



DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)

METHOD CONSTRUCTION OF PILE CAP

Prepared by:

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DECEMBER 2019

It is recommended that the report of this practical training provided

By

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entitled

**Method Construction of Pile Cap for Three-Storey Shophouse in Residential
Area at Taman Emas, Sabak Bernam, Selangor**

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 stated herein, prepared during a practical training session that I underwent at Larisan Maju Sdn Bhd for duration of 14 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 : December 2019

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Thank you so much.

ABSTRACT

Pile cap construction is one of the most important elements to ensure the successful function of any construction projects. This pile cap construction is designed to distribute loads into the group of piles and carries heavy point loads which produces high tensile stress at pile cap. This report was conducted at Taman Emas, Sabak Bernam, Selangor based on project Cadangan Membina Skim Perumahan di atas Lot 874, Lot 875 dan Lot 876 Mukim Panchang Bedena, Sabak Bernam, Selangor. This report is prepared to identify the construction process of pile cap for three-storey shophouse and also determine the materials, equipment and machineries involved during the construction works. The method used to study this topic is by interviewing related individuals, observations and did some study referring to project drawings. Findings show the importance of pile cap construction that built for three-storey shophouse in residential area which play one of the other important parts of the building structure.

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CHAPTER 1.0

PREFACE

1.1 Introduction

A building can be defined as a permanent or temporary structure enclosed within exterior walls and a roof, and including all attached apparatus, equipment and fixtures that cannot be removed without cutting into ceilings, floors or walls. It is typically used for a variety of activities such as living, working and manufacturing. Humans have been using buildings for various purposes since ancient times. In the Stone Age, human ancestors lived in caves and huts as their natural dwelling places. Gradually, as humans they learnt how to make shelters for themselves by using stones, tree branches and leaves to build simple huts. It is typically made of wood and had hearths of fire. Thereby, it can be said that the history of civil construction was begun from the period of human ancestors in the Stone Age. With the evolution of development in the world these days, more complex structures were built by using new materials such as cement, concrete, steel, glass and plastics that completely changed the building technology for a better improvement (Bhavikatti, 2012).

Building construction is an ancient human activity. The vast majority of building construction projects are small renovations, such as the addition of a room, or renovation of a kitchen. However, there are some elements which are design, financial, and legal considerations that need to be included into all building construction projects. To get a positive and better outcome for any projects, those with good experiences in the field should make a detailed plan and maintain careful oversight during the project. With this way, the undesirable outcomes and results such as structural collapse, cost overruns or other reasons could be avoided.

Some of the reason that might affect the undesirable results is lack of proper management and maintenance in the area. It is obviously that in every building structure or any residential area, the building materials should be strong enough to support any loads. This is because, buildings, like all structures are designed to support loads without deforming excessively. The loads are basically called *live loads* and the *dead loads* of the building itself.

Besides that, the building needs to remain solid and strong for long-term purposes to overcome most problems that can causes from bad design, faulty construction, foundation failure, unexpected failure loads and combination of causes. It is highly important to ensure the stability of building and structures, including when doing the construction works, demolition and refurbished works.

In a nutshell, durability and strong building depend mainly on proper construction process and proper use of materials. Apart from that, it could develop more building that can be long-term purposes for citizen in future.

1.2 Objective

The following are the objectives of this study:

- i. To understand the importance of foundation in building construction
- ii. To understand the method and process construction of pile cap
- iii. To identify the problem facing during construction of pile cap

1.3 Scope of Study

This study was carried out to increase the understanding of methods for constructing the pile cap. The study is been priorities at the construction of pile cap for three-storey shophouse in residential area at Taman Emas, Sabak Bernam, Selangor. The planning and construction progresses of this topic will be included in the report which will be related to the process stated below:

- i. The type of material and equipment used
- ii. Preparing and carrying out the construction works

1.4 Method of Study

The following are the methods of this study:

- i. Interview

The interview session occurred at Taman Emas which is my internship program was placed where the site office is directly located. There were 3 persons who involve in the friendly conversation consist of a site supervisor a site officer and a head-worker. A brief of the investigation was given to help in determining the elements of study that required in this report. They gave me opportunities and direct exposure of detail especially related to the current project of residential area which are located in Sabak Bernam, Selangor. Moreover, the head-worker shows me the structural drawings and explains more details to me about the construction works. The interview session is

very important sources as by interviewing the person in charge at the site. It can help me to gain the understanding at the construction site.

ii. Observation

In order to produce this report and the study about pile cap constructions, I have to go to site visit by myself to collect all the data since the site is near to the site office. The information is collected by supervising other person's work. Any important information such as progression of work during construction, all equipment and machineries that have been used will be capture and record by using camera on phones. The site visit helps me to more understand about the way of installed the pile caps more clearly now.

iii. Study referring to project drawings

This method gives me more information which it helps and very useful for finding more information on the particular topic which is construction of pile caps. It contains compilation and synthesis of ideas and data which also interprets information from one or more primary sources. I manage to study the details of structural drawing plan and the architectural drawing of the pile cap construction project with the help of site officers and supervisor at the site office. There are also several websites that I surf to obtain some important information related to the topic that I studied for this report. This internet also can be used as a secondary source as it serves many facts and correct opinions.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

Larisan Maju Sdn. Bhd. was established on 21th September 2002 with registration number 559562-A. It is located at No. 12, Jalan Bunga Matahari, Taman Pertama Fasa 4, 45200 Sabak Bernam, Selangor. This company was established as a house developer and contractor which have class A contractor licensed by Pusat Khidmat Kontraktor and also Construction Industry Development Board G7 license.

This company is a well experienced in the field that includes numerous completed projects from public and private sectors. So far, projects undertaken by Larisan Maju Sdn. Bhd. range from low cost housing, residential two-storey house and high end bungalow. This company has about hundred employees and general labors. There is experienced employees such as managers, engineers, accountants, planners, designers, supervisors and skilled labors and they are all highly motivated to handle all the construction projects. Furthermore, there are many subcontractors whose associations with this company that spend so many years working together to completed the projects smoothly and successfully.

Larisan Maju Sdn. Bhd. always maintain close cooperation with all parties involved in its projects and takes pride for completing projects ahead of schedule, with high standard of workmanship and reasonable profit. This company strengthens form project to project to face new challenges for the rapid changing industry with great experience, professionalism and dedication.

For the current project, this company has took the chance of residential area construction project named Taman Emas that are located at Sabak Bernam, Selangor. The project consists of 95 units of low cost housing and 282 units of free-cost housing. The location of the main office and the construction site as been shown in Figure 2.0 and 2.1 below. The distance between this location is about 8 kilometers only.



Figure 2.0: The location plan of Larisan Maju Sdn. Bhd.'s main office at Taman Pertama

Source : Google Maps



Figure 2.1 : The location plan of Taman Emas's project site

Source : Google Maps

2.2 Company Profile

Table 2.0 Company profile information

1	Company Name	Larisan Maju Sdn. Bhd
2	Business Address	No 12, Jalan Bunga Matahari, Taman Pertama Fasa 4, 45200 Sabak Bernam, Selangor Darul Ehsan
3	No Tel/Fax	Tel No: Fax No:
4	Date of Established	21th September 2002
5	Main Business	Construction & Development
6	Authorized Capital	RM 1,000,000.00
7	Paid Capital	RM 750,000.00
8	Bank	Bank Islam (M) Berhad & Maybank
9	CIDB Registered No.	0120030311-SL081167
10	Registered License No.	559562-A
11	Contractor Class	G7
12	E-mail	larisanmaju@yahoo.com

Source: Larisan Maju Sdn. Bhd

2.2.1 Company Director Information

Puan Arbaiah Binti Shamsuddin is one of the directors of the company of Larisan Maju Sdn Bhd. She started to join the company since it was founded. She has over 27 years of experience in the management and administration. She serves in managing office affairs involving government agencies, banks, purchase and payment arrangements including licensing, permits, approvals from consultants and marketing of housing. In addition, she is also one of the company's managing directors of Lian Soon Thiam Sdn. Bhd. and has been with the company since 1987 until now.

2.4 Organization Chart

This organization chart shown the position of the employer in the company of Larisan Maju Sdn Bhd and Lian Soon Thiam Sdn Bhd. The project director for this company are Pn Arbaiah Binti Shamsuddin and Mr Lian Bok San. Then, followed by En Mohd Khairul Azlan Bin Abdullah as the planner and designer for this company.

At the site construction, one team had mixed together to complete the projects includes a site supervisor, En Ahmad Khairi Bin Samad with the corporation from En Waryono and En Karsid as the head workers at the site. The machinery supervisor, En Separi Bin Suratin also take in part to ensure the construction projects could be runs smoothly with the help and corporation from each other. The organization chart as shown in Figure 2.2.

ORGANIZATION CHART

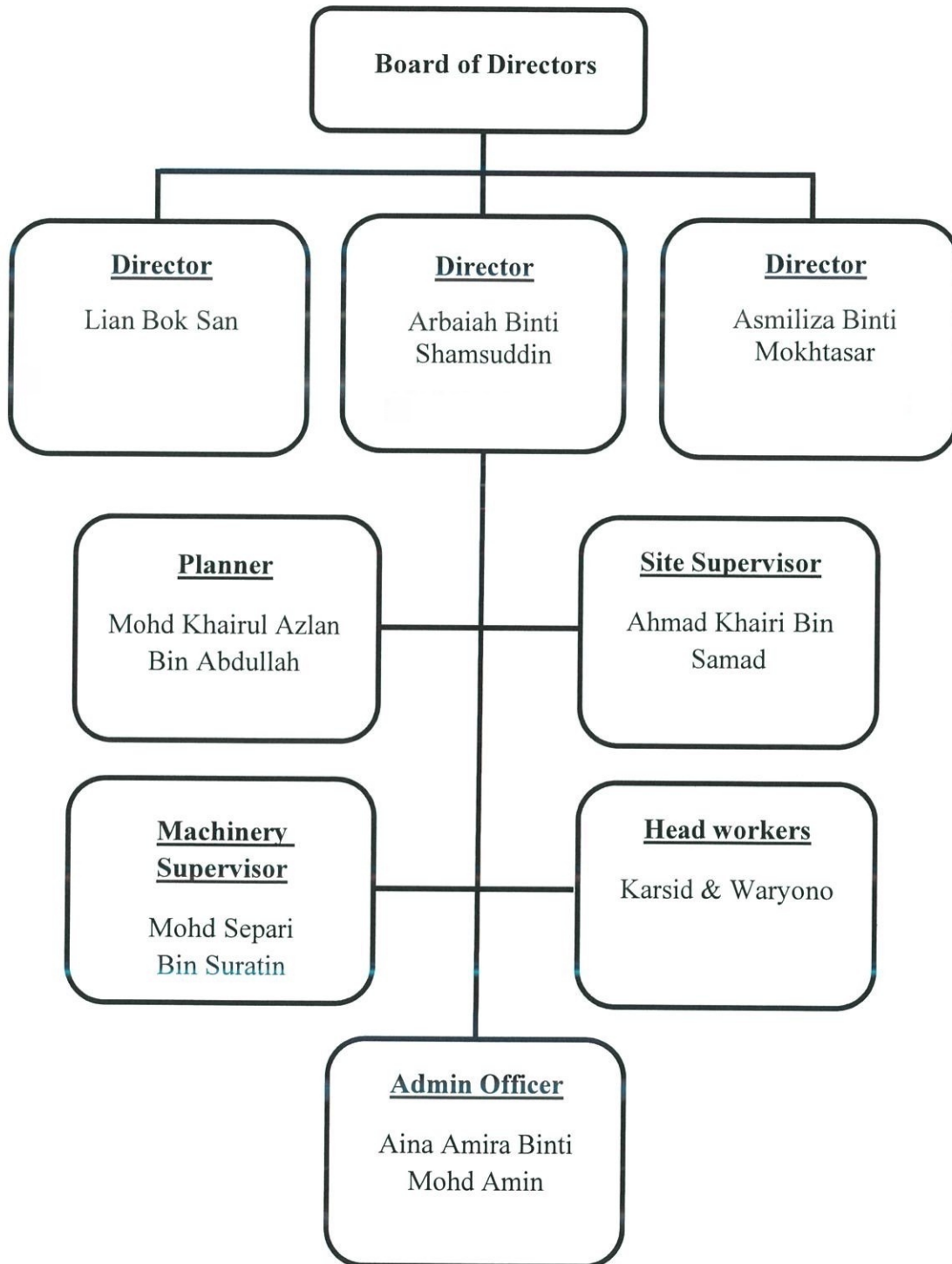


Figure 2.2: Company organization chart

Source: Larisan Maju Sdn. Bhd

2.5 List of Project

2.5.1 Completed Projects

Larisan Maju has completed many projects for the past several years. The past completed project has been listed in the Table 2.1 below:

Table 2.1: List of completed projects

No.	Location	Contract Value (RM)	Built According to Plan No.	Approved by Majlis Daerah Sabak Bernam
1.	Projek di atas Lot PT 2730 – PT 2749 Jalan Bunga Kekwa <ul style="list-style-type: none">• 20 Unit Rumah Berkembar Setingkat Plot 1-20	RM 4,500,000.00	3/118/2003	17 May 2006
2.	Projek di atas Lot 8618 Jalan Ros & Jalan Orkid <ul style="list-style-type: none">• 6 Unit Rumah Berkembar Setingkat (PT 2936 – PT 2941)• 9 Unit Rumah Berkembar Setingkat – 22' x 72' (PT 2942 – PT 2950)• 9 Unit Rumah Teres Setingkat – 24' x 78' (PT 2951 – PT 2959)	RM 5,000,000.00	3/80/2006	2 February 2009

3.	<p>Projek di atas Lot 8617</p> <p>Jalan Ros & Jalan Orkid</p> <ul style="list-style-type: none"> • 6 Unit Rumah Berkembar Setingkat (PT 2909 – PT 2914) • 11 Unit Rumah Teres Setingkat – 24' x 72' (PT 2915 – PT 2925) • 10 Unit Rumah Teres Setingkat – 25' x 78' (PT 2926 – PT 2935) 	RM 5,000,000.00	3/81/2006	2 February 2009
4.	<p>Projek di atas Lot 8611</p> <p>Jalan Bunga Kekwa, Taman Pertama</p> <ul style="list-style-type: none"> • 20 Unit Rumah Berkembar Dua Tingkat (PT 56 - PT 75) 	RM 6,818,000.00	OSC/B1/73/2013 (PBP) & B3E/OSC/61/2016 tp)	7 Jun 2017
5.	<p>Projek di atas Lot 904</p> <p>Taman Angsana</p> <ul style="list-style-type: none"> • 26 Unit Rumah Berkembar 2 Tingkat (PT 189 – PT 201 & PT 202 & PT 214) 	RM 6,381,000.00	OSC/B1/69/2013 (PBP)	25 October 2015

Source: Larisan Maju Sdn. Bhd

2.5.2 Future Project

This company also has planned their future projects as shown in the Table 2.2 below:

Table 2.2: List of future projects

No.	Name of Project	Location / Lot No.	Contract Value (RM)
1.	<ul style="list-style-type: none">• 4 Unit Rumah Berkembar 2 Tingkat (PT 3436 – PT 3437) & PT 3446- PT 3447)• 40 Unit Rumah Teres 1 Tingkat (PT 3438PT 3445) & PT 3396- 3435)	Lot 2143, GM 7407, Mukim Sabak	RM 12, 000,000. 00
2.	<ul style="list-style-type: none">• 28 Unit Rumah Berkembar 1 Tingkat (PT 3630 – PT 8707)	Lot 804, Mukim Panchang Bedena	RM 8, 000,000. 00
3	<ul style="list-style-type: none">• 20 Unit Rumah Teres 1 Tingkat	Lot 20275, GM 7382, Mukim Sabak	RM 5, 000,000. 00
4.	<ul style="list-style-type: none">• 1 Unit Rumah Sesebuah• 8 Unit Rumah Berkembar 1 Tingkat• 46 Rumah Teres 1 Tingkat (PT 249 – PT 270)	Lot 5477, GM 2747, Mukim Sabak	
5.	<ul style="list-style-type: none">• 30 Unit Rumah Berkembar 1Tingkat	GM 6882 – GM 6912, Mukim Sabak	

Source: Larisan Maju Sdn. Bhd

CHAPTER 3.0

CONSTRUCTION OF PILE CAP FOR THREE-STOREY SHOPHOUSE IN RESIDENTIAL AREA AT TAMAN EMAS, SABAK BERNAM, SELANGOR

3.1 Introduction of Project

Larisan Maju Sdn. Bhd. has grabbed any construction project that has been offered to them. This company is well-known to Sabak Bernam's population as they build many residential construction projects covered from Pekan Sabak to Sungai Besar. The director could make the chance to visit the site everyday, eventhough the main office is quite far about 8 kilometres away from the construction site. The project that is still carried out about 4 years ago until today is named "*Cadangan Membina Skim Perumahan at Taman Emas, Mukim Panchang Bedena, Sabak Bernam, Selangor*". The list of table shown below in Table 3.2 stated all the involvement of parties and consultants throughout this project.

This residential and housing project was a partner project between Larisan Maju Sdn Bhd and Lian Soon Thiam Sdn Bhd. The 6.070-hectare housing project of Taman Emas is consists of 95 units of low cost housing and 282 units of free-cost housing as shown in Photo 3.1 below. A perspective view of one block of Tulip that has been finished its construction about 2 years ago also has been attached in Photo 3.2 below.

The case study will focus on method construction of pile cap as the construction process of this element is not heavy and not take a long time to be finished like the other elements. All the progress of this construction has been observed because the knowledge can be gained so much during the 5 months' internship.



Photo 3.1: Signboard project of Taman Emas, Sabak Bernam

Source: Larisan Maju Sdn. Bhd



Photo 3.2: Perspective view of one block of the project (Tulip)

Source: Larisan Maju Sdn. Bhd

3.2 Lists Of Parties And Consultants Involved

Table 3.1 List of parties and consultants involved

Owner	<p>Majlis Daerah Sabak Bernam (MDSB)</p> <ul style="list-style-type: none"> • Majlis Daerah Sabak Bernam, Sungai Besar, 45300 Sungai Besar, Selangor Darul Ehsan • No tel. :
Developer/Contractor	<p>Larisan Maju Sdn. Bhd</p> <ul style="list-style-type: none"> • No. 12, Jalan Bunga Matahari, Taman Pertama Fasa 4, 45200 Sabak Bernam, Selangor Darul Ehsan • No tel. : <p>Lian Soon Thiam Sdn. Bhd.</p> <ul style="list-style-type: none"> • No 14, Jalan Bunga Matahari, Taman Pertama Fasa 4, 45200 Sabak Bernam, Selangor Darul Ehsan • No tel. :
Architect	<p>Archi Invent Architect</p> <ul style="list-style-type: none"> • No 29, Medan Chateau, Taman Chateau, 30250, Ipoh, Perak Darul Ridzuan • No tel. :
Engineer	<p>PYK Consultant</p> <ul style="list-style-type: none"> • No 298, Jalan Chung Ah Ming Pasir Puteh, 20650, Ipoh, Perak Darul Ridzuan • No tel. :

Source: Larisan Maju Sdn. Bhd

3.3 Project Background

3.3.1 Scope of Construction

Larisan Maju Sdn Bhd had joined the venture with Lian Soon Thiam Sdn Bhd to conduct the whole project that are located at Taman Emas, Sabak Bernam. This project should be expected to finish on 18th January 2018 and it has been 1 year late from the exact date. Therefore, the project was be extend until this year due to the problems that cannot be avoided. However, this company had constructed many residential and housing project which is Phase 1 and Phase 2 housing that are located at Taman Pertama, Sabak Bernam. It only took for about 8 kilometres away from the construction site and not far from the main office.

This housing project is located beside the main road and and near to suburban areas that could be easier for the workers and the residents as well to undergo their daily lives. This construction project consists of 17 blocks of housing and 1 shophouse which some of it are still in the progress and had completely done. However, there are still have some blocks of housing and shophouse that need to be construct for the future projects. This whole project includes the playground, mosque, fields, TNB Buildings and Sewerage Treatment Plant (Indah Water).



Figure 3.1: The playground at Taman Emas



Figure 3.2: The construction site for three-storey shophouse at Taman Emas

During this 5 month's of internship, this project is more focused on to construct the three-storey shophouse, 4 units semi detach houses and 1 unit of bungalow that need to be completely finished as soon as possible. Besides that, the maintenance system for this project is having many problems while this company is lack of skilled workers. That could be the major reasons why this construction project was delayed until 1 year late. As the construction project is still in the progress, the scope of construction that undertaken by this company are includes:

- ◆ Construction of bungalow, semi-detach houses and three-storey shophouse
- ◆ Studying drawing plan
- ◆ Dealing with customers and home owners
- ◆ Building defects
- ◆ Piping system
- ◆ Drainage system
- ◆ Renovation of houses
- ◆ Energy supply - wiring, electricity and renewable sources
- ◆ Water pump and plumbing
- ◆ Installation of aluminium, windows and doors
- ◆ Installation of mosaic and ceiling
- ◆ Heating and ventilation

The important factors that need to be considered are the efficiency in the construction works to ensure the services and the outcomes will be functions properly for the residents. However, the management should take a full responsibility to prove the customers and home owners that all the houses and shophouse in their industry are built with the best quality by the skilled workers. Besides that, the sub-contractor also should take the part to provide the best outcomes for all the tasks during the construction works was conducted.

3.4 Case Study (Construction of Pile Cap For Three-Storey Shophouse in Residential Area at Taman Emas, Sabak Bernam, Selangor)

3.4.1 Introduction of Pile Cap

Pile caps are thick reinforced concrete mat which rest on top the concrete or timber piles (driven or bored or cast in-situ) that interconnects with a group of piles and act as a medium to provide stability to the foundation. In other words, pile caps acts as a structural member and usually fastened to the top of a pile or a group of piles. The main objective of constructing the pile cap is to distribute the loads of columns, which is typically huge for large construction, to the under lying piles. Thus, the pile caps should normally be rigid to ensure the forces could be distributes equally on the piles of a group.

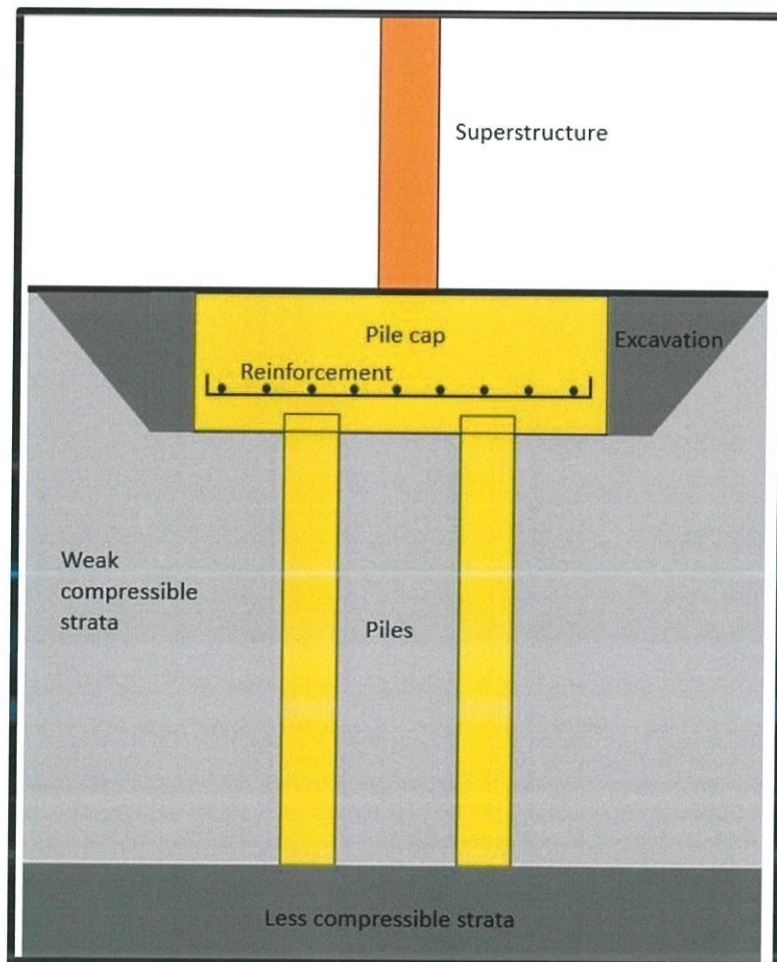


Figure 3.3: Diagram of pile cap

Source : Google Images

The design of pile caps depend on the number of piles that are needed to support the loads. This includes the numbers and arrangements of piles that were determined from unfactored forces moments transmitted to piles. These are the assumptions involved in the design of pile caps:

- ◆ Pile cap should be perfectly rigid
- ◆ Pile heads are totally hinged to the pile cap and hence no bending moment is transmitted to piles from pile caps
- ◆ Since the piles are short and elastic columns, the deformation and stress distribution are planner

In general, the pile caps may be designed by assuming that the load from column is dispersed at 45° from the top of the cap up to the mid depth of the pile cap from the base of the column or pedestal (IS 2911, Part I). The reaction from piles may also be taken to be distributed at 45° from the edge of the pile, up to the mid depth of the pile cap. In this case, the maximum bending moment and shear forces should be concentrated and worked out at critical sections either point loads or distribution.

The design parameters that need to be taken for pile caps are stated below:

- ◆ Shape of pile cap
- ◆ Depth of pile cap
- ◆ The amount of steel provided
- ◆ The arrangement of reinforcement

3.4.2 Function of Pile Cap

Pile caps are thick slabs that used to tie a group of piles together in order to support and transmit column loads to the piles. The function of pile cap are stated below:

- ◆ To distribute a single load equally over the pile group and thus over a greater area of bearing potential
- ◆ To laterally stabilize individual piles thus increasing overall stability of the group
- ◆ To provide the necessary combined resistance to stress set up by the superstructure and ground movement
- ◆ To transmit the building loads to the foundations and the ground soil layers whether these loads vertical or inclined
- ◆ To allow column or superstructure to reside on a stable and solid core foundation instead of residing directly on ground

3.4.3 Typical Shape of Pile Cap

Piles are usually used to support the loads. However, it is more economical and convenient to use piles in groups or clusters that linked together with a reinforced concrete cap. The pile caps can also be linked together with reinforced concrete ground beams (Roy Chudley, 2010).

Technically, the shape and plan dimensions of the pile cap will be determined by the number of piles in the group and the spacing between them. The typical shape of pile caps for different number of piles are either:

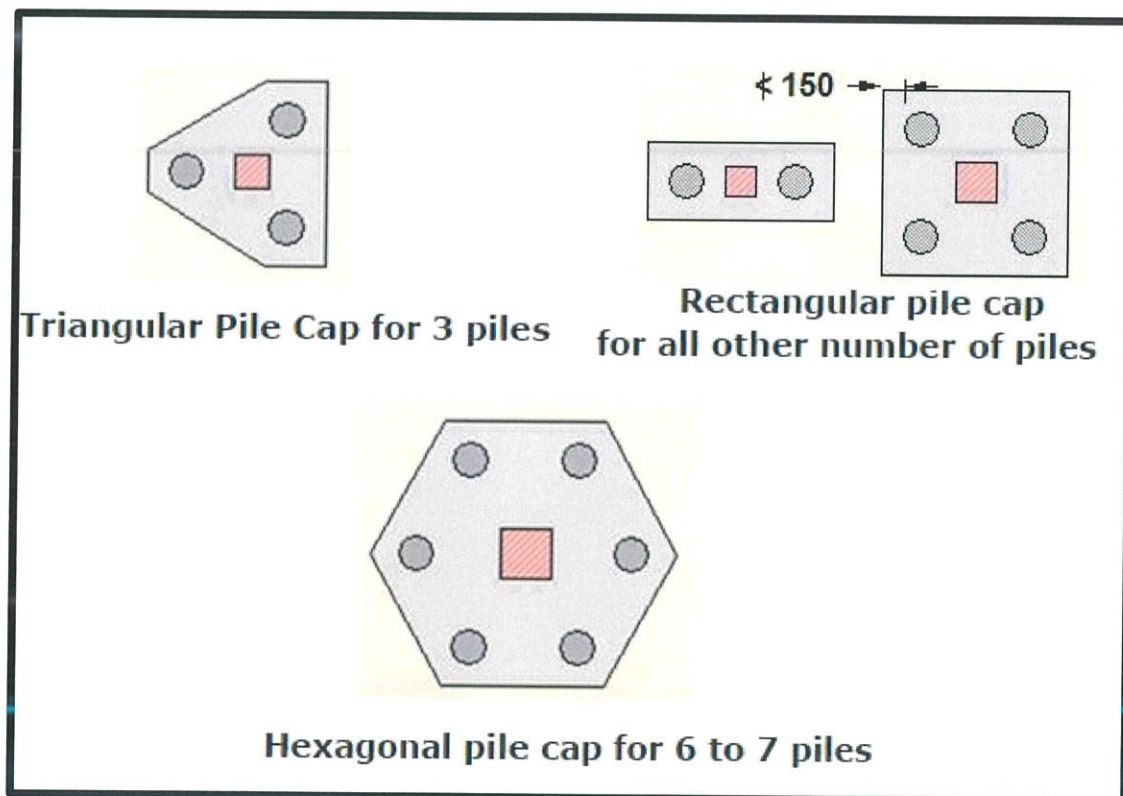


Figure 3.4: Typical shape of pile cap

Source : Google Images

The usual minimum spacing for piles are:

- i. Friction Piles: 1.100 or not less than 3 x pile diameter, whichever is the greater
- ii. Bearing piles: 750 mm or not less than 2 x pile diameter, whichever is the greater

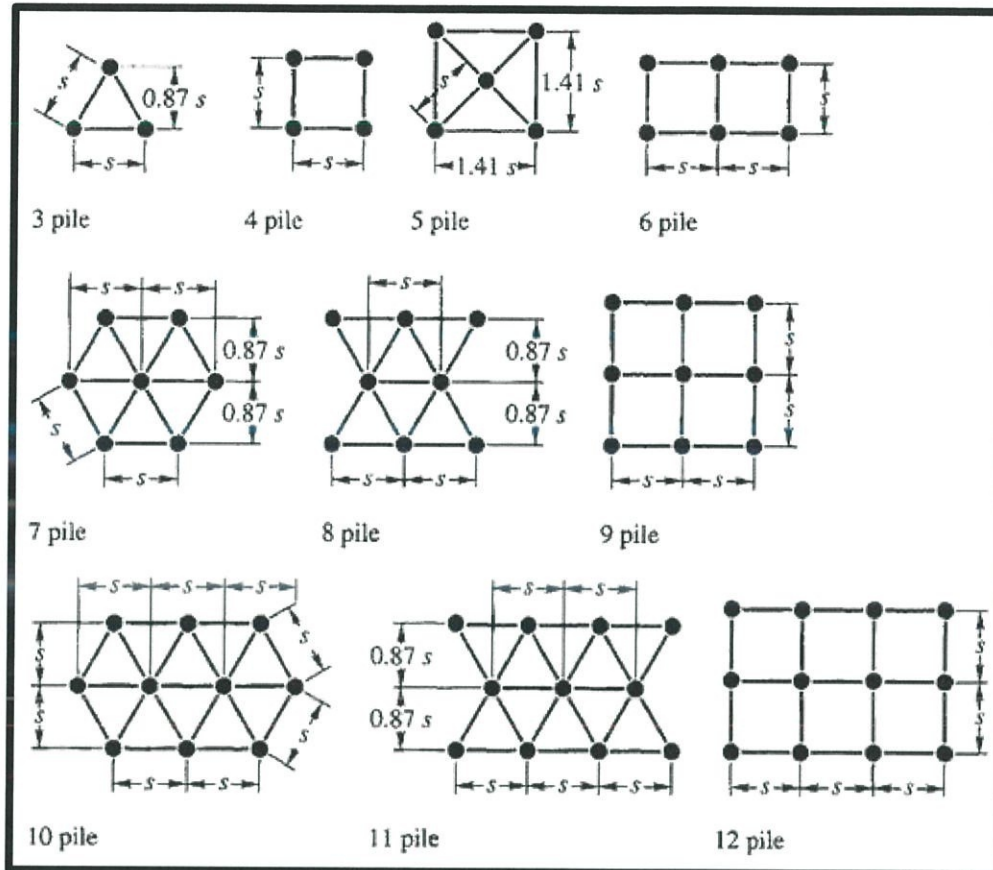


Figure 3.5: Typical arrangements of piles in piles group

Source : Google Images

The design assumptions and recommendations are considered as guidelines in deliberating pile caps as the choice of foundation. A pile cap with a greater depth is more convention than a comparable pad footing as it is typically subject to higher bending moments and shear forces. It will achieves greater rigidity from the increased depth, which allows it to evenly spread the loads to all piles in the group.

The factors that determine the depth of pile cap are:

- ◆ The shear capacity of the pile cap
- ◆ Shrinkage and swelling of the ground (more particularly in clay soils)
- ◆ Pile anchorage
- ◆ The ground's watertable
- ◆ The possibility of frost attack

3.5 Process Involved in Construction of Pile Cap

This is the flowchart process for constructing pile caps in any construction industries. All the process of pile cap that involved may not took a longer time to be completely done because it not a heavy elements compared to other elements. Generally, all the contractors in any construction industry will referred to this following standard during constructing the pile caps.

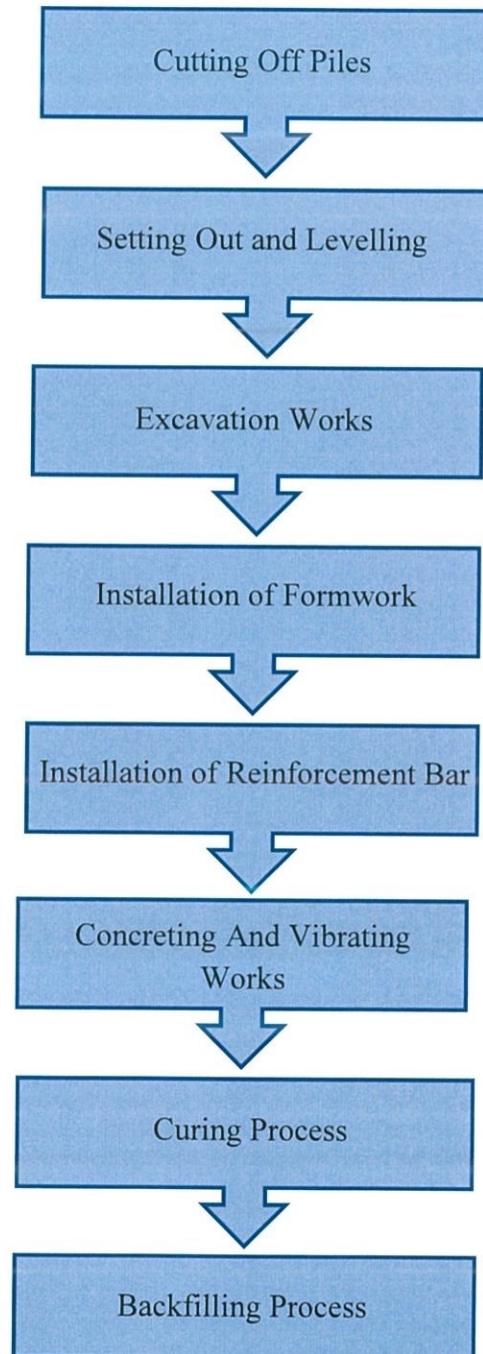


Figure 3.6 Flowchart process of pile cap construction

3.6 Construction Process of Pile Cap

3.6.1 Cutting Off Piles

In this preliminary stages, the piles are driven into the ground by using a drop hammer to the actual level at which the piles below pier are made to be of the same level. To achieve the same height for all pile caps, the concrete of pile tops needs to cut-off based on the required level, which is 75mm to make an effective bond between pile cap and piles.



Figure 3.7: Hammering process of piles



Figure 3.8: The reinforced concrete of piles

3.6.2 Setting Out And Levelling Process

In this stages, the surveyor will do the levelling process to determine height dimensions that relative to a fixed point or datum and to make vertical axis truly vertical. This task usually undertaken after the site clearance is completely done or any reduced level excavation is finished. The main purpose for this task is to establish the size, shape and direction and to establish the width and positions of the walls. The instrument that have been used for this setting out is Automatic Level, levelling staff, linen tapes, wire nail, nylon threads and pegs working from a base line.



Figure 3.9: Automatic Level

By using this automatic level, it will determine the differences in ground levels for calculation of site excavation volumes and costs. The levelling staff are set up at a convenient height and at positions which is required to be measured.

3.6.3 Excavation Works

The soil needs to be excavated for the area that piles have been installed and driven up to the foundation level. The excavation works was carried out to remove earth to form a cavity in the ground and to enable the pile cap formwork to be inserted into the ground with the required size and it is done for 1 day only before the process of formwork installation. By conducting this trench excavation, it will minimum the amount of soil removed and minimum amount of backfilling process. However, the sides of excavation may require some temporary supports. The machinery that have been used for this excavation works is excavator and the workers will excavate the soil within the required depth which is 2 feet under (0.61 metres).



Figure 3.10: Excavation work into the ground



Figure 3.11: Excavation works done with the piles driven into the ground

3.6.4 Installation of Formwork

As the excavation works is done, the pile cap formwork will be inserted into the ground. For this three-storey shophouse project, they use plywood as the type of formwork. The size of this pile cap formwork are distinct, which is 1700mm x 1700 mm, 1700mm x 1100 mm, etc. It is based on the shape and design of the pile caps that have been driven into the ground. Overall, there are 274 points of piles and the biggest pile holds 9 points together. Thus, the workers need to start the progression early due to many formworks that need to be installed. To provide shuttering, there should be a working space, which is 0.5m, extra than the pile cap size. The need of working space is to provide the supports to the shutters from behind with the support of vertical post, horizontal members and wedges.



Figure 3.12: The workers are doing the pile cap formwork



Figure 3.13: Installation of pile cap formwork

3.6.5 Installation of Reinforcement Bar

In this stage, the pile cap formwork need to be filled with the reinforcement bar of pile caps and column stumps. To reduce the usage of formwork, there will be 2 points of pile that become together in 1 pile cap due to the points are closed and linked to each other. They use size Y12 and Y16 for the reinforcement bar of pile cap and tying it together. The workers will bending the reinforcement bar by using the machine into the required shape and tied it together to form the reinforcement for pile caps and column stumps as well.



Figure 3.14: Installation of reinforcement bar for pile cap

3.6.6 Concreting And Vibrating Works

As the reinforcement bar installation is done, concrete of required grade, which is Grade 25 will be transported to the site and placed into the pile cap formwork. The concrete compaction will be ensured with concrete vibrators and needles which will be made during the concrete pour. The main function of vibrating process for concreting the pile cap is to remove the high percentage of entrapped air and eliminates as many large bubbles as possible. In that way, it will likely have a solid strength of concrete and also increase the permeability of the pile cap.

The concrete will laid up to the required level and concrete surface will be finished as smooth as required. Thus, the concrete pump need to be used for pouring the concrete whenever applicable.



Figure 3.15: Concreting and vibrating works

3.5.7 Curing Process

After the removal of pile cap formwork is completely done, it will be cured in 24 or 48 hours that allows to walk on it and partially cured within a week before moving on to the next process. It is one of the method to protect the concrete against loss of moisture required for hydration and kept within the specific temperature range. By doing this curing process, it will increase the strength of the concrete and decrease the permeability of hardened concrete. Most mixes fully cures at 28 days.



Figure 3.16: The removal of pile cap formwork



Figure 3.17: Curing process for pile cap

3.5.8 Backfilling Works

Backfilling happens after the excavation works, when the soil is compacted back into the trench or foundation. It is one of the important part of construction process and it will be doing by using the excavator. The workers will backfilling the soil until it reaches into the required level before moving on to the next process which is the ground beam installation.



Figure 3.18: The backfilling process of pile cap

3.7 Problems And Preventive Action During The Construction Works

◆ Lack of safety when constructing pile cap

The construction industry has long been considered as a difficult, dangerous and dirty occupation due to high number of accidents, injuries and deaths. In this construction site, the workers that involved in the construction of pile cap are failed to wear the complete personal protective equipment (PPE). They only wear hard hats and safety boots but not be able to wear face and hear protection. By conducting this pile cap, there will be any risks from the noises or flying objects while doing their works. The workers could be suffer a lot of problems that include lost sight due to the flying object.

Therefore, the workers should remind to wear the complete personal protective equipment (PPE) like safety boots, safety helmet, gloves or mask before starting the construction work. The employer also should convince and give a perfect training to the workers before selected to do any construction work.

◆ Unusual weather conditions

Climate change has caused weather to become much less predictable. It is not only affects the construction equipment and operation, but it can also injured the workers involved such as having frost bites, hypothermia and trench foot during the cold weather. Besides that, the heavy rainfall may delay the construction work for pile cap. It can causes damage, excavation collapse, silt and debris have to be cleared, and having problems during the concreting works for pile cap.

Thus, the employers and the workers that involved in the construction of pile cap should estimating the weather impact on the duration of any construction activities. By incorporating with the effect of weather in construction scheduling, it will ensure the construction works can be done smoothly and without any interruption.

CHAPTER 4.0

CONCLUSION

Pile cap is actually one of the most important things that should be taken seriously in every construction project. Generally, pile cap is a thick reinforced concrete that rests on concrete or timber piles that have been driven or installed into the soft and unstable soil in order to provide a suitable stable foundation. It is very important to ensure the type of foundation base for any construction project, because the cast concrete pile cap will distribute the load of the building into the soil. As examples, multi-storey building, structure or support base that carries heavy equipment needs a strong and stable foundation to support all the loads and prevent the building from collapsing. Therefore, all the aspects including precautions and safety have been considered by a site supervisor during the construction process of pile cap to ensure the smoothest way for this project to be done. So, the conclusions for this topic are:

To understand the importance of foundation in building construction. The main function of any foundation is to safely sustain and transmit to the ground that combined dead, imposed and wind loads so as not to cause any settlement which could affect the stability and cause damage to any part of the building. Therefore, the selection of the type of foundation for the ground needs to be considered in some aspects such as soil condition, type of structure, economic factors and construction problems.

To understand the method and construction process of pile cap from the preliminary stages until it is completely done. The construction of pile cap has the advantages to ensure the quality of the buildings to support all the loads even in settlement amount. This construction method for pile cap is suitable for heavy buildings or structures that are built on soft foundations that could prevent the building from collapsing or causing any damages.

To identify the problem facing during the construction of pile cap. As general, the construction industry will faces any problems and challenges during the construction works were conducted. Thus, it is very important to improve the performance of any construction industries of the developing projects to prevent the problems from impairing to any part of the buildings. The major problems during the pile cap construction were conducted by the workers are lack of skilled workers and lack of communication between them. However, any kind of problem facing during the construction progress could be solved in many ways to achieve the best quality for the buildings.

To summarize, all the aspects in any construction projects need to be given a big priority to avoid any risks or defects in the future. The minor mistakes should be aware for the workers during the construction of pile cap were conducted because it might affect the buildings in a long term. This company is fully responsible for any possibilities that could happens in the construction site and to ensure that all the materials that used to construct the reinforced concrete of pile cap should be referred to the exact standard in building construction and drawing plan as well. Furthermore, new experiences, practical and technical knowledge also some new skills can be gained during the internship programme regarding to the working environment in the construction site. Overall, all the objectives for this study have been achieved successfully and it might be helpful in the future.

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