



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

**CONSTRUCTON OF PILE CAP FOR DOUBLE STOREY HOUSE  
RENOVATION**

**Prepared by:  
KHAIRUL AZHAR BIN ZAINUL RASHID  
2016458388**



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

**CONSTRUCTON OF PILE CAP FOR DOUBLE STOREY HOUSE  
RENOVATION**

**Prepared by:  
KHAIRUL AZHAR BIN ZAINUL RASHID  
2016458388**

**DEPARTMENT OF BUILDING  
FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING  
UNIVERSITI TEKNOLOGI MARA  
(PERAK)**

**DECEMBER 2018**

**By**

**KHAIRUL AZHAR BIN ZAINUL RASHID  
2016458388**

**Entitled**

**CONSTRUCTION OF PILE CAP FOR DOUBLE STOREY HOUSE RENOVATION**

Accepted in partial fulfilment of requirement has for obtaining Diploma In Building.

Report Supervisor : Cik Nor ~~Azizah~~ Binti Talkis

Practical Training Coordinator : En. Muhammad Naim Bin Mahyuddin.

Programme Coordinator : Dr. Dzulkarnaen Bin Ismail.

**DEPARTMENT OF BUILDING  
FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING  
UNIVERSITI TEKNOLOGI MARA  
(PERAK)**

**JANUARY 2019**

**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 SANJUNG SEMPURNA Sdn Bhd for duration of 14 weeks starting from 8 September 2018 and ended on 7 December 2018. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

Name : KHAIRUL AZHAR BIN ZAINUL RASHID  
UITM ID No : 2016458388  
Date : 18/12/2018



## ACKNOWLEDGEMENT

Alhamdulillah, praise be to Allah, the Most Merciful, the Most Graceful.

I would like to express my utmost gratitude for the guidance, advice and help provided throughout the period of training by the following group of kind individuals. Firstly, I would like to thank Datin Noraini Bt Jaafar for the opportunity given, to conduct my training in her company. Her team of professional comprises of a few individuals, En Sheikh Izzat Azhar, En Sheikh Luqman Aqeel, Mr Ho Mook Sing, En Mohammad Izraie Umar and Muhammad Amirulnaim bin Aznam, have taught and increased my understanding, knowledge, feel of real time projects and theory involving the analysis of building and civil structures. They have been the one to polish and sharpen my knowledge while assessing my training. Also to the site personnel who worked in Kg Paloh bridge and Metro Pengkalan Batu Gajah who have been helping me to understanding the ropes of work in construction procedures, site administration, site safety and the best method of work in the industry. It is an honour for me to be given the opportunity to 'work' with all of you.

I would also like to thank ALL the UITM lecturers that have taught and nurtured me in becoming a successful student and person. I would like to give my biggest appreciation to the lecturers who are directly involved during the period of my internship. To Cik Nor Azizah Binti Talkis, Supervising Lecturer, En Muhammad Naim bin Mahayuddin, Practical Training Coordinator, and Dr Zulkarnaen bin Ismail, Programme Coordinator, I value time, effort and encouragement of ideas that they have contributed to the completion of my internship.

## **ABSTRACT**

Foundation is an important element in any structure. Its role is to transfer all the load subjected onto it all the way from the roof structure and redirect it onto the soil underground. Live load, imposed load and wind load that is subjected onto the superstructure are also transferred to the substructure also known as foundation. Foundation consist of a few elements which is pile, pile cap and ground beam. The purpose of this report is to briefly identify the methods of constructing an element for foundation which is the pile cap. This study is conducted at a house renovation site located in No 1, Persiaran Bukit Meru 20, Taman Meru, 30020 Ipoh, Perak. Next, is to determine the tools and machinery needed for constructing pile cap. Finally, the problems arising and solution that is implemented on site via observation.

<b>CONTENTS</b>			<b>PAGE NO</b>
Acknowledgements			i
Contents			iii
List of Tables			iv
List of Figures			v
<b>CHAPTER 1.0</b>	<b>INTRODUCTION</b>		1
1.1	Background and Scope of Study		2
	1.1.1 Background		2
	1.1.2 Scope of Study		4
1.2	Objectives		4
1.3	Methods of Study		5
<b>CHAPTER 2.0</b>	<b>COMPANY BACKGROUND</b>		6
2.1	Introduction of Company		7
2.2	Company Profile		8
2.3	Organization Chart		10
2.4	List of Project		11
	2.4.1 Completed Projects		11
	2.4.2 Project in Progress		14
<b>CHAPTER 3.0</b>	<b>CASE STUDY</b>		15
3.1	Introduction to Case Study		16
3.2	Method of Constructing Pile Cap		24
	3.2.1 Tools and Machineries		33
3.3	Problems On site and Solution Implemented		39

<b>CHAPTER 4.0</b>	<b>CONCLUSION</b>	42
4.1	Conclusion	43
<b>REFERENCES</b>		44
<b>APPENDICES</b>		45

## LIST OF TABLES

	<b>Page</b>
Table 2.1 Board of Directors	9
Table 2.2 List of completed projects	11
Table 2.3 List of on-going projects	14
Table 3.1 Plan view and detailed drawing for pile cap P1 and P1X 21	21
Table 3.2 Plan view and detailed drawing for pile cap P1Y and P2 22	22
Table 3.3 Machineries used during pile cap construction	33
Table 3.4 Tools used during pile cap construction	34
Table 3.9 Problems and solution	39

## LIST OF FIGURES

	<b>Page</b>
Figure 1.1 Identical shape and size of pile cap with different amount of pile cluster	2
Figure 1.2 Large pile cap size with only one pile placed under it	2
Figure 1.3 Square shaped pile cap with various number of pile cluster	3
Figure 1.4 Pressure Distribution represented by Influence lines in the case of End Bearing Pile.	3
Figure 2.1 Company Management Structure	8
Figure 2.2 Directors and Key Management Structure	10
Figure 3.1 Entrance to Puncak Meru Residential area	16
Figure 3.2 Location of site via satellite imaging	17
Figure 3.3 Ground Floor Plan of renovated house	18
Figure 3.4 First Floor Plan of renovated house	19
Figure 3.5 Left Elevation of renovated house	20
Figure 3.6 Section D-D of renovated house	20
Figure 3.7 Typical connection of pile to pile cap	22
Figure 3.8 Ground Floor Key Plan	23
Figure 3.9 Flow Chart of Pile Cap Construction	24

## LIST OF APPENDICES

	<b>Page</b>
APPENDIX I	46
APPENDIX II	47
APPENDIX III	48

# **CHAPTER 1.0**



# INTRODUCTION

## 1.1 Background and Scope of Study

### 1.1.1 Background

Pile cap is a reinforced concrete structure that is placed on top of a cluster of pile to distribute the load that is transferred from column to the cluster of pile below it evenly to each pile. Pile cap also provides a stable foundation and offers a larger area to transfer load evenly onto the pile. Size of pile cap may vary depending on the load exerted onto it that is design by engineer to suit the amount of load it needs to transfer to the cluster of pile beneath it. The same size and shape of pile cap may also contain different numbers of pile cluster beneath it depending on the design specified by the engineer. Large pile cap size may also be used with only one pile placed under it as the size of pile cap also helps to distribute the load of the structure exerted onto it into the ground and act according to the same principle of a raft foundation and most of the load is transferred into the strong soil strata via pile. The focus of this report is about the various sizes and design of pile cap used in the renovation of the double storey bungalow house located at No 1, Persiaran Bukit Meru 20, Taman Meru, Ipoh Perak.

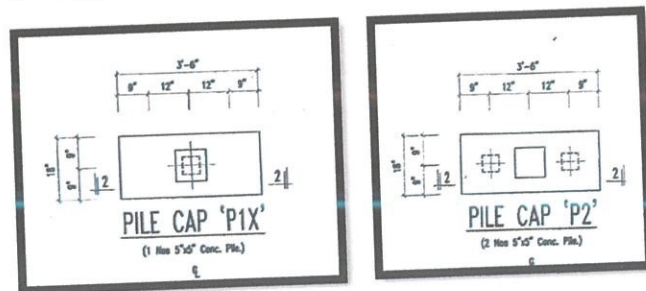


Figure 1.1 Identical shape and size of pile cap with different amount of pile cluster

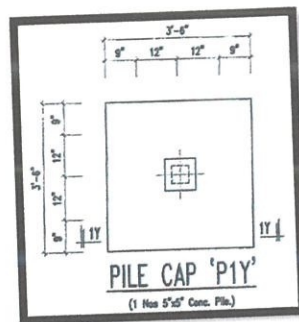


Figure 1.2 Large pile cap size with only one pile placed under it

Shape of pile may vary depending on the number of pile cluster as for example a hexagonal shape is used for a pile cluster of 6 or 7 and an octagonal shape for a pile cluster of 8 or 9 but the most common shape used on site are square shape as it the most economical shape and easy to construct and does not require highly skilled workers to construct intricate formwork shapes. Higher number of pile cluster are usually used for structure with high load or soil with low load bearing capacity so high number of pile is required to share the load and distribute it evenly into the soil thus prevent soil failure. The shape of pile cap used for the renovation are all consist of square shaped pile cap.

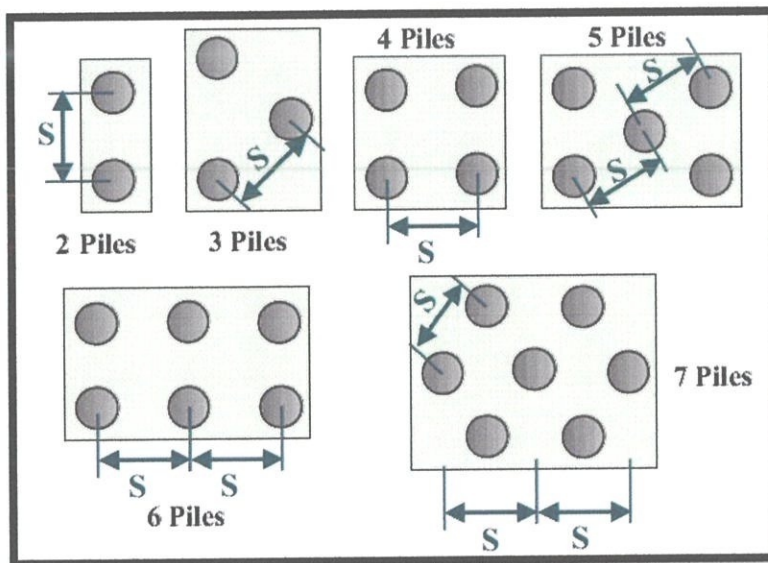


Figure 1.3 Square shaped pile cap with various number of pile cluster

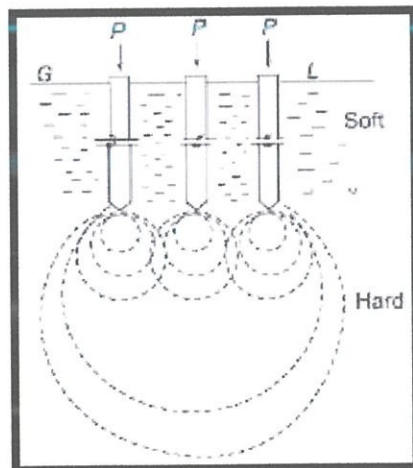


Figure 1.4 Pressure Distribution represented by Influence lines in the case of End Bearing Pile.

### 1.1.2 **Scope of Study**

This report contains information about the process for construction of pile cap for a double storey house renovation project, Problems arising during the construction process and its solution for problem of constructing the pile cap located at No 1, Puncak Meru, Persiaran Bukit Meru 5, 30020 Ipoh, Perak that commences on 10<sup>th</sup> December 2018 and is expected to finish on 15 March 2019.

### 1.2 **Objectives**

- To identify the methods of pile cap construction process through observation on site.
- To determine the tools and machineries used for pile cap construction through observation.
- To identify the problems during pile cap construction work and solution implemented on site.

### 1.3 **Methods of Study**

Method of study used during the completion of this report:

#### 1.3.1 **Primary**

- i) Observation
  - Observation is done during the construction of the pile cap on site as it progresses daily towards completion.
- ii) Interview
  - Question and answer session are made from time to time with Project Manager, Site Supervisor and Construction Worker regarding any doubts or misunderstanding of any process of the pile cap construction.

#### 1.3.2 **Secondary**

- iii) Research
  - Books and internet are used as reference to support the knowledge gained during lecture in class regarding pile construction and solution for any pile cap construction issues.

# **CHAPTER 2.0**

## COMPANY BACKGROUND

### 2.1 Introduction of Company

Sanjung Sempurna Sdn Bhd is a Malaysian owned company that is established in January 1997 by its Founder Dato' Sheikh Ahmad bin Sheikh Long and his wife Datin Noraini binti Jaafar. The company is registered with PKK Class 'A' and CIDB 'G7'. Sanjung Sempurna Sdn Bhd have successfully obtained the Certification of ISO 9001:2015 Quality Management System from URS of which accredited by United Kingdom Accreditation Service (UKAS) which enables them to penetrate the global market overseas. Sanjung Sempurna core activities are Building construction, Comercial & Housing Development, Road & Bridges Construction and Project Management. Its main specialty is Comercial & Housing Developement which is currently undergoing in Batu Gajah for its third phase. However, the company also does civil construction such as the construction of bridge located is Kampung Paloh, Ipoh, Perak which has just undergone handing over process after its completion in 28<sup>th</sup> September 2018. Sanjung Sempurna has a subsidiary company which is known as Erkan Entreprise with a CIDB license of G2 which is owned by Miss Najiha binti Sheikh Ahmad who is also the daughter of the founder. The company is run by family members whom all has qualification and experience in the construction industry.



## 2.2 Company Profile

### Management Structure

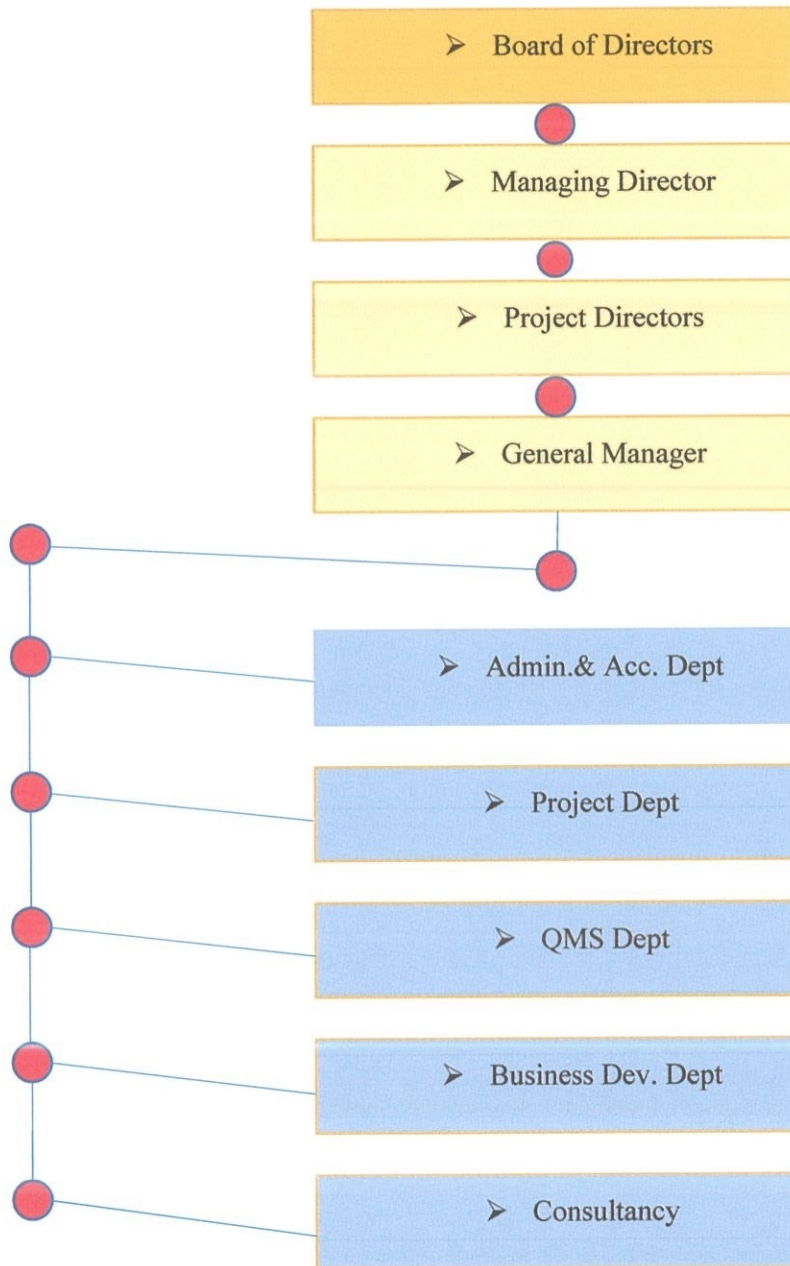


Figure 2.1 Company Management Structure

Board of Directors

<b>NAME</b>	<b>NRIC NO.</b>	<b>ADDRESS</b>	<b>% OF SHARE HOLDING</b>
Datin Noraini bt. Jaafar		11, Persiaran Bukit Meru 12, Puncak Meru, 30020 Ipoh	96
Sheikh Izat Azhar Bin Sheikh Ahmad		11, Persiaran Bukit Meru 12, Puncak Meru, 30020 Ipoh	4
Dato' Sheikh Ahmad Bin Sheikh Long		11, Persiaran Bukit Meru 12, Puncak Meru, 30020 Ipoh	NIL

Table 2.1 Board of Directors



## 2.3 Organization Chart

### Directors & Key Management

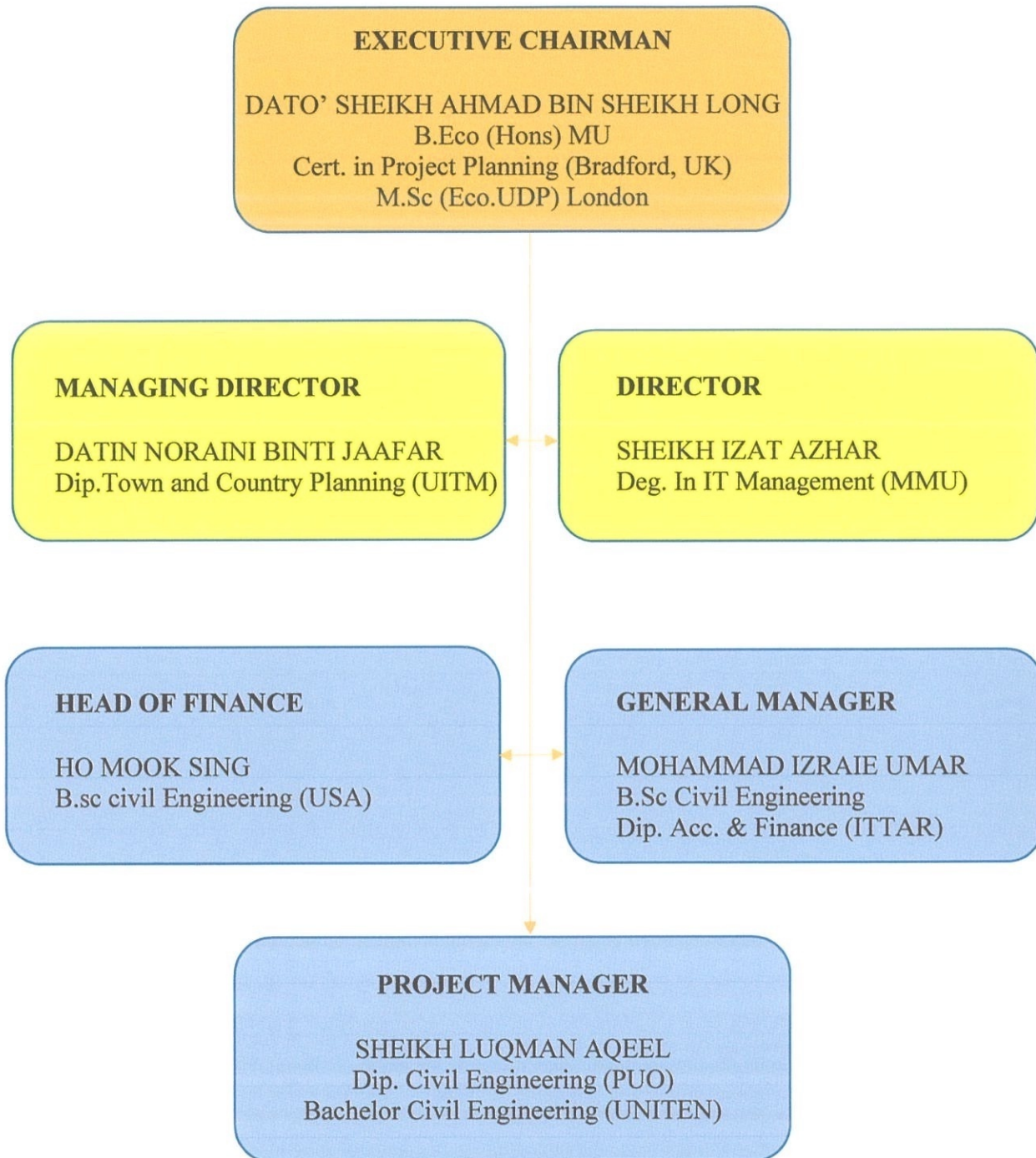


Figure 2.2 Directors and Key Management Structure

## 2.4 List of Project

### 2.4.1 Completed Projects

Table 2.2 List of completed projects

No	Project Description	Amount (RM)	Commence	Complete
1	Construct 24 units 1-storey type A, 12 units 1-storey type B & 13 units 1-storey type C for Medan Pengkalan Bidari, Phase 1A at Mukim Hulu Kinta, Negeri Perak.	1,295,892	11/2/98	8/3/00
2	Construct & completion 63 units of terrace houses type A at Medan Pengkalan Bidari, Phase 1B, Mukim Hulu Kinta, Daerah Kinta, Negeri Perak.	2,019,000	16/6/99	3/1/01
3	Construct & Completion 31 units of terrace house for Medan Pengkalan Bidari, Phase 2 at Mukim Hulu Kinta, Daerah Kinta, Negeri Perak.	1,203,300	1/7/00	30/6/01
4	Construct & complete sewerage treatment plant for Medan Pengkalan Bidari at Mukim Hulu Kinta, Daerah Kinta, Negeri Perak.	462,100	1/02/99	1/12/00
5	Construct and complete 5 units of factory at Gerik Industrial Estate, Mukim Gerik, Daerah Hulu Perak, Negeri Perak.	2,441,152	1/4/00	1/12/00

6	Kerja-kerja Mengganti & Menyiapkan Atap Genting Bumbung di Bangunan JKR 107-A (Blok-A), 107-B (Blok B), 107-C (Blok C) & Laluan Berbumbung Tertutup (Covered Way) Ketiga-tiga Bangunan Tersebut di Changkat Batu Gajah, Perak Darul Ridzuan.	1,343,000		10/12/03
7	Construction & Completion of Building Contract for 88 units (Type A & B) Double Storey Terrace House of Medan Pengkalan Megah.	6,170,000	15/12/01	15/05/03
8	Build & complete Community College at Gerik Lot 7406, Mukim Gerik, Daerah Hulu Perak, Perak	11,850,000	6/02/03	30/11/04
9	Proposed Universiti Teknologi Petronas Development at Bandar Seri Iskandar, Perak. Construction and completion of Drainage Improvement Works (Package 1 L)	4,985,123	18/10/04	7/01/06
10	To Design, Build and Complete Slope Repairs at Daerah Hulu Perak, Perak (Pakej A & B)	9,499,532	18/04/05	14/05/06
11	Cadangan Projek Pembinaan Bangunan Tambahan Pusat Servis SKOMK HP) Berhad	655,100	15/05/06	30/04/07
12	Cadangan Menaiktaraf, Membina dan Menyiapkan Bangunan sedia ada kepada Dewan Kuliah, Makmal Computer Dab E-Learning, Dewan Konvensyen, Bilik Pensyarah dan Lain-lain Kemudahan, Universiti Pendidikan Sultan Idris, Tanjung Malim, Perak.	31,621,862	26/01/07	8/09/08



13	Cad. Membina dan Menyiapkan sebuah Sebuah Sekolah Kebangsaan Proton City yang Mengandungi 18 Bilik Darjah dan Kemudahan Berkaitan di Daerah Batang Hulu Bernam, Perak.	12,485,389	7/07/07	12/06/08
14	.Membina Jalan dan Jambatan Dari Pekan Chikus/Langkap, Daerah Hilir Perak, Perak	11,553,681	13//12/07	30/4/09
15	Menggantikan Jambatan Sultan Iskandar Jalan Hugh Low, Ipoh, Perak.	9,113,021	8/06/09	7/12/10
16	Turnkey Project of 175 acres of mixed development at Mukim Sg. Terap, Daerah Kinta, Perak	150,000,000	1/05/04	31/12/16
17	Cadangan Pembangunan Kampus 2, INSPEN Diatas Lot 2298(559) Mukim Dengkil, Daerah Sepang, Selangor.	48,869,785	17/07/08	1/03/11
18	Membina Jalan Baru Dari Malim Nawar ke Kampar Daerah Kinta, Perak (CH0.00 – CH700.00) Termasuk Persimpangan Jalan Malim Nawar, Kota Bahru Dan Tanjung Tualang (Jalan EPA, EPB dan EPC)	13,931,608	23/11/11	23/05/14
19	Membina Dan Menyiapkan Kerja-kerja Terbengkalai Bagi Bangunan Baru Bengkel Pertanian Dan Lain-lain Kemudahan Di Sekolah Menengah Teknik Teluk Intan, Hilir Perak, Perak.	12,719,559	16/12/15	14/12/16
	<b>Total Amount Projects Completed</b>			

## 2.4.2 Projects in Progress

No	Project Description	Amount (RM)	Commence	Complete
1	Menggantikan Jambatan Kg. Paloh, Ipoh, Daerah Kinta, Perak	12,000,605	14/12/15	11/12/17
2	Construction & Completion of Building Contract for 120 units Phase 3C (Type A & B) Double Storey Terrace House of Metro Pengkalan Batu Gajah, Perak.	9,850,000	2/8/18	3/5/21

Table 2.5 List of on-going projects

## **CHAPTER 3.0**

## CASE STUDY

### 3.1 Introduction to Case Study

Puncak Meru Residential is residential area of double storey bungalow houses with average dimension of 42' by 35' on lot with the size of 0.257 acres. The residence only contains 48 units of double storey bungalow houses as it is an exclusive housing area for residence with high income as the costs for houses in the area ranges from RM400,000.00 to RM2,500,000.00 per house. The area is located nearby recreational parks and a golf course. Size and design of the house may vary but the lot size remains the same. Most of the houses present at the area are built on different elevations as the area is located on top of a hill.

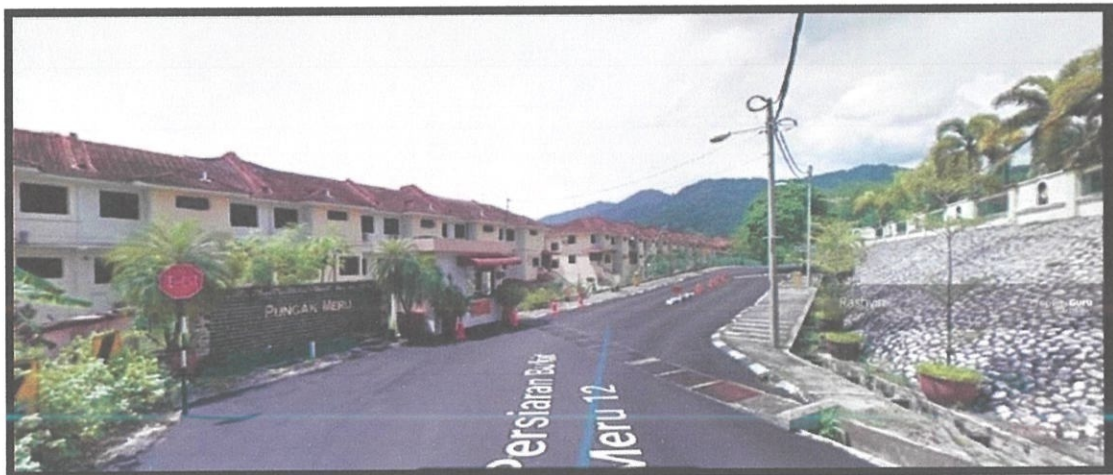


Figure 3.1 Entrance to Puncak Meru Residential area

Source : <https://www.propertyguru.com.my>





Figure 3.2 Location of site via satellite imaging

**Source : Google Maps**

The focus of this case study is the house located at No 1, Persiaran Bukit Meru 20, Taman Meru, 30020 Ipoh, Perak. The house is a double storey bungalow with the dimension of 39' by 30'. The house owner wishes to renovate the house to a certain extend and came to SANJUNG SEMPURNA SDN BHD as the Main Contractor for the renovation works. Structural works for the house extension are done by KOH PERUNDING SDN BHD which is a company of civil consulting and structural engineers that is hired by the Main Contractor.



The renovation of the house commence on 2<sup>nd</sup> October 2018 and is expected to finish in the period of 4 months. The total cost of this project is RM188,000.00. The original house dimension of 39' by 30' is to be extended to the dimension of 52' by 41'. The house is maintained as a 2 storey bungalow. The extension of house has reduced the size of land within the compound significantly.

The structure in black is the original structure, whilst the structure in red is the new that is to be constructed for renovation.

### Ground Floor Plan

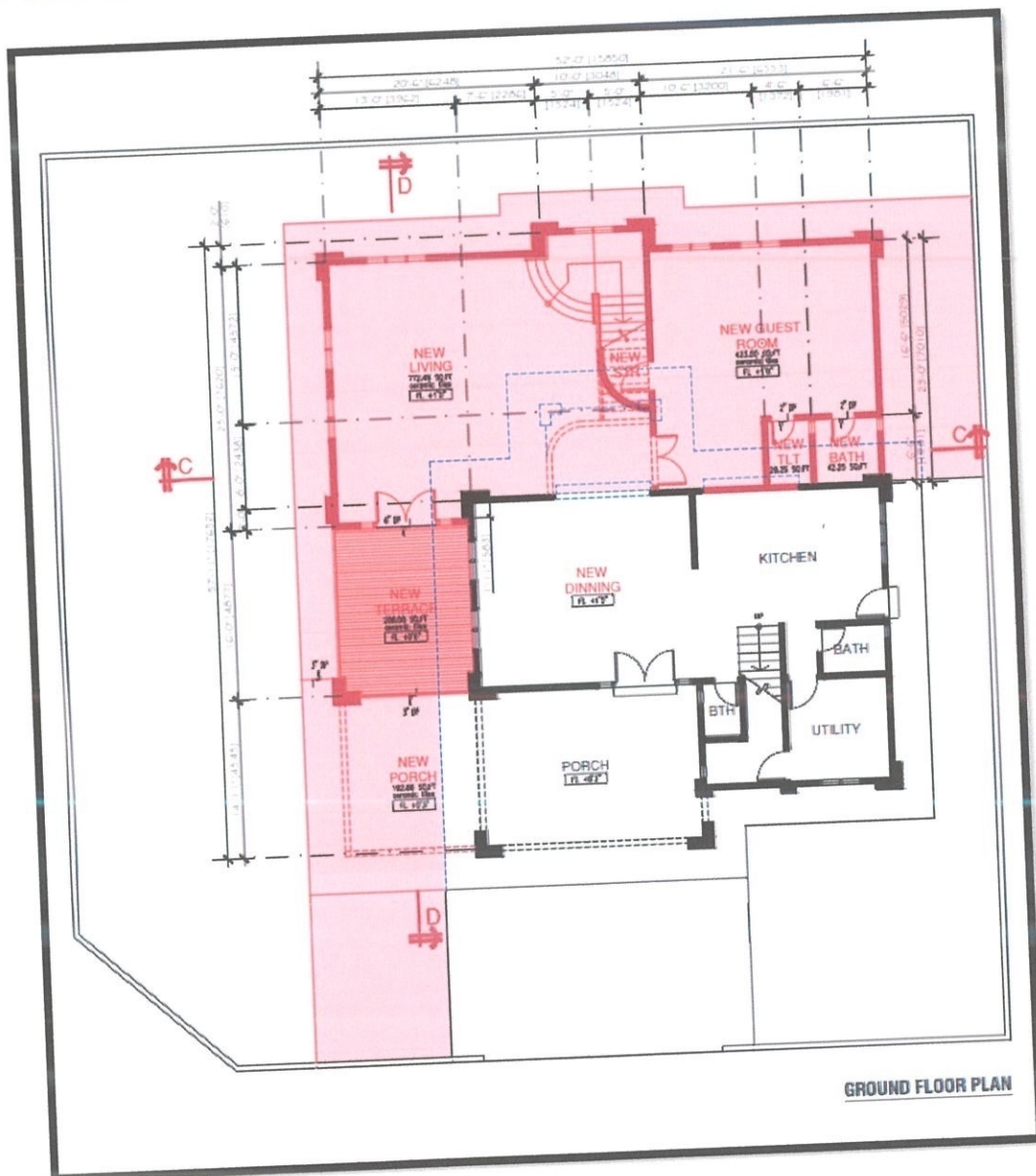


Figure 3.3 Ground Floor Plan of renovated house

Source : Sanjung Sempurna Sdn Bhd

# First Floor Plan

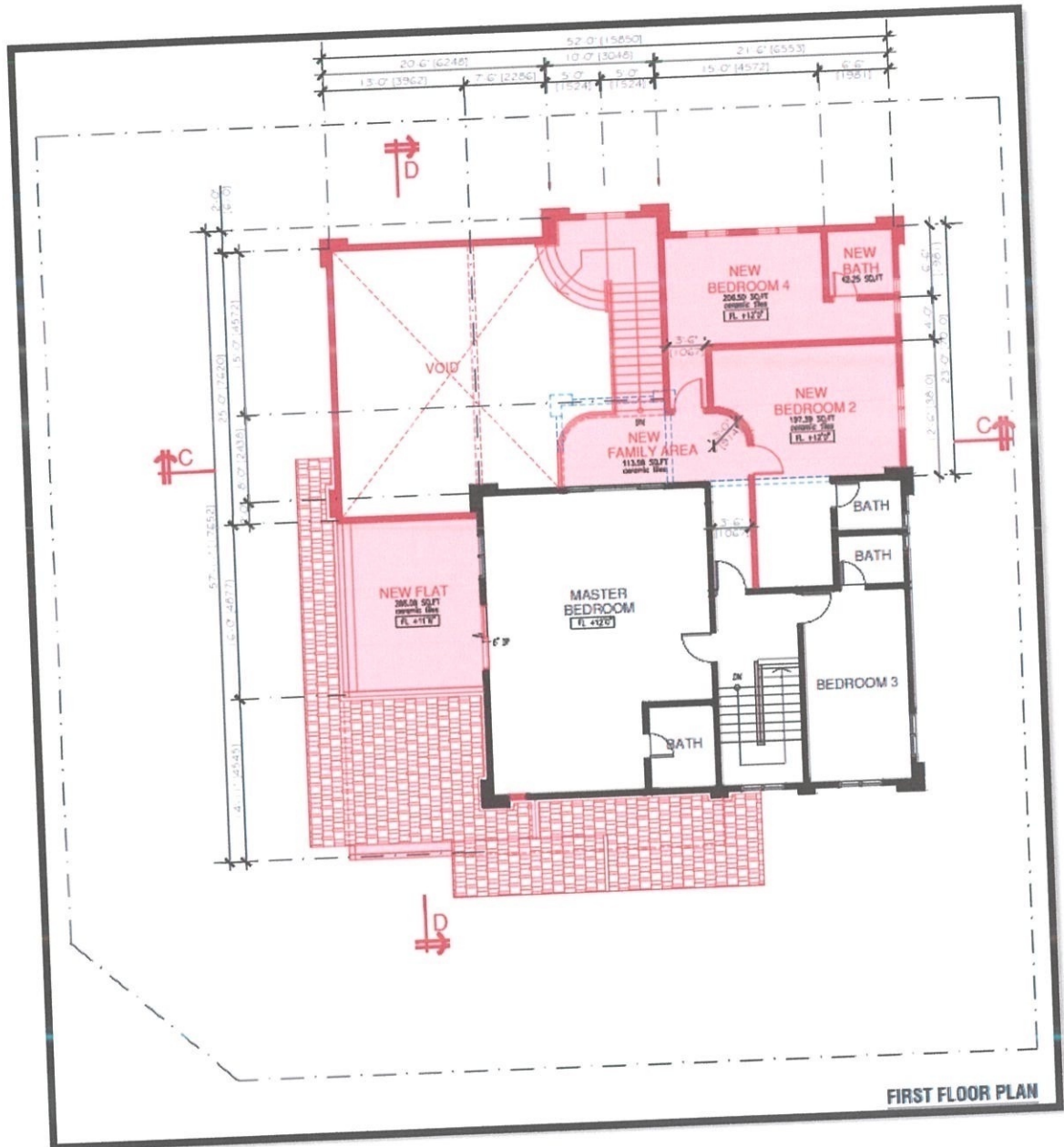


Figure 3.4 First Floor Plan of renovated house

Source : Sanjung Sempurna Sdn Bhd

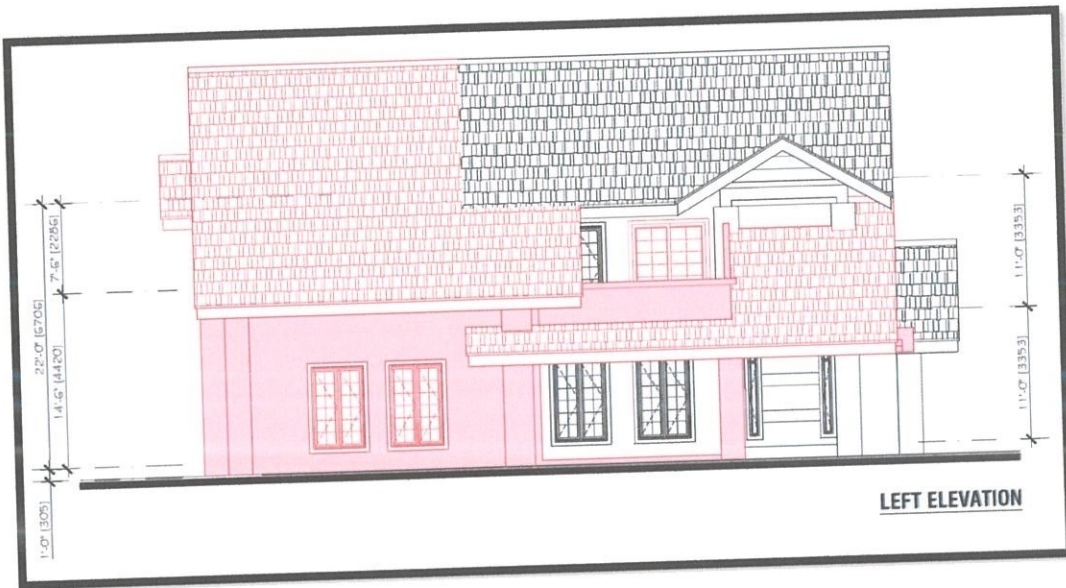


Figure 3.5 Left Elevation of renovated house

Source : Sanjung Sempurna Sdn Bhd



Figure 3.6 Section D-D of renovated house

Source : Sanjung Sempurna Sdn Bhd

There are a total of four designs of pile cap used for the construction with a number of 20 pile caps in total. 600mm of reinforcement are exposed during pile cut off for the purpose of connection to the pile cap.

### Types of Pile Cap used

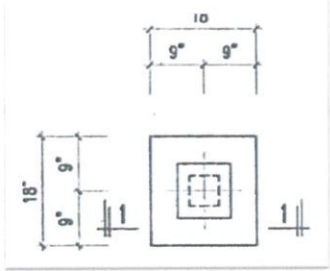
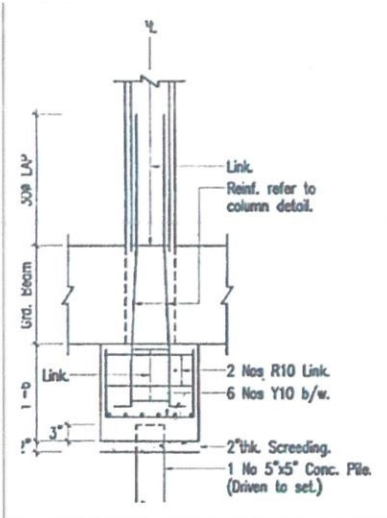
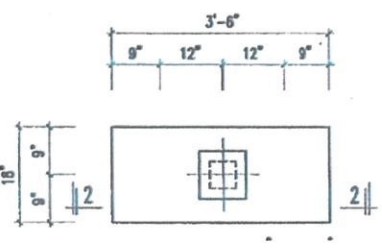
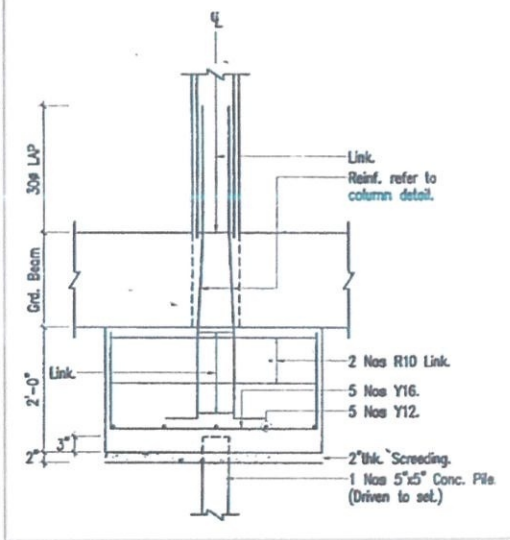
Pile Cap	Plan View	Detailed Drawing
P1		
PIX		

Table 3.1 Plan view and detailed drawing for pile cap P1 and PIX



Pile Cap	Plan View	Detailed Drawing
P1Y		
P2		

Table 3.2 Plan view and detailed drawing for pile cap P1Y and P2

Source : Sanjung Sempurna Sdn Bhd

Pile is cut according to the level prepared by the site supervisor or surveyor while leaving between 2 to 3 feet of reinforcement exposed from within the pile cap. The reinforcement is then bent to act as a hook in the concreted pile cap. Reinforcement in the pile cap are also tied to the exposed reinforcement from the pile to prevent movement of reinforcement during concreting or compaction of concrete in the pile cap.

# Ground Floor Key Plan

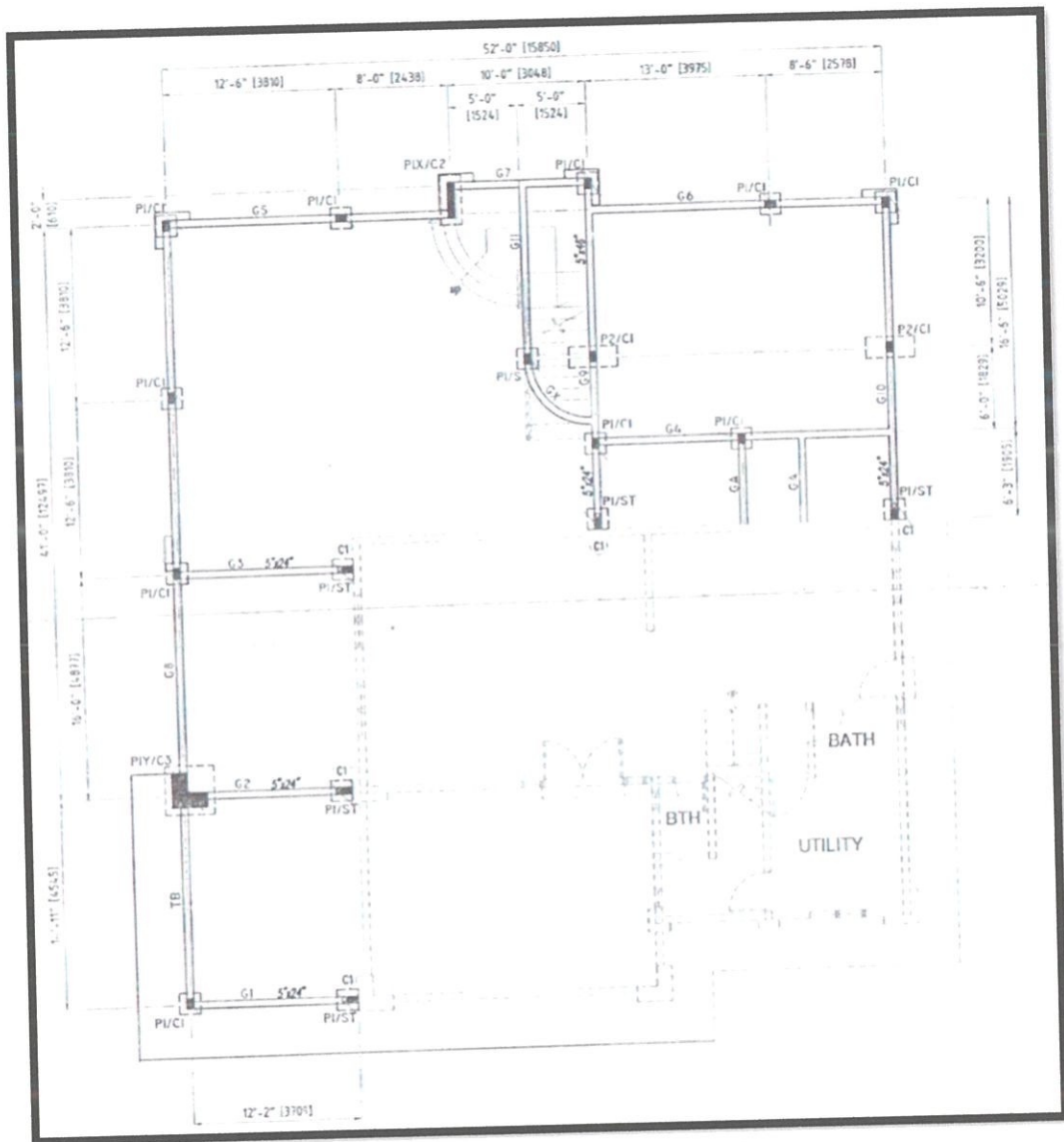


Figure 3.8 Ground Floor Key Plan

Source : Sanjung Sempurna Sdn Bhd

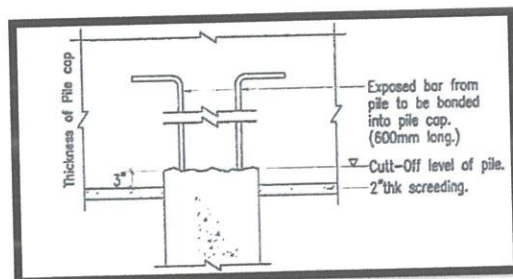


Figure 3.7 Typical connection of pile to pile cap

Source : Sanjung Sempurna Sdn Bhd

### 3.2 Method of Constructing Pile Cap

Pile cap construction is very similar to constructing other elements of structure such as the construction of beams and columns with the only difference is where excavation pit requires backfill where the construction of upper floor beam and column does not require of a structure does not require.

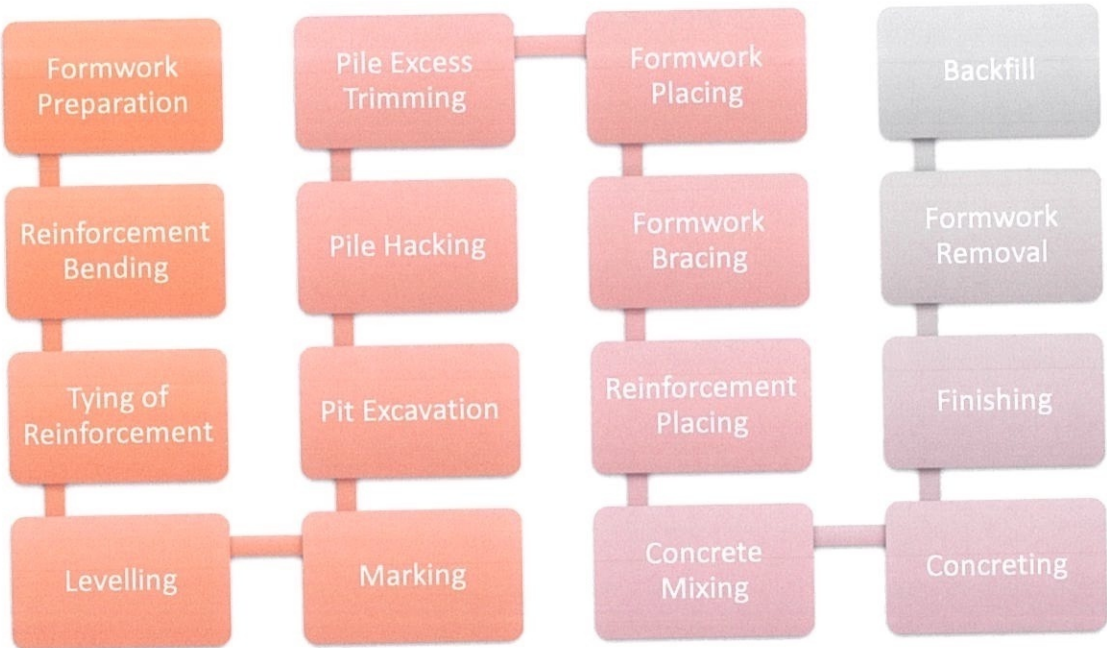


Figure 3.9 Flow Chart of Pile Cap Construction

### Step 1 : Formwork Preparation



#### Work Description

All four types of pile cap formwork are prepared in sets of 2 and will be used twice for concreting. 2 no's of workers are responsible for formwork preparation.

Tools used: -Hammer  
-Circular saw  
-Marking ink pot

Manpower: -1 Skilled labour  
-1 Semi skilled labour

### Step 2 : Reinforcement Bending



#### Work Description

Reinforcement bending are done according to bar bending schedule that is provided by the site supervisor. Bending works are done on a bar bending platform using a handheld bar bender. 2 no's of worker are responsible for reinforcement bending works

Tools used: -Angle grinder  
-Bar bending tool

Manpower: -2 Semi skilled labour



### Step 3 : Tying of Reinforcements



#### Work Description

Bended reinforcements bars are then tied together using a steel wire by a worker to form a pile cap reinforcement.

Tools used: -Steel wire  
-Re-bar tying hook

Manpower: -1 Semi skilled labour

### Step 4 : Levelling



#### Work Description

Levelling works are done by a site supervisor to establish the excavation depth and the pile cut off level using a levelling instrument and measuring staff.

Tools used: -Theodolite  
-Tripod  
-Measuring Staff

Manpower: -1 Site supervisor  
-1 Semi skilled labour

### Step 5 : Marking



#### Work Description

Markings are made on pile using spray paint or permanent marker on pile. A level is established on the pile and is written on each pile the depth of excavation and pile cut off level from the marking made.

Tools used: -Theodolite  
-Tripod  
-Measuring Staff

Manpower: -1 Site supervisor  
-1 Semi skilled labour

### Step 6 : Pit Excavation



#### Work Description

An excavator is used to excavate pit around each pile according to the depth and size of each pile cap. A 2 feet wide bucket is used by the excavator for excavation.

Machineries: -Excavator

Manpower: -1 Machine Operator

### Step 7 : Pile Hacking



#### Work Description

Depth of pile cut of level are measured using a measuring tape from the established marking downwards according to the depth specified on each pile. Pile is then cut off using a hacker and a grinder.

Tools used: -Hacker

Manpower: -2 Semi skilled labour

### Step 8 : Pile Excess Trimming



#### Work Description

Pile is then trimmed using a smaller hacker and a finer hacking bit for a flat and smooth finish. 600mm of reinforcement bar are exposed for joint to pile cap.

Tools used: -Hacker

Manpower: -2 Semi skilled labour



### Step 9 : Formwork Placing



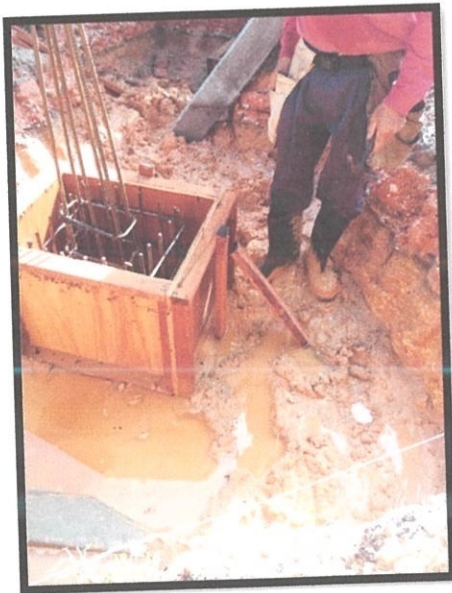
#### Work Description

Formwork are assembled on of each pile cap location. Gaps beneath the formwork are filled with soil to prevent leakage during concreting. Formwork is also lubricated to prevent sticking during formwork removal.

Tools used: -Hammer

Manpower: -2 Semi skilled labour

### Step 10 : Formwork Bracing



#### Work Description

Bracing are added on sides of formwork to prevent formwork failure during concreting due to concrete mass.

Tools used: -Hammer

Manpower: -2 Semi skilled labour

### Step 11 : Reinforcement Placing



#### Work Description

Concrete spacer is added before the placement of reinforcements to prevent exposure of reinforcements to water which may damage it.

Manpower: -2 Semi skilled labour

### Step 12 : Concrete Mixing



#### Work Description

A mix Grade 30 Concrete is used for the construction of pile cap. G30 concrete has a mix ratio of 1:1:2 of cement sand and aggregates.

Tools used: -Shovel

Manpower: -2 Semi skilled labour

Machineries: -Concrete mixer

### Step 13 : Concreting



#### Work Description

A wheelbarrow is used to transport concrete and is directly poured into the formwork via chute for longer span between ground and formwork or is directly poured into the formwork using the wheel barrow. 1 no's of worker will be poking the poured concrete as a form of compaction to prevent honeycomb which may jeopardise the finished pile cap strength.

Tools used: -Wheelbarrow

Manpower: -2 Semi skilled labour

### Step 14 : Finishing



#### Work Description

Concrete is smoothed out and levelled using a trowel for a smooth and flat surface. Any excess concrete will be removed and poured into other pile caps.

Tools used: -Trowel

Manpower: -1 Semi skilled worker



### Step 15 : Formwork Removal



#### Work Description

After one day curing the formwork are ready to be removed and used for another batch of concreting. Workers will first remove the side bracing and then knock the formwork gently to release the bond of concrete to the formwork panel.

Tools used: -Hammer

Manpower: -1 Semi skilled worker

### Step 16 : Backfill



#### Work Description

After all pile cap have been has completed, an excavator is used to fill the pit with the existing excavated soil which is then compacted using a plate compactor to prepare a strong base for the ground beam and gorund floor slab.

Machineries: -Excavator





Manpower: -Machine operator

### 3.2.1 Tools and Machineries

Tools and machineries are an essential during any construction phase to ease and increases working efficiency. Pile cap construction also requires a certain tools and machineries.





#### Machineries




Table 3.3 Machineries used during pile cap construction

Machineries	Purpose
<p>Excavator</p> 	<ul style="list-style-type: none"> <li>- Used to excavate pit and backfill soil into excavated pit</li> </ul>
<p>Concrete Mixer</p> 	<ul style="list-style-type: none"> <li>- To mix concrete on site.</li> </ul>
<p>Plate Compactor</p> 	<ul style="list-style-type: none"> <li>- To compact and flatten loose soil for stronger and stable soil for concreting purposes.</li> </ul>
<p>Petrol Powered Engine</p> 	<ul style="list-style-type: none"> <li>- To act as a multipurpose machinery such as power supply or powering a water pump.</li> </ul>




## Tools




Table 3.4 Tools used during pile cap construction

Tools	Purpose
<p data-bbox="204 465 368 501">Water Pump</p> 	<ul data-bbox="651 456 1310 546" style="list-style-type: none"><li>- To extract water from excavation pit especially during rainy seasons.</li></ul>
<p data-bbox="204 869 316 904">Grinder</p> 	<ul data-bbox="651 860 1310 949" style="list-style-type: none"><li>- To cut reinforcement bar after pile hacking for pile cut off.</li></ul>
<p data-bbox="204 1249 368 1285">Bar Bender</p> 	<ul data-bbox="651 1240 1066 1276" style="list-style-type: none"><li>- To bend reinforcement bar.</li></ul>
<p data-bbox="204 1630 395 1666">Re-bar Hook</p> 	<ul data-bbox="651 1621 1161 1657" style="list-style-type: none"><li>- To tie reinforcement bar together.</li></ul>



Tools	Purpose
<p data-bbox="204 439 300 465">Hacker</p> 	<ul style="list-style-type: none"> <li data-bbox="596 427 1278 517">- To hack pile, breaking rock obstruction underground and removal of existing structure.</li> </ul>
<p data-bbox="212 954 323 981">Hammer</p> 	<ul style="list-style-type: none"> <li data-bbox="596 943 1278 1088">- To drive nail during formwork making process, formwork assembly and remove nails during formwork removal.</li> </ul>
<p data-bbox="220 1469 435 1496">Marking Ink Pot</p> 	<ul style="list-style-type: none"> <li data-bbox="596 1458 1278 1547">- To mark the plywood with ink to be the sawn into the formwork panel.</li> </ul>



Tools	Purpose
<p data-bbox="204 398 416 427">Measuring Tape</p> 	<ul style="list-style-type: none"> <li data-bbox="655 387 1283 477">- Used to measure reinforcements, formwork, depth of excavation and basic measurement.</li> </ul>
<p data-bbox="212 835 384 864">Circular Saw</p> 	<ul style="list-style-type: none"> <li data-bbox="659 824 1291 913">- To cut plywood panel or wooden bracing for formwork.</li> </ul>
<p data-bbox="220 1350 312 1379">Gloves</p> 	<ul style="list-style-type: none"> <li data-bbox="667 1330 1300 1420">- To protect workers hands and provides grip to materials on site.</li> </ul>





Tools	Purpose
<p data-bbox="193 387 276 427">Saw</p> 	<ul data-bbox="715 387 1121 427" style="list-style-type: none"> <li>- To cut wood for formwork.</li> </ul>
<p data-bbox="193 949 308 990">Bucket</p> 	<ul data-bbox="715 949 1289 1099" style="list-style-type: none"> <li>- Used for transporting material and act as a tool during concrete mixing for precise ratio mix.</li> </ul>
<p data-bbox="193 1391 395 1431">Wheel barrow</p> 	<ul data-bbox="715 1391 1289 1431" style="list-style-type: none"> <li>- To transport concrete or soil around site.</li> </ul>



Tools	Purpose
<p data-bbox="204 398 300 427">Shovel</p> 	<ul style="list-style-type: none"> <li data-bbox="687 398 1283 488">- To scoop material during concreting mixing.</li> </ul>
<p data-bbox="204 981 416 1010">Steel Bar Cutter</p> 	<ul style="list-style-type: none"> <li data-bbox="687 981 1193 1010">- To cut steel bar during bar bending.</li> </ul>
<p data-bbox="204 1332 491 1361">Metal Cut-off Grinder</p> 	<ul style="list-style-type: none"> <li data-bbox="687 1332 1283 1422">- To cut multiple long pieces of reinforcements to length at once.</li> </ul>



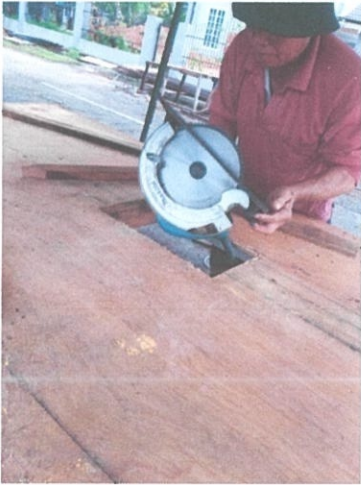

### 3.3 Problems On site and Solution Implemented

Table 3.9 Problems and solution

No	Problems	Solution
1	 <p>Workers on site complains about the lack of shade during concreting which also significantly reduces efficiency</p>	 <p>Site supervisor responsible provides a canopy at the concrete mixing station thus provide shade and workers comfortability and also improves concrete production speed.</p>
2	 <p>Water ponding is an occurring phenomenon on site during rainy season and needs to be removed before concreting</p>	 <p>Water is removed using water pump that is provided by the company for areas with high water ponding and bucket is used for small areas.</p>

No	Problems	Solution
3	 <p data-bbox="279 790 767 936">Chute used for pouring concrete into pile collapses and causes spillage due to concrete weight and long span.</p>	 <p data-bbox="791 790 1279 943">Wooden plank are used for supporting the chute to withstand the concrete weight during concreting.</p>
4	 <p data-bbox="276 1406 767 1552">Chute slide towards starter bar reinforcements and off sets the position.</p>	 <p data-bbox="788 1402 1279 1491">Starter bar is re-positioned and chute is secure with wooden bracing.</p>



No	Problems	Solution
5	 <p data-bbox="279 813 767 958">Completed pile cap are positioned a few inches higher than it is supposed to.</p>	 <p data-bbox="791 869 1279 1014">Pile cap is hacked to the desired level using a hacker and exposed reinforcements are cut with grinder.</p>
6	 <p data-bbox="279 1581 767 1727">Small wood piece stuck between saw blade and housing which causes the blade to jam.</p>	 <p data-bbox="791 1581 1279 1783">.Hammer and chisel are used to pry the jammed wood piece out of the housing. Power supply is closed for safety</p>

## **CHAPTER 4.0**

## CONCLUSION

### 4.0 Conclusion

In conclusion, pile cap is an important element in every structure. Even though the pile cap is a mostly considered minor, it plays an important role as it is used to transfer the load of the building into the ground. Any faults in the foundation may result in building failure.

Each structure requires different type of pile cap design as it depends on the load of the structure and the soil bearing capacity of the soil that the structure was built on. Even in the same structure may use different size and design of pile cap if it was located at a different point of the buildings structure. The type of pile cap used in this structure in the case study uses four different sizes in total as each section of the building transmit different amount of load.

As for this report, the renovation project used a suitable design of pile cap as it is approved by the engineer and is built according to the given specification and is expected to last a lifetime and will pose no threat to the building occupants.



## REFERENCE

### Books.

Build Land Technology. Sdn. Bhd. (2007). Company Profile. *Build Land Technology. Sdn. Bhd Company Profile.*

DURASAMY, Y. (2009). *Introduction to Pile Foundation.*

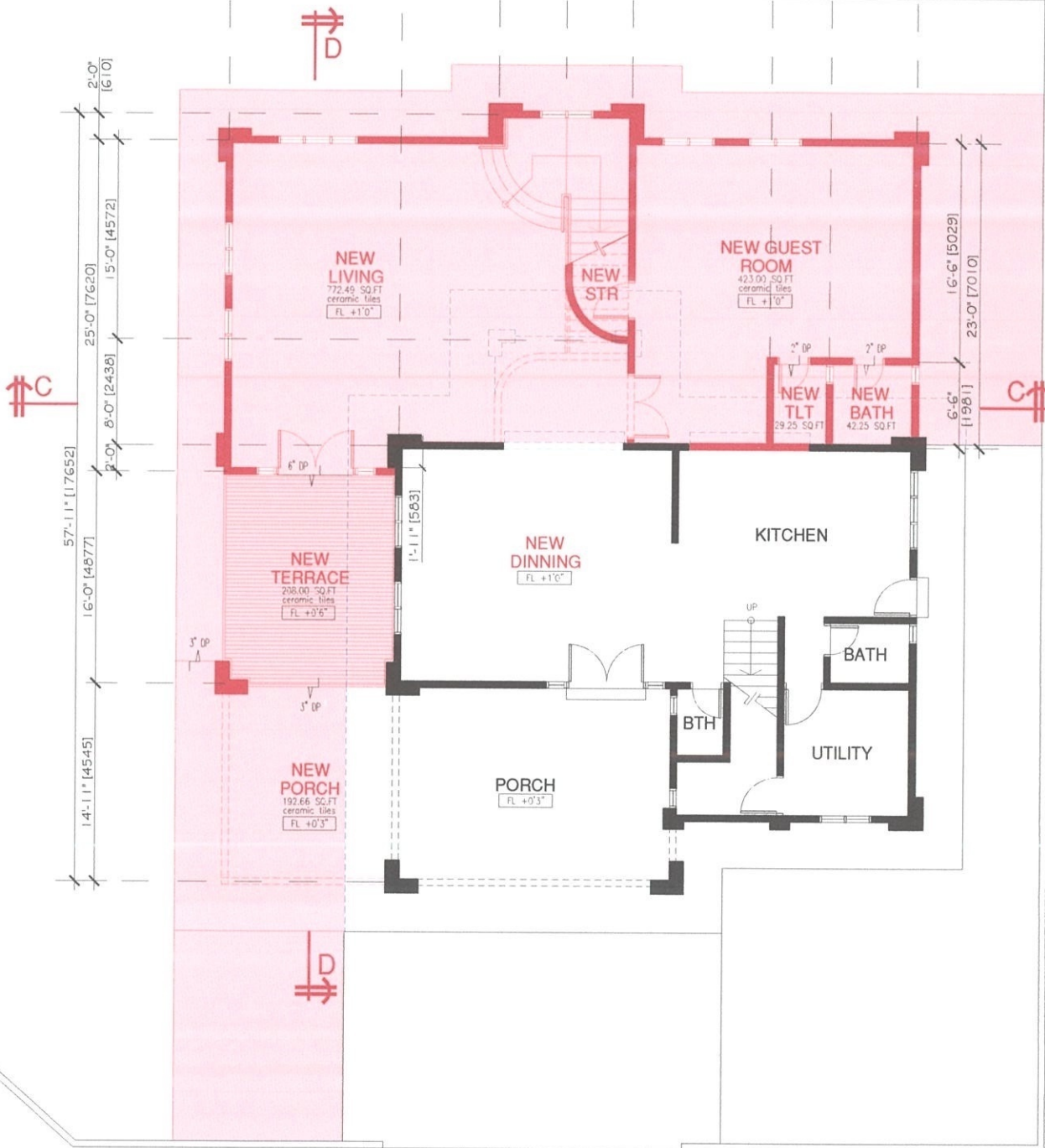
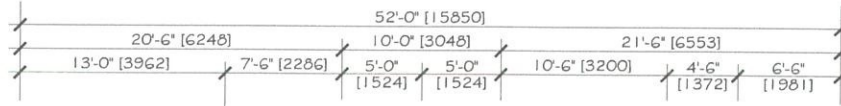
### Internet

CivilToday.com. (2007). *Types of Pile Foundation.* Retrieved from Civil Today.com:  
<https://civiltoday.com/geotechnical-engineering/foundation-engineering/deep-foundation/176-pile-foundation-definition-types>

ECKERT.corp. (2009). *Oxygen Cutting.* Retrieved from ECKERT.

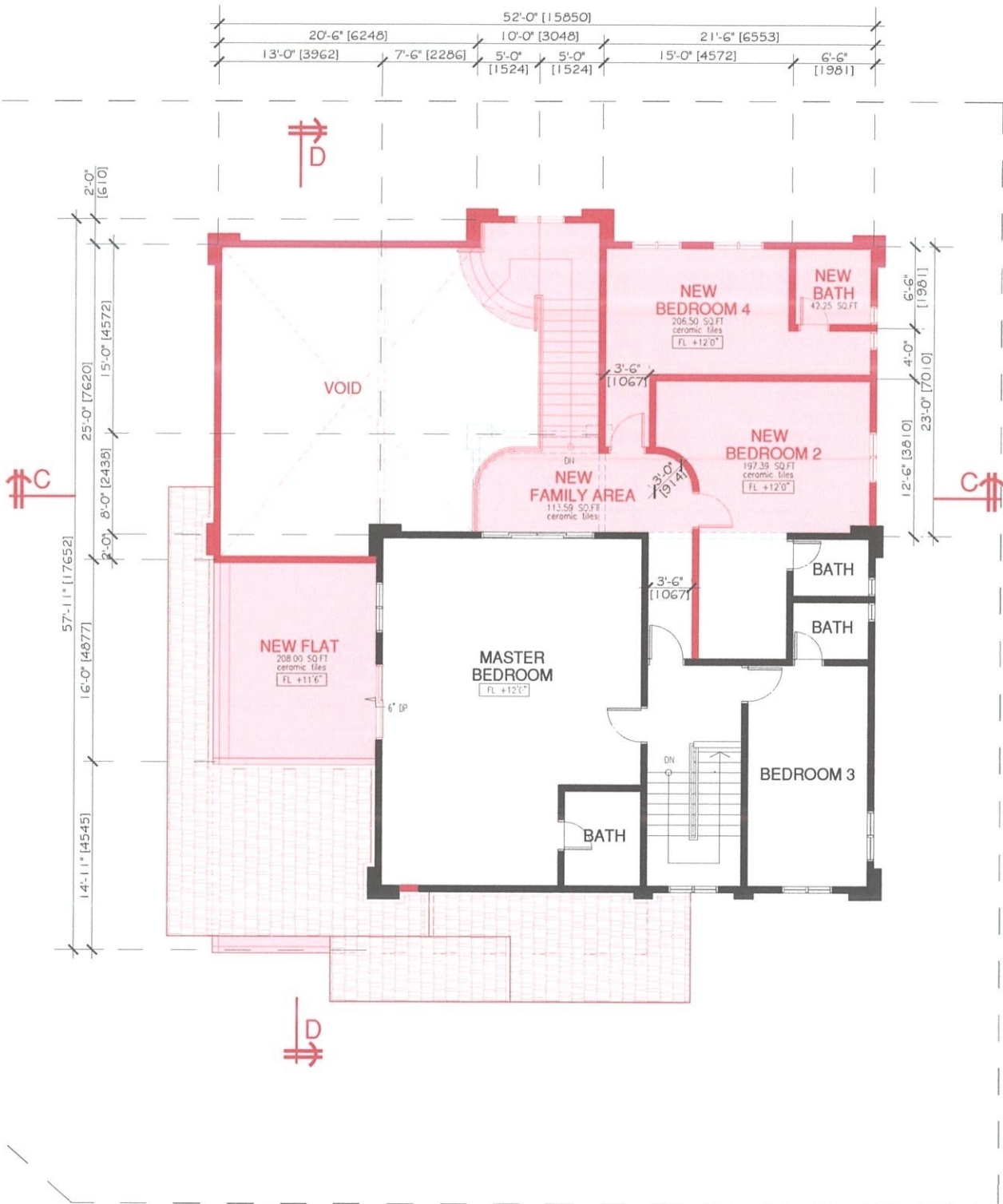
understandconstruction.com. (2014). *Pile Foundation and types of pile.* Retrieved from Understand Building Construction:  
<http://www.understandconstruction.com/pile-foundations.html>

# **APPENDICES**



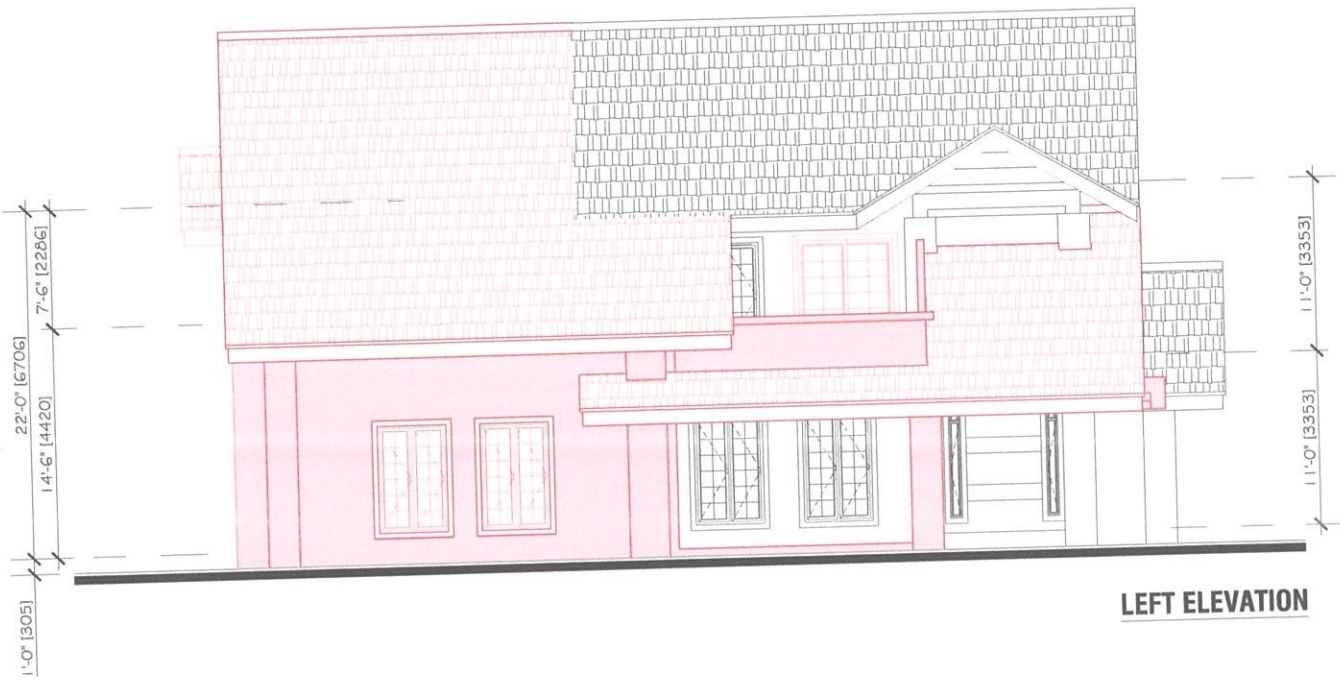
**GROUND FLOOR PLAN**

**APPENDIX I**

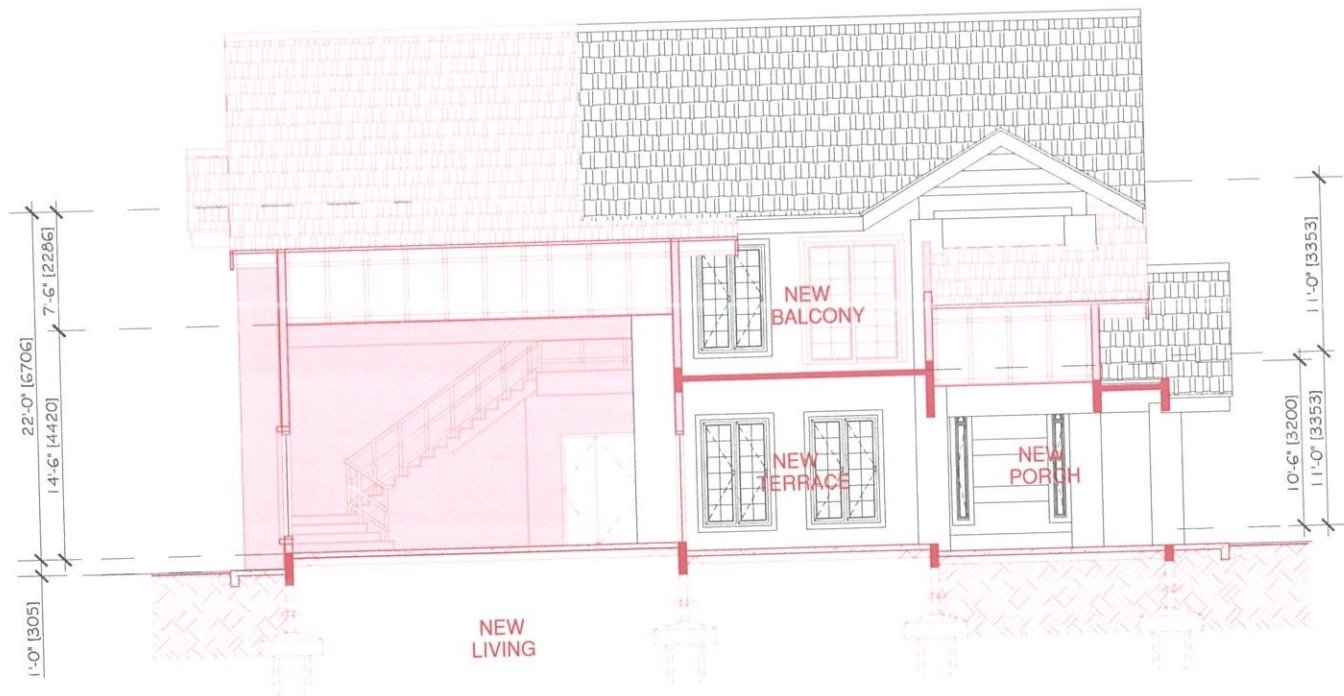


FIRST FLOOR PLAN

APPENDIX II



**LEFT ELEVATION**



**SECTION D-D**

**APPENDIX III**