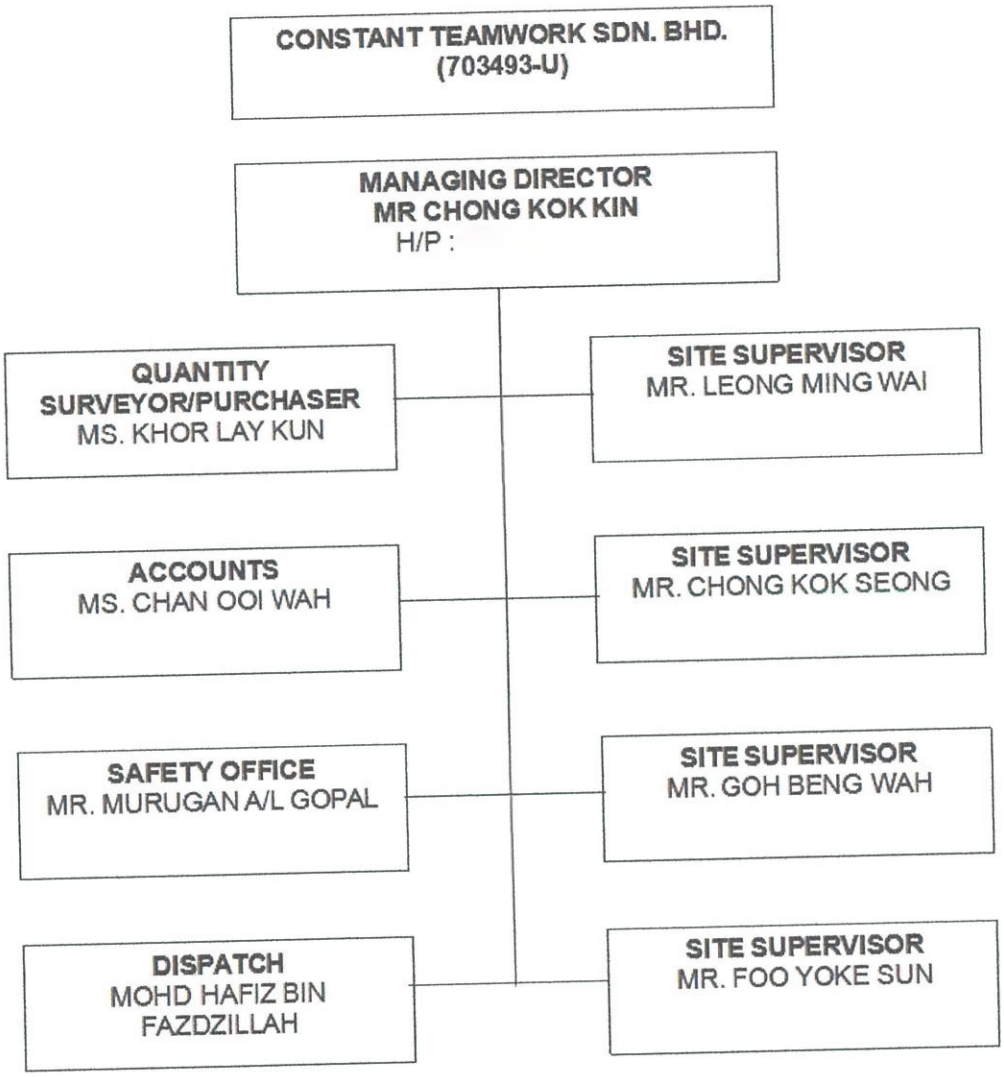

Figure 2.1: The Constant Teamwork Company Organization Chart

2.3.1 Site organization chart

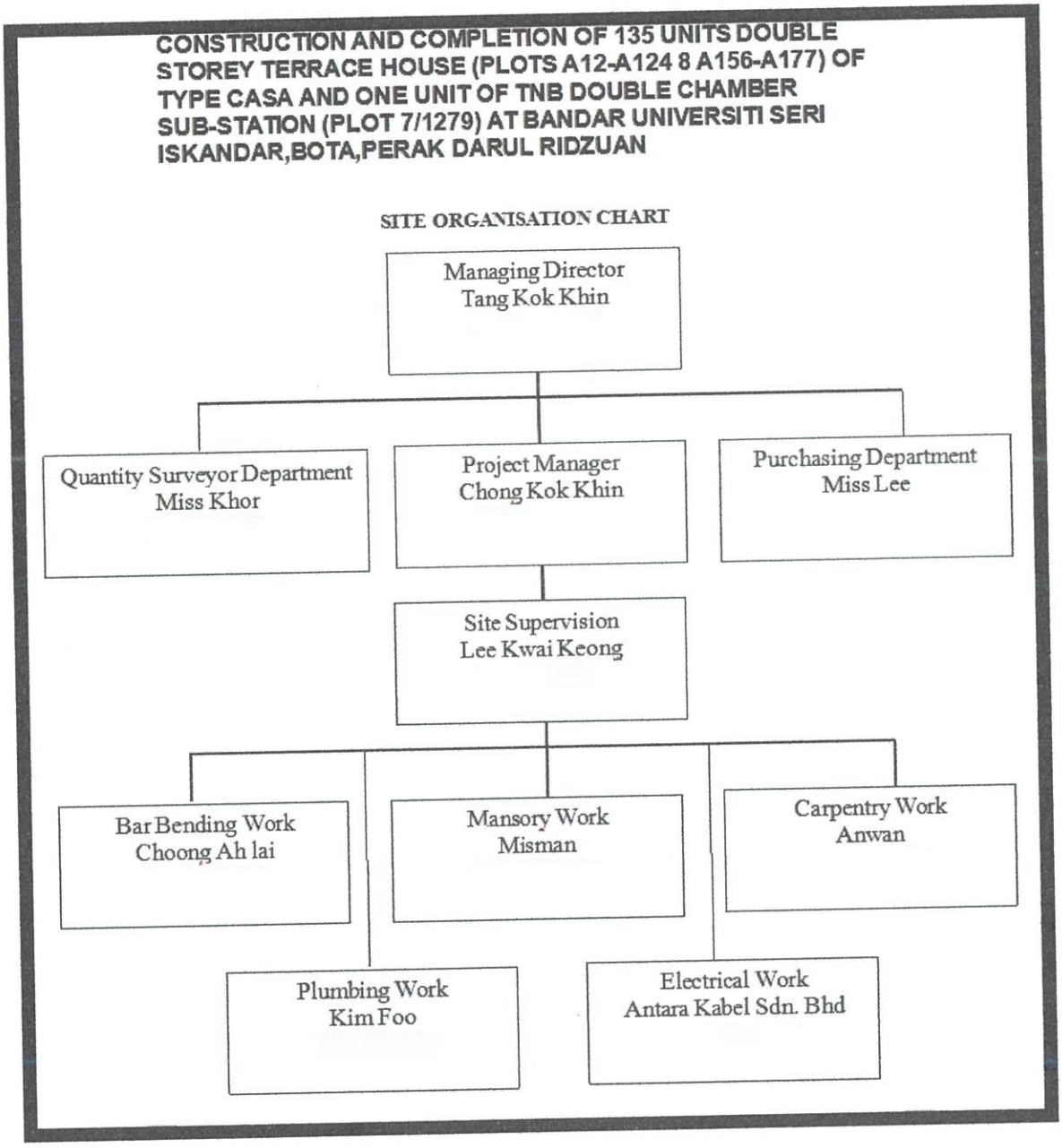

Figure 2.2: The Constant Teamwork Site Organization Chart

2.4 List of project

2.4.1 Current Projects

Table 2.1: The Constant Teamwork current projects

PROJECTS	DATES
Construction and Completion of 135 Units Double Storey Terrace House (Plots A12-A124 8 A156-A177) of type Casa and one unit of TNB Double Chamber Sub-Station (Plot 7/1279) at Bandar Universiti Seri Iskandar,Bota,Perak Darul Ridzuan	Date of Commencement : April 2013 Date of Completion : March 2014
Construction and Completion of 137 units Double Storey Terrace Houses at PT 8529 (PLOT 7A), PT 8530 (PLOT 7B) and Part Of PLOT 7C, Bandar Universiti Seri Iskandar, On Part Of LOT 12670, Mukim Bota, Daerah Perak Tengah, Perak Darul Ridzuan.	Date of Commencement : January 2013 Date of Completion : December 2013
Proposed 156 Units Double Storey Terrace Houses At Bandar Seri Botani, Off Jalan Gopeng (Phase 1.5B(1a and 1b) For M/s Pinji Botanics Sdn. Bhd.	Date of Commencement : February 2013 Date of Completion : March 2014
Cadangan Membina 20 unit kedai pejabat 2 tingkat di atas Pt.215371-Pt.215390, Off Jalan Persiaran Kilang, Taman Pertama,Ipoh, Perak untuk M/s Pusaka Unik S/B	Date of Commencement : January 2013 Date of Completion : Jun 2013
Cadangan Membina Pusat Penjaja Setingkat Dengan Setengah Aras Kedai di atas Lot Pt. 196781, Off Jalan Persiaran Kilang, Taman Pertama, IPoh, Perak Untuk Tetuan Pusaka Unik Sdn. Bhd	Date of Commencement : September 2013 Date of Completion : December 2013
Proposed 146 Units Double Storey Terrace Houses At Bandar Seri Botani, Off Jalan Gopeng, Ipoh (Phase 1.5B(2)) For M/s Pinji Botanics Sdn. Bhd.	Date of Commencement : July 2013 Date of Completion : September 2014
Cadangan Membina Sebuah banglo 2 tingkat di atas lot 198781, (No. 214, Persiaran Buntong Jaya 7, Taman Buntong Jaya, 30100 Ipoh, Perak) R.P.T. Ulu Buntong, Mukim Hulu Kinta, Daerah Kinta, Ipoh, Perak untuk En. Ramesh A/L Subramaniam	Date of Commencement : September 2013 Date of Completion : January 2014

2.4.2 Completed Projects

Table 2.2: The Constant Teamwork completed projects

PROJECTS	DATES
Construction and Completion of 24 Units Double Storey Terrace House on (PT.9010-PT.9033) Type Gardenia At Bandar Universiti Seri Iskandar, Mukim Bota, Daerah Perak Tengah, Perak Darul Ridzuan.	Date of Commencement :Mac 2011 Date of Completion : November 2011
Erection & Completion of Proposed 56 Units Double Storey Terrace House On Plots No. 189-244 (Pt.211053-Pt. 211080) Lot No. 181709, Jalan Kuala Kangsar, Ipoh-Tasek Mutiara Phase 1E Untuk Tetuan Tasek Boulevard Development S/B	Date of Commencement :Mac 2011 Date of Completion : November 2011
Cadangan Membina 13 Unit Rumah Teres 2-Tingkat Di atas Pt. 190928-Pt 190940, Laluan Lapangan Siber 6, Taman Lapangan Megan, Ipoh, Perak	Date of Commencement :May 2010 Date of Completion :September 2010
Cadangan Sekim Perumahan Di atas Tanah Kerajaan, Mukim Hulu Kinta, Daerah Kinta Bersebelahan Taman Seri Margosa, Ipoh, Perak untuk Tetuan Constantland Development Sdn. Bhd.	Date of Commencement :Jun 2011 Date of Completion: December 2011
Construction and Completion of 56 D/s Terrace (Phase 1A & 1B) Di atas Tanah Kerajaan Kawasan Bercham (Sebahagian Lot 69028) Berhampiran Taman Kinta Mas, Mukim Hulu Kinta, Daerah Kinta, Perak Untuk Anggerek Merah Sdn. Bhd.	Date of Commencement :April 2009 Date of Completion: November 2009

CHAPTER 3:

THE CONSTRUCTION OF IN-SITU CONCRETE STAIRCASE

3.1 Introduction

3.1.1 History of staircase construction

The staircase is one of the oldest building in the history. The earliest type of staircase was made by wood trunk that was fitted together (as shown in figure 3.1). The main purpose was to overcome the problem by the difficult terrain. The stair provides a path to early people to access the higher level of terrain. This provides the higher chance of survival from the threat such as wild animals ("The History of Stairs", 2003).

However, the stairs also were used for the religion purpose. In China, the early stairs believed was used as the path to God and connection between earth and sky. These stairs were built by rock that was arranged in the valleys of mountains (as shown in figure 3.2). Other examples of stairs built for religious purposes are: the biblical Jacob's ladder, the tower of Babel, and the pyramids of Egypt ("The History of Stairs", 2003).

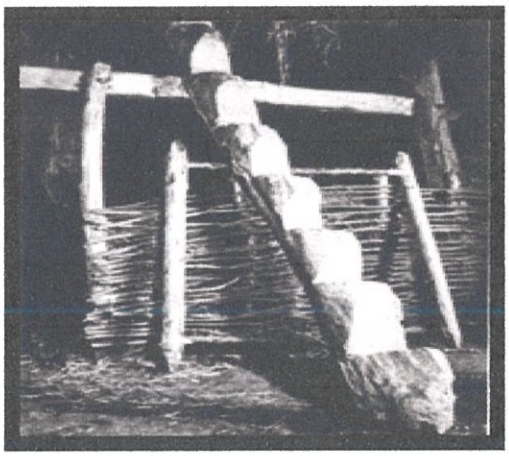

Figure 3.1: The old wood trunk stair.
Source : http://www.elevestairs.com

Figure 3.2: The early stair in the mountain.
Source : http://www.elevestairs.com

The other purpose of the stair in ancient times was also for the military reasons. The best example was the construction of spiral stairs for the fort and the castle (as shown in figure 3.3).The spiral stairs was crucial in the defense towers because of the spiral shape will utilized the space as well provide access to the top. The Dark Ages were the great example of era that used a lot of spiral stairs in for military. This is because there were a lot of war and the fort become the best defense from the enemies. The shape of spiral stair was not casual but its allow strategic positions to the knights that defends the castle. The stair was designed with no railing component. It gives advantages to the soldier at the top to push enemies that march through the castle tower. The aim to push enemies towards the edge . Besides, these soldiers would have a lot of space to move his sword freely towards the enemy. While the soldier at the bottom will hit the wall many times, this is because the part range of the moves would be blocked by the right side ("The History of Stairs", 2003).

Figure 3.3: The spiral stairs in the castle.
Source : http://www.elevestairs.com

3.1.2 The Type of Staircase

3.1.2.1 The Straight Stair

According to John (1992) straight stair is a type of stair that has a single or several flights. Most of the buildings are using this type of stairs. In these flights sometime linked by landings. This type of stair does not change direction. It provides a single straight passage to the top. In the early design, the width of the stairs was longer that today's design (as shown in figure 3.4 and 3.5) because the main purpose for the public usage. Although the straight stairs was simple by design but it also takes a lot of space to construct.

Figure 3.4: The Potemkin Stairs in Odessa

Source : John (1992) The Staircase, History and Theories.

Figure 3.5: Castillo Stair, Chichén Itzá Mexico

Source : John (1992) The Staircase, History and Theories.

3.1.2.2 The Helical Stair

The helical stair is also called the spiral stair and geometric stair (as shown in figure 3.6) .The helical stair utilizes the space and suitable for the building that has limited span area (John, 1992).

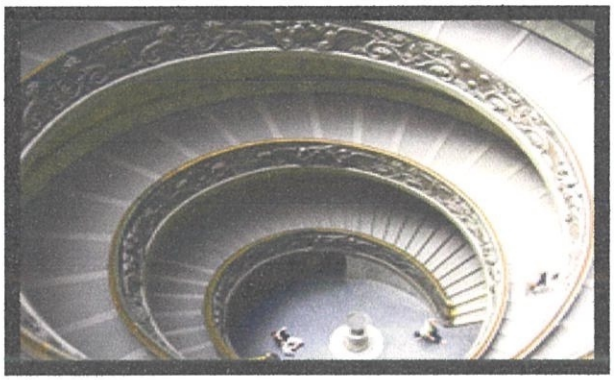

Figure 3.6: The Vatican Museum Stairs, Rome
Source : John (1992) The Staircase, History and Theories.

3.1.2.3 Composite Stairs

According to John (1992), the composite stairs is a combination of helical or straight stairs with landings as a coupling. Usually these stairs were used in the majestic place such as government building or opera house (as shown in figure 3.7).

Figure 3.7: Paris Opera and Theater, Venice
Source : John (1992) The Staircase, History and Theories.

3.1.3 The Staircase in the Modern Days

The end of the nineteenth century is known by many as the golden era of construction of stairs. The development of a mathematical system for calculating stairs and handrail was become important things in those era. The result was the precision and accuracy in calculating the riser, tread and landing of the stairs. Apart from that, the trend also leads to the art of the stairs from wood, metal, glass and stainless steel (as shown in figure 3.8). The new material to construct the stairs gives a sleek and futuristic looks ("The Twentieth Century, Modernism, and On", 2008).

Figure 3.8: A Modern long stair

Source : http.www.flexistairs.com

However, the most staircases used in the modern construction industry is concrete staircase. Concrete staircases are often specified for their strength, durability, fire protection, moisture resistance and sound attenuation properties. Outstanding aesthetics also can be added to list of benefits. Even the handrails can be concrete for a sleek look, although they are typically constructed in wrought iron, timber or glass. There are variety of finishing options, including hardwood, carpet, marble or tiles for the treads and risers. Concrete Stairs provides both precast and in situ high quality concrete steps ideal for commercial buildings and gardens ("The Twentieth Century, Modernism, and On", 2008).

3.2 Background of project

The project which the construction of in-situ concrete staircase was carry out at the site 135 Units Double Storey Terrace House (Plots A12-A124 8 A156-A177) of type Casa and one unit of TNB Double Chamber Sub-Station (Plot 7/1279) at Bandar Universiti Seri Iskandar,Bota,Perak Darul Ridzuan (as shown in photo 3.1 and 3.2). The cost for the project was approximately 30 million. The project was 60% done and Its follows the project schedule.

The developer is the Agro- Mod Industries Sdn. Bhd. Addressed at No 123A, Jalan Kampar, 30250, Ipoh,Perak. The architect is from Archi-Invent Architect addressed at No 19 Medan Chateau, Taman Chateau, 30250, Ipoh, Perak. The Engineer is from F,C, NG Perunding addressed at No 3, Jalan Sybil Kathigasu, Fair Park, 31400 Ipoh, Perak. The Contractor is from Constant Teamwork Sdn. Bhd. No 12B, Jalan Lapangan Siber 10, Bandar Siber, 31350 Ipoh, Perak.

Photo 3.1: The view of double storey terrace house from the rear

Photo 3.2: The view of double storey terrace house from the front

The shape of the staircase for the project was Quarter turn. The quarter turn is the type of stair that changing the direction (as shown in the figure 3.9). This stairs change the direction 90 degrees and its very suitable for limited span area such as terrace house. It has two flights of stairs with the landings as the coupling. The detail of the stairs was shown in figure 3.10 and the appendix A.

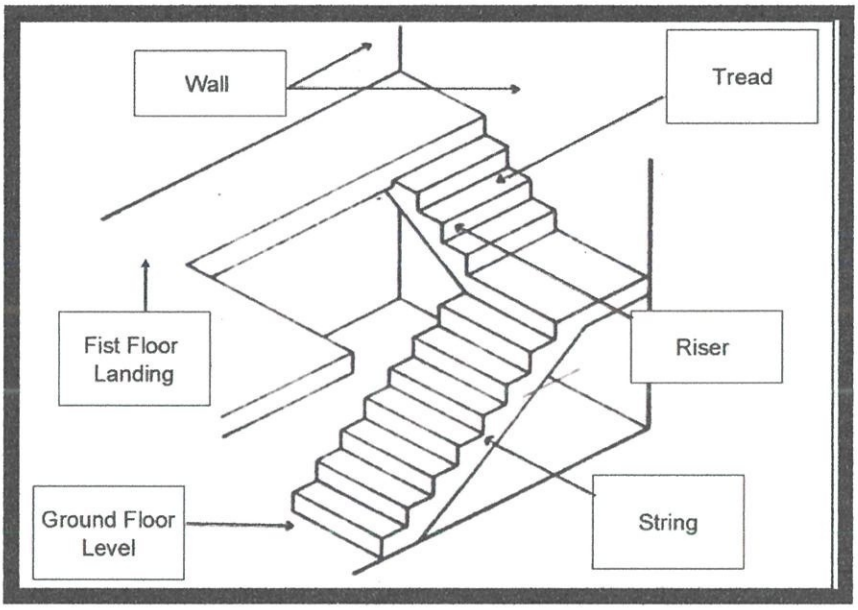

Figure 3.9: The basic diagram of the project

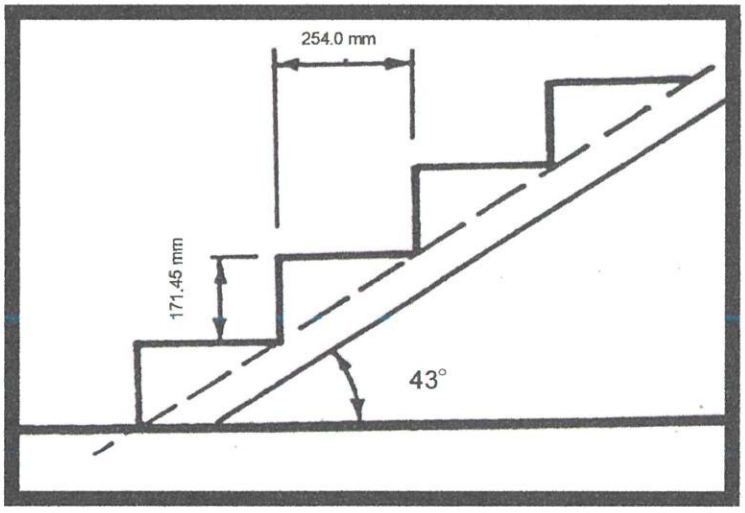

Figure 3.10: The detail of the stair

3.3 Case Study: Method Construction of In-Situ Concrete Staircase

There are several steps to construct the in-Situ concrete staircase. The overall process from the beginning to end takes about two weeks to finish, the number of workers involved were seven people for each stairs. Usually, the workers made three construction works at one time and each one can be divided into to two houses. There would be the total of six stairs will be made simultaneously.

3.3.1 Setting Out

The area to construct the stairs needs to be cleared. Removes any forms, wood panels, plastic sheets, and steel from the area (as shown in photo 3.3). Make sure that the foundation as the base to the stairs is flat. It was important to make sure the structure is stable because it will carry dead load of the people. Besides, this flat surface will ease the workers to build the stairs. After that, calculate the elevation, the height of one floor to the others. Measure the horizontal distance the staircase will span. Measure the width of each step from left to right area where the staircase will go. This calculation was stated in the appendix A.

Photo 3.3: The view of the area which the stairs will be constructed

3.3.2 Building the formwork

The next process of the construction works was to build the formwork. The formwork used to shape the thread, the riser and also the string of the stair. The material of the formwork can be made from scrap or low grade timber (as shown on the photo 3.4). Usually the forms can be used several times. So, there no need to cut the new forms from the lumber board and it will speeds up the process. However, these would result to the low quality of the concrete stair surface. Usually, the workers used the chainsaw to cut the board into several pieces as the chainsaw provide nice cutting edge and easy to handle.

Photo 3.4: The low grade timber board which will be cut and shaped

After the timber board was cut. There will be several shapes of formwork. There was half zigzag shape which used as the side forms (as shown in photo 3.5). Then, there was also long rectangular timber panel which used to shape the riser of the stairs.

Photo 3.5: The side forms which cut from the timber boards

3.3.3 Assembling the formwork

The next step is to assemble the formwork (as shown in photo 3.6). Firstly, install the bottom form of a piece of plywood board. This will form the basic shape of the string with the leaning angle of 43 degree. Make sure that the foundation is flat to enable the stability of the structure. After that, install the side forms. The sides forms must be install perpendicular to the bottom forms .The forms was connected by 1 inch nail.

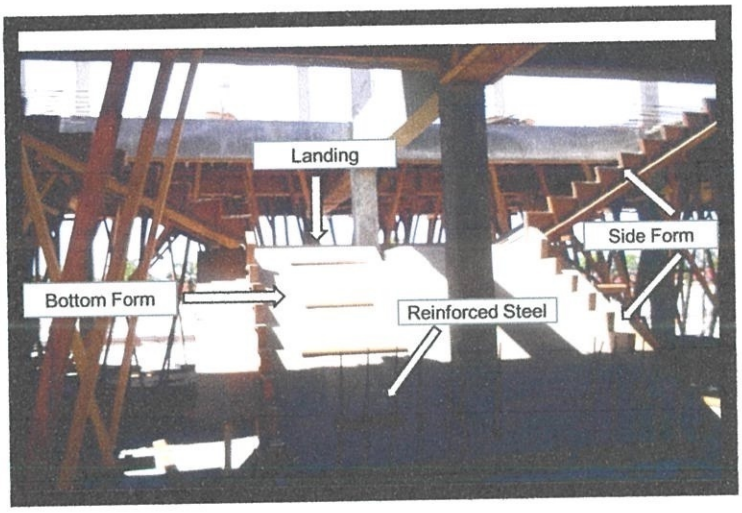

Photo 3.6: The side forms which cut form the timber boards

To support the formwork, the wooden braces were installed under the forms (as shown in photo 3.7 and 3.8). This also will avoid the outward movements when pouring the concrete.

Photo 3.7: The wooden bracing which supports the forms

Photo 3.8: The worker installed the wooden braces

3.3.4 Installing the reinforcement bar

Then, next step was to install the reinforcement bar to the formwork (as shown in photo 3.9). The type of reinforcement bars used for this construction were Y10 1nd Y12 (as shown in appendix A). For the landings the reinforcement bar was installed by two way overlapping .While the rest of the stairs we installed by one way overlapping. The main objective for installing the reinforcement bar was to increase the strength of the stairs. The stairs will be able to withstand with heavy dead load.

Photo 3.9: The worker installed the reinforcement bar.

The reinforcement bar was installed by connecting it with the bonding bars(as shown in photo 3.10 and 3.11). The bonding bars connect the staircase structure to the first floor and ground floor.

Photo 3.10: The bonding bars at the ground floor.

Photo 3.11: The bonding bars at the first floor

3.3.5 Installing the panel boards

After the process of installing the reinforcement bar is done, the timber panels can be installed (as shown in photo 3.12). These panels will forms the shape of the thread and riser when the concrete was poured. The height of the panel must be equal to the height of the riser. The panel was installed to all the flight of the stairs. Beside, these panels also form the shape of the landings (as shown in photo 3.13).

Photo 3.12: The workers installing the timber panels

Photo 3.13: The view of staircase from the first floor

Furthermore, the wooden braces also added to the timber panels (as shown in photo 3.14). The braces were installed at the top of these panels. The objective of installing these braces was to hold the panels from the movement caused during the process of pouring the concrete.

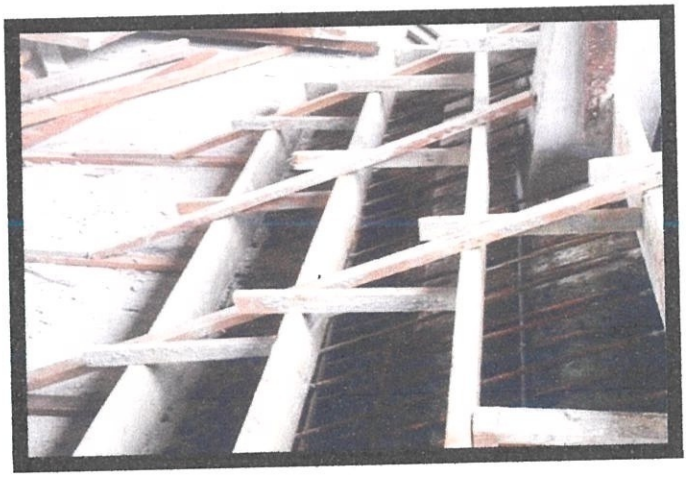

Photo 3.14: The braces on the timber panels

3.3.6 Concreting Work

The concreting process is the most important method on this construction work. The workers would do the work carefully to avoid any mistake during the process. This was because the repairing process after pouring concrete was difficult to handle. The amount of concrete needed to cover the staircase area was 15 metre cube. The suitable grade for the concrete was grade 25. The slump test must be carried out at the site(as shown in photo 3.25).The slump must be follows the specific slump of 75mm+ or -25mm. If the slump collapse, the concrete would be rejected by site supervisor. Besides, the cube test also was carried out to test the strength of the concrete (as shown in photo 3.16).

Photo 3.15: The slump test of concrete

Photo 3.16: The cube test of the concrete

Apart from the workers, the machineries also had crucial part to complete the concreting work. The concrete was carried by the mixer lorry from the benching plant (as shown in photo 3.17). However, the lorry can carry only 6 metre cube of concrete. Therefore, to fulfill the total order of 15 metre cube, the site supervisor had ordered several lorries from the batching plant.

Photo 3.17: The concrete mixer lorry

From the mixer lorry, the concrete was poured into the concrete bucket (as shown in photo 3.18). The bucket was attached to the chain which will be lifted by the mobile crane (as shown in photo 3.19) There was simple equation in which the 3 bucket full of concrete equal to 1 metre cube of the concrete. Therefore, the site supervisor can assume whether the amount of concrete delivered at site same as the amount stated at the delivery order.

Photo 3.18: The bucket of concrete

Photo 3.19: The mobile crane carrying the bucket

Before the concrete was poured, the inner parts of the formworks was greased to make it easier to dismantle the panels once the cement had dried Then, cement is poured into the form panels. The cement must be highly viscous as runny mix will cause the steps to slump downwards. The concrete was poured from the upper part of the forms (as shown in photo 3.20). Then, the concrete fall down to the lower part the forms (as shown in photo 3.21).

Photo 3.20: The workers poured the concrete to the forms.

Photo 3.21: The concrete flew in the forms

At the lower part of the forms, there were several workers that waiting the concrete to fall down at the lowest riser panel. After that, the workers insert a concrete vibrator to the forms (as shown in photo 3.22). The function of the vibrator was to eliminate the void in the concrete that resulted from the air bubbles. This would ensure the structure rigidity and strength.

Photo 3.22: The concrete vibrator

Any excess concrete at the lowest riser transported to the upper riser by using shovel then vibrate by the vibrator. Then, the process was continued until the concrete was fully reached at the uppermost part of the staircase forms panels(as shown in photo 3.33).Finally, the workers flatten the concrete surface by using the steel trowel .(as shown in photo 3.34). As the result, the surface looks finer and less bubble.

Photo 3.23: The workers transport the excess concrete to upper panels

Photo 3.24: The workers flatten the surface with steel trowel.

3.3.7 Drying Process

The staircase concrete was left to dry about a week in the hot weather. One week was the optimum time for the concrete to attain its final shape (as shown in photo 3.25). For your information, this construction works does not need the curing works because the staircase surface would be installed with the floor finishes.

Photo 3.25: The tread and riser that attained final shape.

Then, the workers began by removing the staircase riser panels (as shown in photo 3.26). The workers remove it carefully in order not to damage the structure or the formwork panels. If panels were not damaged its can be used again for another place. After the workers finish removing the panels, all these panels would be cleared from the area of the staircase (as shown in photo 3.27).

Photo 3.26: The staircase after dismantle the riser

Photo 3.27: The staircase after remove the riser boards

3.3.8 Adding finishing Touches

The final process for the construction of in-situ concrete staircase was adding the finished to the structure. The finishes for this works was ceramic tiles. The staircase surface need to be marked before the tiling works (as shown in photo 3.28). The marking acts as a guide to the workers during install the ceramic tiles. Then, the surface was applied with mortar and screed to make it rough. After that, the ceramic tiles can install to the surface of the stairs (as shown in photo 3.29).

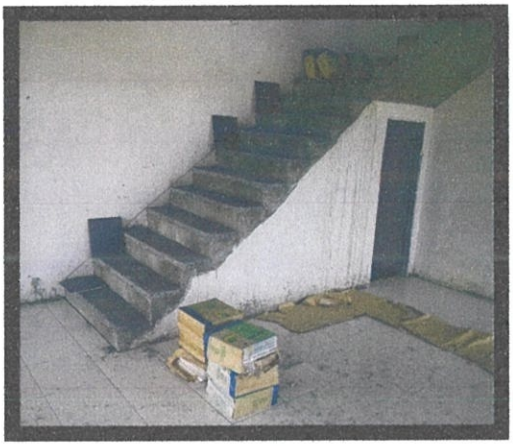

Photo 3.28: The staircase surface that was marked

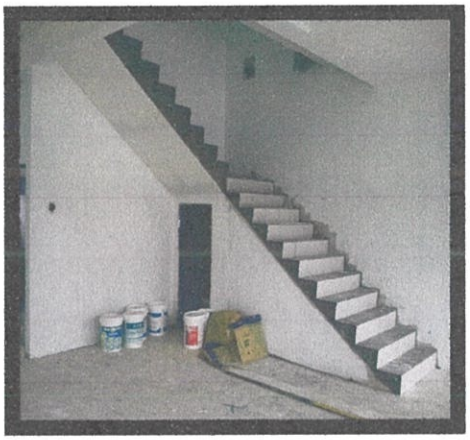

Photo 3.29: The installation of the ceramic tiles

The entire stairs was covered with the plastic sheet (as shown in photo 3.30). The plastic sheet protects the surface from the traffic. The drying process takes about three days. After that, the workers can install the handrail and the balusters to the staircase as safety and artistic features (as shown in photo 3.31). The baluster was made from metal and the handrail from the timber.

Photo 3.30: The stair was covered with plastic sheet

Photo 3.31: The handrail and baluster were installed to the stair

3.3.9 The Problem That Occurs After the Concreting Works

There were several problems that occurs after the construction works. The problem usually happens because the lack of experience of the workers when doing the tasks.

3.3.9.1 The Crack on the Concrete Surface

The surfaces become crack and not smooth (as shown in Photo 3.32). This happens because the staircase surface was evaporated fast because of the hot weather.

Photo 3.32: The crack on the stair surface

The solution to the surface crack was to plaster the surface. The workers can plaster the surface with the mortar (as shown in photo 3.33). The result was the surface of stairs become smooth and flat.

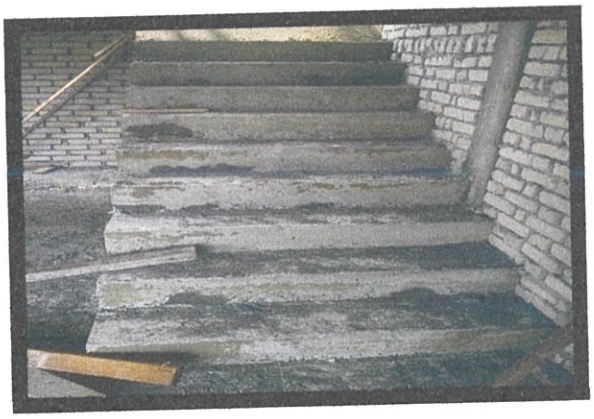

Photo 3.33: The crack was plastered with mortars

3.3.9.2 The Remains of Formworks Sticks to the Surface

There was the remains of formworks that stick the surface of the concrete (as shown in photo 3.34). This happens because of the formworks using to the construction works was not fully grease with the diesel fuel. The wood would likely sticks to the concrete during the dismantle process. So, this problem was not easy to repair as the wood was hard to remove.

Photo 3.34: The crack was plastered with mortars

There is a solution for this type of problem. Make sure that all the inner parts of the formworks were grease completely. This was important because the diesel oil can avoid the formworks and the concrete surface to stick together. This also would easy up the formworks dismantle process and not leaves any remains to the concrete surface.

CHAPTER 4

CONCLUSION AND RECOMMENDATION

4.1 CONCLUSION

From the study it can be concluded that the method to construct in-situ concrete staircase needs be done in a proper procedures and accurately. The construction process was complicated and also requires systematic arrangement of work. The key to successful and smooth progress of the project is much depends on the skills of the workers to construct the work correctly. The lots of experience the in-situ Concrete staircase is mostly construct in the Malaysia because its was low cost compared to the precast staircase. Besides, the In-situ was able to design according to the needs of the clients. Besides that, communication between all the parties is important because to ensure all works can move on easily and smoothly and no problems will appear. The right on controlling and supervising during the process of draw the plan are need to do by schedule for avoid any problems that can cause wasted of time and also money.

4.2 RECOMMENDATION

There was several recommendations that can be used in improving the quality of the works and to reduce the hazards that may occur during the construction process. Among the suggestion are;

1. The workers must not use the same formworks many times in the construction works.

   The formwork that was used in the works was used too many times. This was because the workers can reduce cost and time to make the new one. However, the surface of the formwork becomes not smooth and flat. Besides, there was moisture to the forms that leads to the production of algae and fungi. So, It will result to low quality of work. The workers should not use the forms many times because the forms can only be used twice.

2. The workers must wear personal protective equipment (PPE) during the construction works.

   There were many workers that not wear the PPE during the construction work .The PPE is the important tools to the workers. It's may become the live saver during the worst case scenario. The few examples of PPE is the safety helmet, safety boots, gloves, ear protector and mask. The PPE can protect the workers from falling objects, electric shock, sharp object, explosion, excessive sound and poisonous gases.

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Interviews

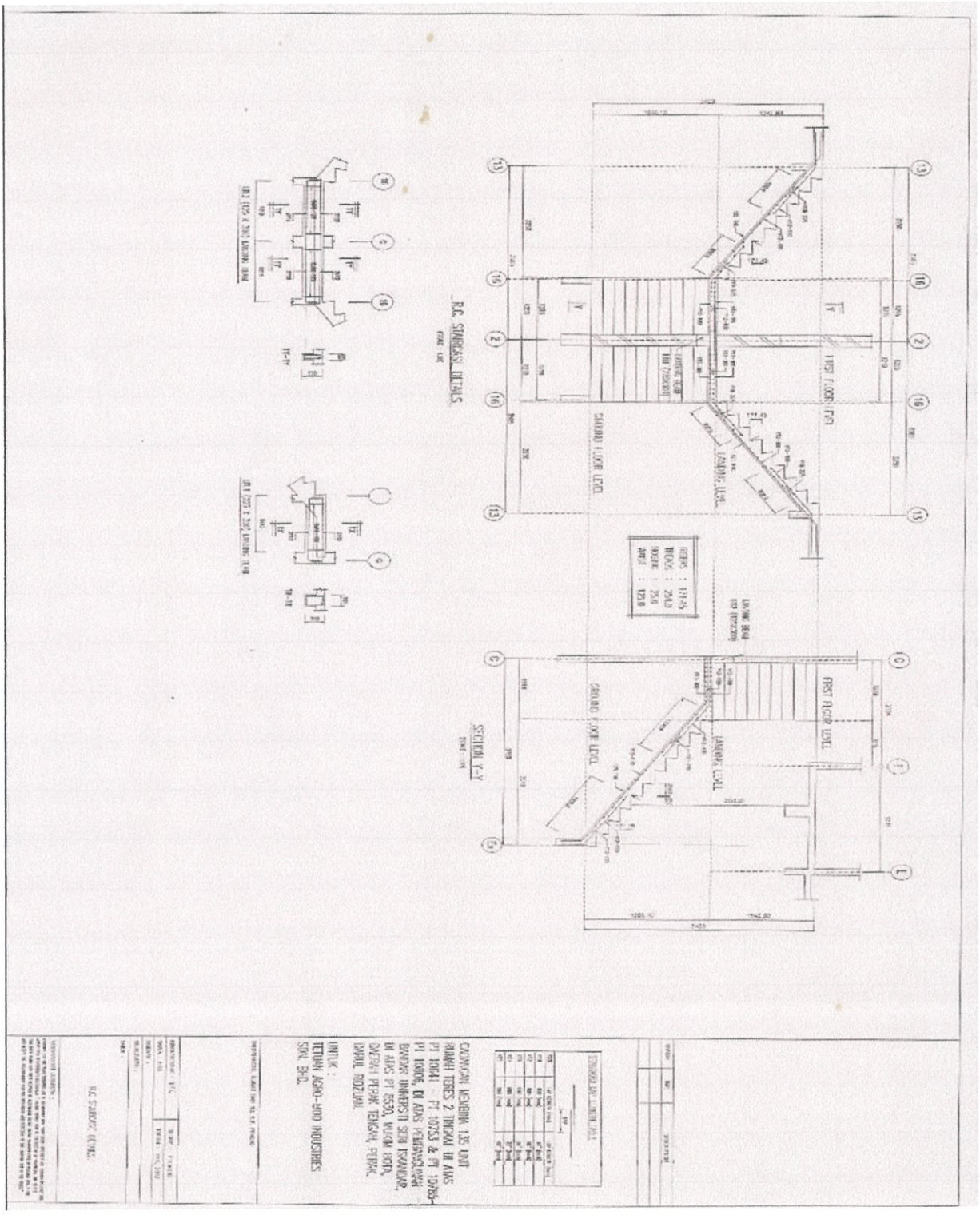
1. En. Chai Kok Onn, The site supervisor for the Constant Teamwork Sdn. Bhd,

2. En. Osman Muhammad, The site supervisor for the Huayang Sdn, Bhd

3. En. Supardi, The head worker of the site

APPENDIX

Appendix A



The detail drawing of staircase