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UNIVERSITI
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FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING
UNIVERSITY TECHNOLOGY MARA
(PERAK)

OCTOBER 2013

It is recommended that the report of this practical training is made

By

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Entitle

METHOD CONSTRUCTION OF REINFORCEMENT CONCRETE PILE

Is accepted as the partially fulfillment of the requirement in obtaining the diploma in building.

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(PERAK)**

OCTOBER 2013

STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for the extract and summaries for which the original references stated here in for the five month practical which is from 13th of May to 28th of September 2013 at Sunway Construction Sdn. Bhd. It's also as one of the requirements to pass the course DBN 307 and received in partial fulfillment requirements for obtaining a Diploma in Building.

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ABSTRACT

A building is generally composed of a superstructure above the ground and a substructure which forms the foundation below ground level. The foundations transfer and spread the loads from a structure's columns and walls in to the ground. This report briefly describes about all the process and method involved in reinforced concrete (RC) pile work that carried on at residential area based on interview, observation, searching internet and reading book. This report prepared based on the five months working experience at the construction site. Two proposed objective been highlight is to understand the installation procedure, process, and to identify material, plant and machineries used for RC pile. This report divided by several parts which started with the company background and construction project background. Based on the experience, RC pile work is not easy as it looks in terms of its construction process. However, it is more economical and faster to construct compared to other types of pile foundation. The method of embedded RC piles is using a hydraulic piling machine. Furthermore, all the machineries, plants and equipment's that involved in RC pile construction also are study. During the RC pile work, has a small number of problem and a few suggestion that believe can overcome the problem occur stated herein. As a conclusion, this report should expose to readers in details about the process and method involved in RC pile work.

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LIST OF ABBREVIATIONS

SunCon	Sunway Construction Sdn Bhd
PKK	Pusat Khidmat Kontraktor
CIDB	Construction Industry Development Board
TNB	Tenaga Nasional Berhad
MBAM	Master Builders Association Malaysia
CHOGM	Commonwealth Heads of Government Meeting
RC Pile	Reinforcement Concrete Pile
TBM	Temporary Bench Mark
EI	Engineer Instruction
PDA Test	Pile Driving Analyser Test

CHAPTER 1

1.0 INTRODUCTION

1.1 Introduction

In this era of 20th century, Malaysia is trying their best to develop more, even more and start to compete with others developed countries. At the same time, construction sector also having a growth technology and lots of new method is presented. If people who live in a peaceful and harmony been a basis in the developed of Malaysia, then foundation is a basis in determine the success of a buildings.

A foundation often called footing is a supporting layer and the lowest part of a structure. Generally, foundation is a part located between the soil and others part of structure, make it as the lowest part in the structure components. Received a load from the superstructure and distribute to the supportive layer of soil or bedrock. Acts as an agent to carried life load, dead load and wind load (for high-storey building) to distribute to the soil or bedrock. Foundations are commonly divided into two categories that are shallow foundation and deep foundation. This report would discuss about piling a type of deep foundation.

Back to the past years of century, when the pile foundation are firstly used. A zone that located near the lakes and rivers become a place for development, villages and towns due to the availability of water. Therefore, the weak and soft soil condition was reinforced by the use of timber piles that were either manually forced into the

ground, or fixed in holes that were filled with stones
(<http://www.brighthubengineering.com>).

After a year of decades, when the industrial had revolved, new techniques of pile installation were introduced into installation by steam or diesel driven machines replaced the old primitive techniques. Noted that the primitive pile was wood, but now pile can be steel, reinforced concrete, and pre-tensioned concrete
(<http://www.brighthubengineering.com>).

A piling is a type of deep foundation distinguished from shallow foundation by the depth they are embedded into the ground. There are many reasons why a geotechnical engineer would recommend a deep foundation over a shallow foundation, Piles are generally driven into the ground in situ, other deep foundations are typically put in place using excavation and drilling. Deep foundations can be made out of timber, steel, reinforced concrete and pre-stressed concrete.
(<http://www.greatpossibilities.com>).

Like others structure, both types of foundation (shallow or deep foundation) also need to carefully design by a structural engineer. It is design to ensure the reliability of the foundation that should perform as a unit.

1.2 Objective

- i. To study the installation procedure and process of reinforcement concrete pile works.
- ii. To identify and determine the material, plant, and machineries used for reinforcement concrete pile works.

1.3 Scope of Study

The study covers on the reinforcement concrete pile works that has been carried on residential area at Selangor Darul Ehsan. The exact location is around Sunway Alam Suria, Shah Alam. This study shall be discussed to go through in detail in all perspectives to understand the needs of piling in construction and it's important towards surrounding.

The research focused on the method of piles driven into the subsoil. Besides it does include the setting out the line in perspective area, identifying the location to embedded piles, the required depth, planting method of piles driven. Plus, it also expresses the tested that required in reinforcement concrete pile works. The material, plant and machineries used in embedded piles also will be deliberated later.

1.4 Methodology

To achieve the objectives, there are several methodology used, which are:

1. Interview

Interview can be defined as the communication between two parties or in other word dialogue. Based on the conservation, the information and explanation that has been given by Mr. Kong Kok Meng and En Hassan both as a Project Engineer, Sunway Construction, and Supervisor, Ah Soon Construction, are more clearly and easily to be understood compared to the other ways. From this discussion can help the information explain more clearly and briefly.

2. Observation

The field observation can be described as the surveys that carry on a field or location of construction site to obtain a data. Project Sunway Alam Suria located at Shah Alam, Selangor has been selected as a place in observation for this report. This method of learning is very effective way to gained knowledge about the reinforcement concrete pile works. The information that being at the site provided the details and the direct information from the experience will give more knowledge.

3. Internet

In a modern era, all the information around the world can be shared and collect in the spaced-age technology called as internet. Internet is a devise that use to get any information in an instant. It is also the fastest way to search for information. The various types of information can easily to understand this topic by refer to difference sources.

4. Book

Reference can be determined as something that we refer to. During the progress to complete this report, book has become my reference. Any books or articles related to the reinforcement concrete pile works. These types of methodology are very supportive method in gaining information about the reinforcement concrete pile works. However, the information given in books or articles is more to theoretical review and more to standard guidelines.

CHAPTER 2

2.0 BACKGROUND OF COMPANY

2.1 Introduction



Picture 2.1 Sunway Construction Sdn Bhd logo

Sunway Construction Sdn. Bhd. (SunCon) is registered with Pusat Khidmat Kontraktor (PKK) and the Construction Industry Development Board (CIDB) as a Class 'A' and Grade '7' construction corporation respectively. PKK is the Government's classification and registration body for contractors and CIDB is a body set up by the Government to promote and stimulate the development, improvement and expansion of the construction industry. Construction companies are classified according to their technical and financial abilities with Class 'A' and Grade '7' being the highest classifications. With the highest classifications, SunCon can tender for contracts of unlimited value. This is an important consideration particularly when competing for government contracts.

SunCon has the advantage to tap the combined resources of the Sunway Group, one of Malaysia's most dynamic and integrated corporations. This enables SunCon to access the invaluable experience and expertise of the Group's management team, its financial strength, and also reliable sources of materials and services from companies within the Group. This synergy adds strength to SunCon capabilities, providing it with a competitive advantage in terms of competitive pricing, assured quality, and shorter project completion period. SunCon is an active member of Master Builders Association Malaysia (MBAM), a national trade association representing the construction industry in Malaysia.

2.2 Company Profile

Sunway Construction Sdn. Bhd. (SunCon) is registered with Pusat Khidmat Kontraktor (PKK) and the Construction Industry Development Board (CIDB) as a class 'A' and grade '7' construction corporation respectively where Sunway Construction Sdn. Bhd. can tender for contracts of unlimited value.

SunCon offer complete turnkey design and construction services, with prominent recognition in the fields of building construction, civil engineering, infrastructure, mechanical and electrical engineering as well as machinery and site equipment rental. Recent additions to the SunCon Group including precast, piling and stone materials have further strengthened our capability as an integrated builder, in Malaysia and the region. SunCon draws on the strengths of its diverse team, expertise and resources, and remains committed to building quality and innovation into products and services.

SunCon played its first role in nation-building soon after its inception by working with the Works Ministry to undertake the Langkawi Jetty project from start to finish in anticipation of the Commonwealth Heads of Government Meeting (CHOGM). It was a success, as SunCon completed the project in 90 days, in time for the meeting. Since then, SunCon has been one of growth and achievement, becoming one of Malaysia's largest construction companies, with interests throughout the region.

As SunCon climb the ranks of the design and build elite, continue to build landmarks of achievement in its portfolio and help shape nation's progress. SunCon have established an enviable track record and the projects in showcase include the world-class Kuala Lumpur Convention Centre (KLCC), Traders Hotel Kuala Lumpur, the 37 km dual 3-lane carriageway Kajang SILK Highway, Ministry of Finance, National Registration Department and Ministry of Entrepreneur and Cooperative Development in Putrajaya, and 2,200 units of teachers' quarters located throughout 17 project sites in Malaysia, built using precast construction technology.

On the international front, SunCon is currently undertaking the construction of six major highways in India for the National Highways Authority of India, the 21-storey Ministry of Legal Affairs Tower in the Republic of Trinidad & Tobago, as well as the recent Al Reem Island Development in Abu Dhabi, UAE.

2.3 Vision and Mission

Vision

- i. To be a leading construction conglomerate providing world class and competitive products and services that enhances stakeholders' value.

Mission

- i. To provide innovative quality products and services those exceed customer's expectation.
- ii. To continuously attract, retain and develop human capital.
- iii. To achieve market leadership and operating excellence in every business segment.

2.4 Sunway Group Organisation Chart

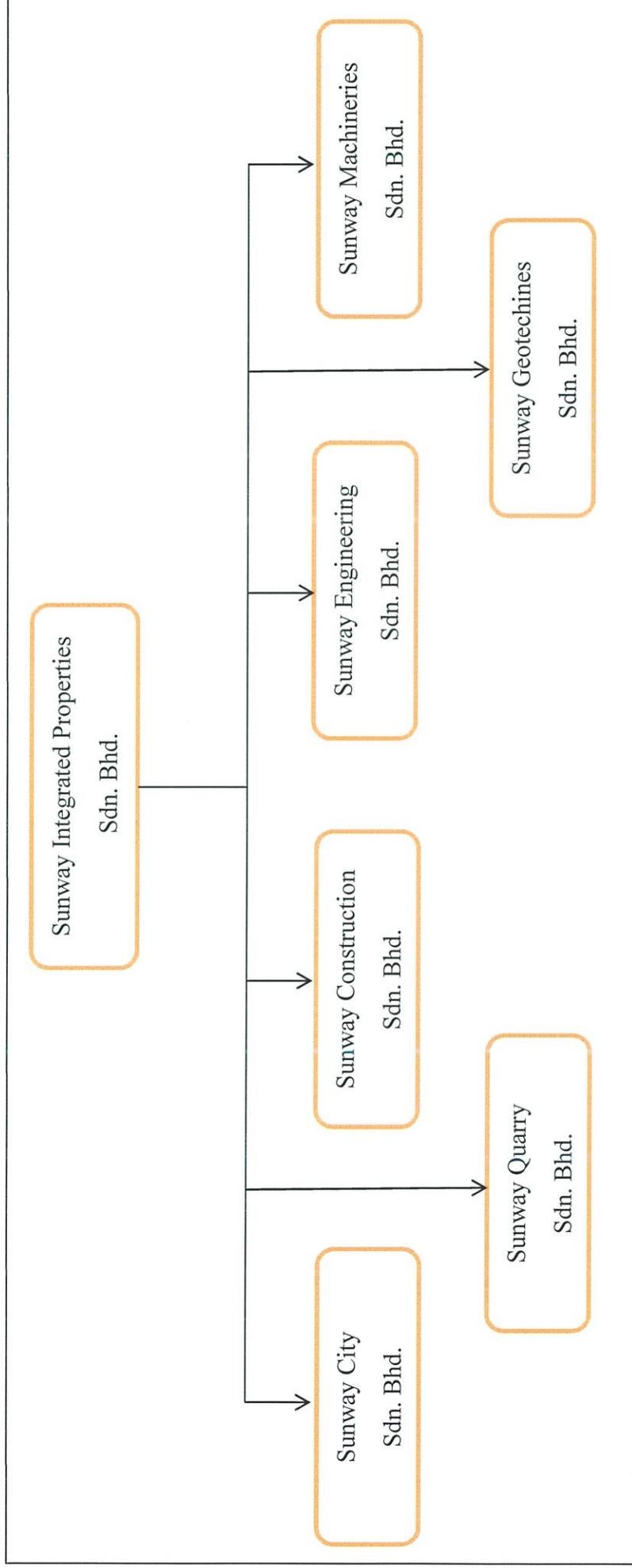


Figure 2.1 Sunway Group Organisation Chart

Source: Sunway Head Quarters

2. 4 Sunway Alam Suria Organisation Chart

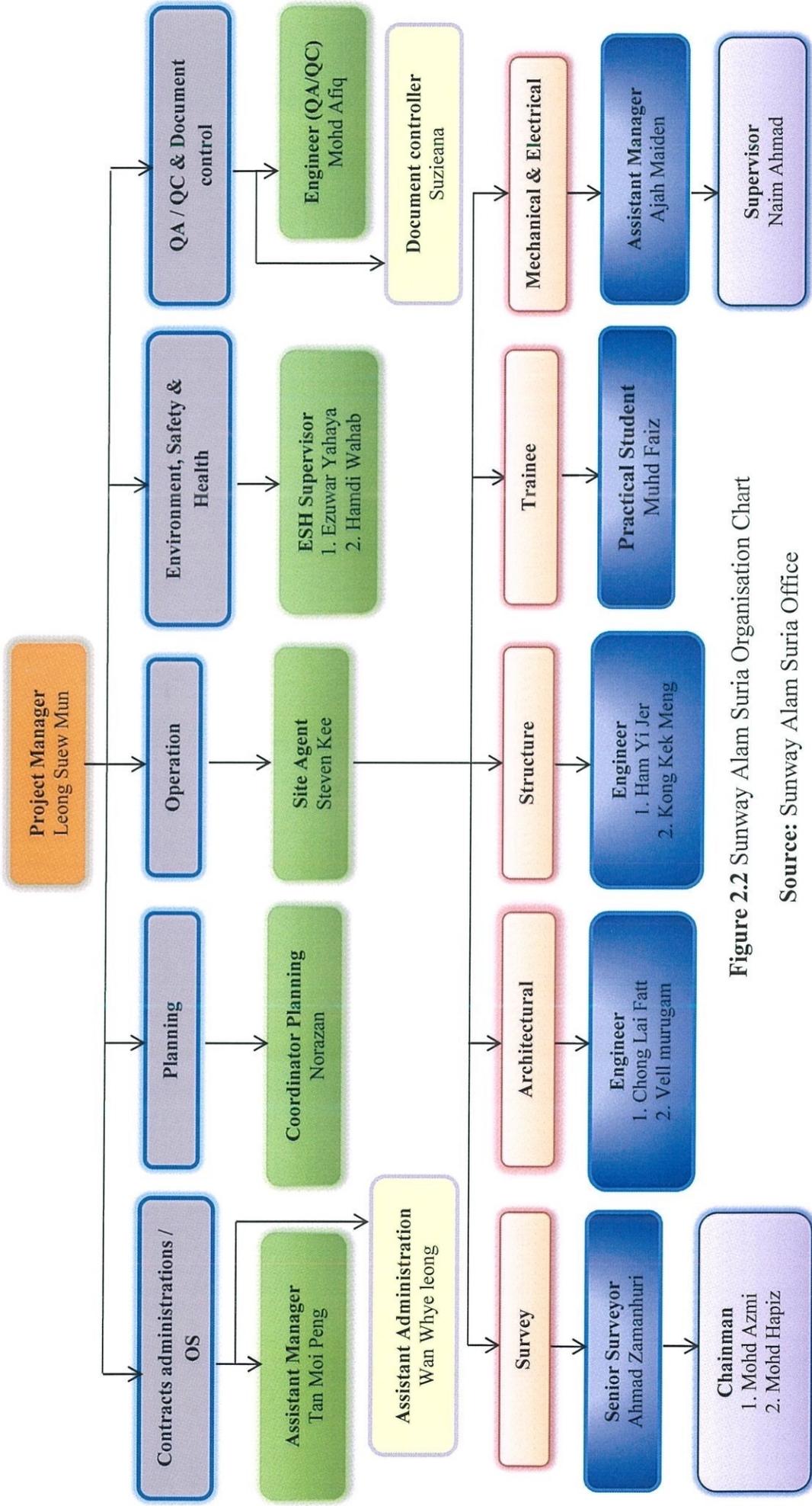


Figure 2.2 Sunway Alam Suria Organisation Chart

Source: Sunway Alam Suria Office

2.5 Sunway Construction Sdn. Bhd Project

2.5.1 List of completed project (2006 – 2011)

Table 2.1 Sunway Construction completed project

No	Project Title	Client	Contract Value	Commencement Date	Completion Date
1	Execution and completion of building works for basement B1 to B7 for Solaris 2 Dutamas located at Sri Hartamas, Kuala Lumpur.	Aston Star Sdn Bhd	RM 154,870,000.00	28 June 2006	31 July 2008
2	Construction and completion of the main contract and associated works for the proposed phase 2 of Impiana KLCC development, which is an extension to the above the existing 4-storey car park podium on lots 696, 697 and 698, Seksyen 57, Jalan Pinang, Kuala Lumpur.	Heritage Line Sdn Bhd	RM 88,000,000.00	1 April 2010	2 November 2011

No	Project Title	Client	Contract Value	Commencement Date	Completion Date
3	Proposed construction of a dairy product factory on lot 56 (pt125494), Jalan Sungai Pinang /5, Pulau Indah (KS 13) Port Klang Bandar Diraja, Selangor.	PML Dairies Sdn Bhd	RM 129,000,000.00	28 June 2010	11 July 2011
4	Proposed the construction of 1 storey of component composite aeroplane factory with 1 storey of office space, 1 unit of guard house, 1 unit of garbage house, 1 unit of pump house, 1 unit of compressor space, 1 unit of chillier plant and 1 unit of gas space on part of lot 1210, Pusat Aeroangkasa Antarabangsa Malaysia (MIAC), Lapangan Terbang Sultan Abdul Aziz Shah, 47200 Subang, Selangor.	Malaysia Airports Holdings Berhad	RM 119,800,000.00	14 May 2007	27 Nov 2008

2.4 Sunway Construction Sdn Bhd Project

2.4.2 List of current project

Table 2.2 Sunway Construction current project

No	Project Title	Client	Contract Value	Commencement Date	Completion Date
1	Mara University of Technology Proposed design, construction and completion of main infrastructure works and satellite works for extension of University Technology Mara campus (Zone 1 phase 2) utilising private finance initiative (PFI) on lot pt1567 & pt.1568, Mukim Jeram, Daerah Kuala Selangor, Selangor.	TRIpIc Industries Sdn Bhd & Haluan Prisma Sdn Bhd	RM 191,370,000.00	1 Feb 2011	29 Jan 2014
2	Light Rail Transit Package B (KLG -LRT) The construction and completion of facilities works (package b) for the Kelana Jaya (KLJ) line extension project.	Syarikat Prasarana Negara Berhad	RM 569,000,000.00	4 Oct 2011	13 March 2014

No	Project Title	Client	Contract value	Commencement Date	Completion Date
3	<p>Legoland Water Theme Park Development (Package 11)</p> <p>Proposed design, construction and completion of package 11 – Legoland water theme park development on part of lot PTD 170659, Mukim Pulai, Daerah Johor Bahru, Johor.</p>	IDR Assets Sdn Bhd	RM 44,988,668.00	21 Dec 2012	6 Oct 2013
4	<p>Mass Rapid Transit (MRT) – Package V4</p> <p>Project mass rapid transit Lembah Klang: Jajaran Sg Buloh – Kajang package V4: construction and completion of viaduct guide way and other associated works from section 17 to Semantan portal.</p>	Mass Rapid Transit Corporation Sdn Bhd (MRT Corp)	RM 1,172,750,000.00	18 Jun 2012	18 Jan 2016

CHAPTER 3

3.0 REINFORCED CONCRETE PILE WORKS

3.1 Introduction

Before construct any types of building, the structure need to build first. But, before the superstructure start, the sub-structure is compulsory to construct. A major part of sub-structure shall include foundation (shallow or deep), ground beam, and column stump. It is well known and accepted fact that for any building, house or concrete structure to be built well, it must have a very strong foundation and underground structural base that supports the building. This is what makes piling so important.

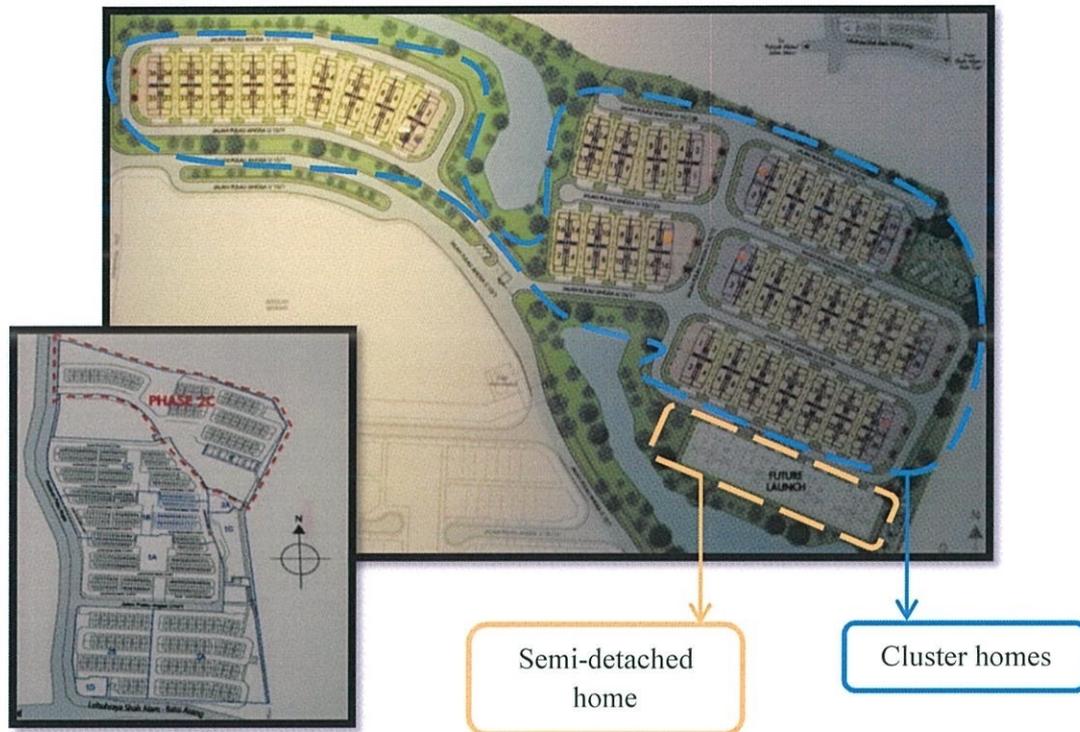
Reinforcement concrete pile (RC pile) foundation consist of pile that are dug into the soil used to transfer the load of a structure down through the upper weak layer of topsoil to the stronger layer of subsoil below or on unstable soils, piles are indispensable building supports and may also be used on stable ground when exceptionally large structural loads are involved. By driving and embedding RC piles into the deep soil of the ground, the piling is able to provide a strong support to the building structure at the foundation level. Factors such as the size, capacity and scope of the project, the condition of the soil immediately beneath the ground, all need to be taken into consideration before beginning the piling process. (<http://www.greatpossibilities.com>).

At the head of the RC pile or RC piles group there is a pile cap, which provides a connection between the pile and the ground, slab or superstructure elements. Pile cap incorporating a multiple pile system comprising two or more piles require no additional restraint.

Some of the common reasons why a geotechnical engineer would recommend a deep foundation over a shallow foundation are very large design loads, a poor condition of topsoil, or site constraints. Plus, there are different terms used to describe different types of deep foundations including the pile and the pier, drilled shafts, and caissons.

In designing a pile foundation, a common characteristic need to be taken seriously before progressed any work. Pile foundations are designed to have an adequate load capacity with limited settlement by a geotechnical engineer and the pile itself may be designed by a structural engineer. When considering settlement, total settlement and differential settlement is normally considered. Problem will occur when one part of a piling settles more than another part due to differential settlement.

3.2 Background of Project

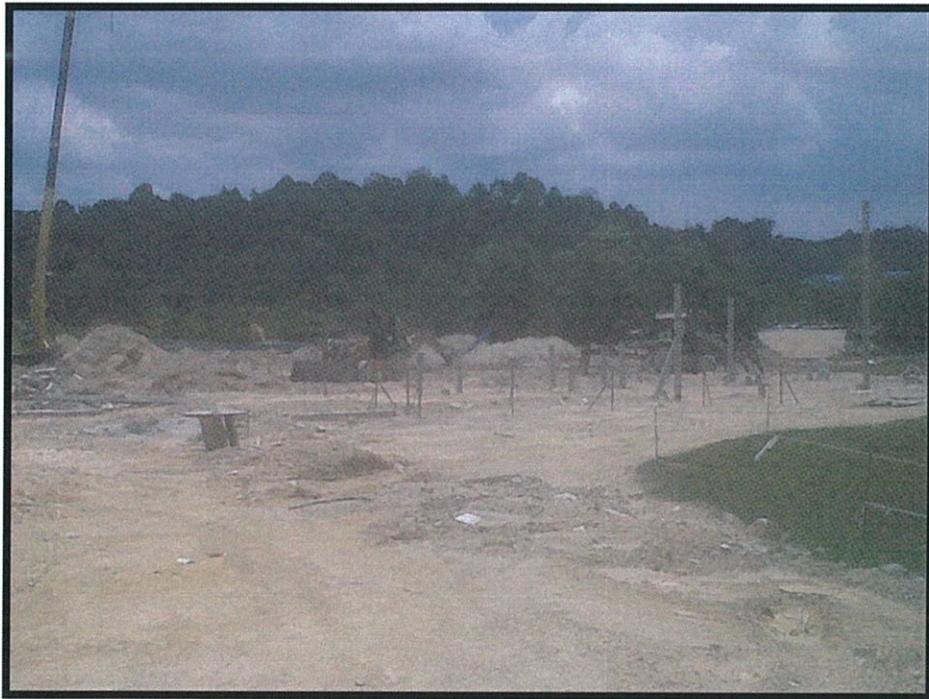


Picture 3.1 Sunway Alam Suria phase 2C & 3

Source Office Sunway Alam Suria project

Sunway Alam Suria is a residential project located at Seksyen U10, Shah Alam. Sunway Alam Suria consist of few phase to completed. Now, Sunway Alam Suria phase 2C & 3 is the final stage in completion of Sunway Alam Suria and this final stage take a cost about RM 50,000,000.00 respectively. This final stage, phase 2C & 3 is proposed construction and completion of 144 unit's double-storey cluster home, 8 units of double storey semi-detached home, 4 units of gazebo and single unit of double chamber Tenaga Nasional Berhad (TNB) station. Sunway Alam Suria construction are started on 05 March 2012 and targeted to complete on 01 March 2014, take 100 weeks duration from starting date to the completion of these final phase.

However, in these final stages the use of foundation is different between cluster homes and semi-detached homes. Type of foundation used in construction of cluster homes is combined footing where pad used as a car porch foundation while raft foundation are majorly used at whole area of building except car porch area. Otherwise, only 8 units of semi-detached home are using pile foundation and this study about reinforced concrete pile works are run at semi-detached homes.



Picture 3.2 Construction of Semi-detached area

Table 3.1 Sunway Alam Suria Participants

Project Title:	Proposed of Construction and Completion of 144 Units Double-Storey Cluster Home, 8 Units of Double-Storey Semi-Detached Home, and 4 Units Of Gazebo and Single Unit of Double Chamber TNB Station.
Developer:	SUNWAY INTEGRATED PROPERTIES SDN. BHD. Level 3, Menara Sunway, Jalan Lagoon Timur, Bandar Sunway, 46150 Petaling Jaya, Selangor.
Architect:	ARIKITEK MAJU BINA SDN. BHD. 3A10, Block C, Phileo Damansara 19, Jalan 16/11, 46350 Petaling Jaya Selangor.
C&S:	BERAKAN JURUTERA PERUNDING SDN. BHD. 69A, Jalan SS 25/2, Taman Bukit Emas, 47301 Petaling Jaya, Selangor.
M&E:	J. ROGER PRESTON (M) SDN. BHD. H-4, Excella Business Park, Jalan Ampang Hilir, 55100 Kuala Lumpur, Wilayah Persekutuan.
Q&S	ECONCOS CONSULTANTS SDN. BHD. 43, Jalan 5/62A, Bandar Manjalara, 52200 Kuala Lumpur, Wilayah Persekutuan.
Landscape Architect:	UBS ASSOCIATES SDN. BHD. 52-2-2, Jalan 4/62D, Medan Purta Business Centre, Bandar Manjalara, 52200 Kuala Lumpur, Wilayah Persekutuan.
Main Contractor:	SUNWAY CONSTRUCTION SDN. BHD. Level 8, Menara Sunway, Jalan Lagoon Timur, Bandar Sunway, 46150 Petaling Jaya.

3.3 Reinforced Concrete Pile Works

3.3.1 Construction procedure

Based on the observation during my practical period, it can be conclude that there are seven procedures in order to construct a single reinforced concrete (RC) pile. The procedures are as follow:

1. Soil investigation
2. Setting out the pile position
3. Pile driving
 - a) Lifting the RC pile
 - b) RC pile drive into the ground
 - c) Welding and coating
 - d) Penetration set
4. Pile testing
5. Pile cutting
6. Pile cap construction
7. Pile cap concreting work

1. Soil investigation

Before begin with reinforced concrete (RC) pile works, soil investigation should be examine first to know the types of subsoil below and help in the designing a pile foundation. In this project, Sunway Alam Suria phase 2C & 3 consists of 144 units double storey clusters home and 8 units of double storey semi-detached home. The soil investigation has been made at the selected point in the area of this project to determine the types of subsoil below.

A soil in this project is not the origin, a soil take form others place and been lay in the ground. Even, the soil used is same but 144 units of double storey clusters home and 8 units of double storey semi-detached homes have different type of foundation. A cluster home type of foundation is a combined footing with pad and raft foundation one type of shallow foundation and for semi-detached home is a pile type of deep foundation. There are many reason why pile foundation been used in the construction of semi-detached home because the location of semi-detached near with the main and big pond. The pond used as an outlet for water from forest nearby and during a rain or storm.

Another reason why the pile foundation been choose in the construction of semi-detached homes is a burden of load itself. The design of semi-detached homes comes with a massive load burden that most impossible to used raft foundation with the condition of the soil near to the main pond. These two theories became a main reason why the pile type of deep foundation is used in the construction of semi-detached homes. Typical design of pile foundation is RC square pile with 150 millimetre (mm) x 150 mm x 6 metre (m) and 3 m height each. And typical pile shoe is steel dowel rock shoe with 85 mm length.

2. Setting out the pile position

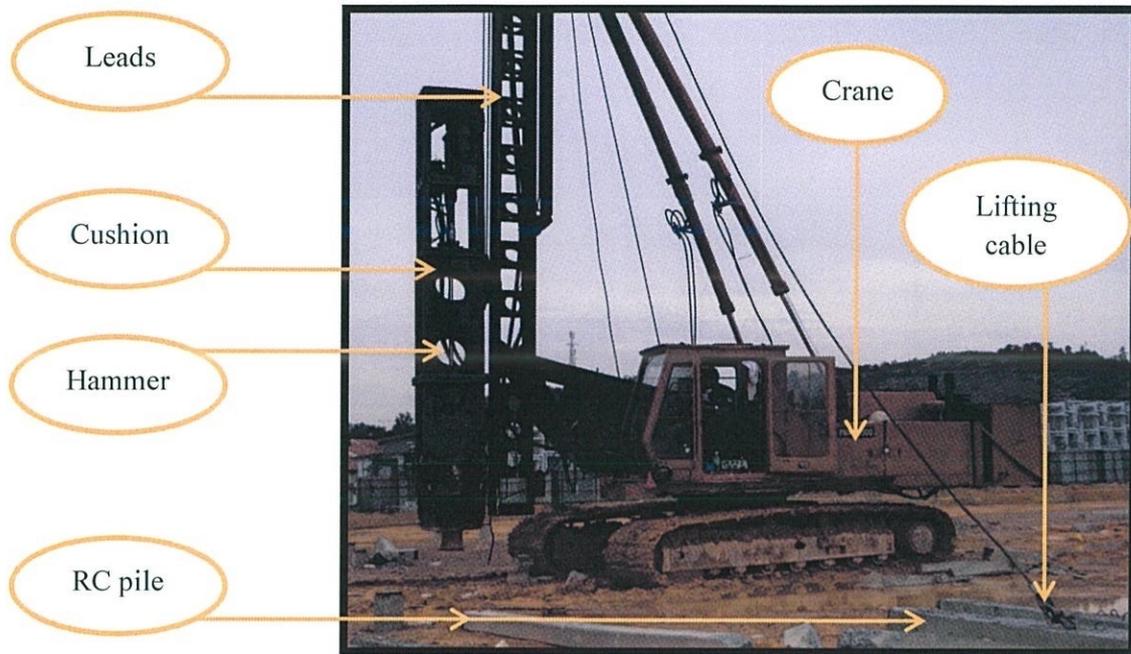


Picture 3.3 Setting out the pile position

After the soil investigation carried out with the design of pile foundation, it's time for setting out the grid line or boundary line at the 8 units of semi-detached home. The setting out work perform by a surveyor team to mark or as a guidelines for others operation work. From a temporary bench mark (TBM), the setting out being make at the all 8 units of semi-detached home. From a TBM point, the required point in the 8 units of semi-detached home been mark and noted by a red plastic with white strip that show a place for piles to be embedded. Early, the required piling point cover the all 8 units of semi-detached home is only 360 points to be mark with depth of penetration only 12 m depths from the ground level. Then, an issue came and forced a Berakan Jurutera Perunding Sdn. Bhd. to come out with the Engineer Instructions (EI) number four to add the piling points up to 698 points with the depth of penetration is 24m depth.

3. Pile driving

a) Lifting the RC pile



Picture 3.4 Component of piling driving machine

Next, when the points are fully marked in the ground, the method of pile driven is start. The piles that ready in the site are lifted by a lifting cable outside the leads, a part of hydraulic piling machine, staked with a wheel in a body of hydraulic piling machine. Preparation need to done first before lifting any piles. An example of some preparation is the embedded point, position of hammer and location of piles. Three workers are involved, one is an operator that handling a hydraulic piling machine, one is handling a RC pile while another worker is record the data obtained.

Operators free a pedal that grips the wheel to allow other worker to pull the cable and hooked the end of cable to the copping of pile. At the side of pile have two small copping located at the end-end of pile that look similar like ears. Operator carefully pushes a pedal makes a wheel to operate and pile are lifting. Make sure that the

hooked are tight before lifting the pile. During a lifting, no one is allowed to be nearby as a preventive action if the lifting cable is accidentally cut or the wheel loses its operation. Operator lifting the pile and placed the pile head at the inside and bottom of the cushion, a part of hydraulic piling machine. Remember that while lifting the pile the position must be correct where pile shoe placed at the bottom while pile head being at the upper side. Double handling work will happen if the lifting pile is upside down where the pile shoe placed at the upper side.

b) RC pile drive into the ground



Picture 3.5 Drive pile into the ground

Second step of pile driven is dug the pile into the ground below. When the pile head are inside the bottom cushion, a worker carefully placed a steel dowel that ready existed outside in the pile shoe to the point where the pile need to be dug. A point that early been marked by surveyor team. Placing the steel dowel centre with the

point, the position of pile must be correctly perpendicular to the pile layout plan. Once all the position is correct, the operator begins the hammer blow to drive the pile which height is 6 m into the ground. Numbers of blow counted and record with the depth of penetration by another worker. While embedded pile, anyone not allowed being nearby as a preventive action if the pile accidently crack.

c) Welding and coating



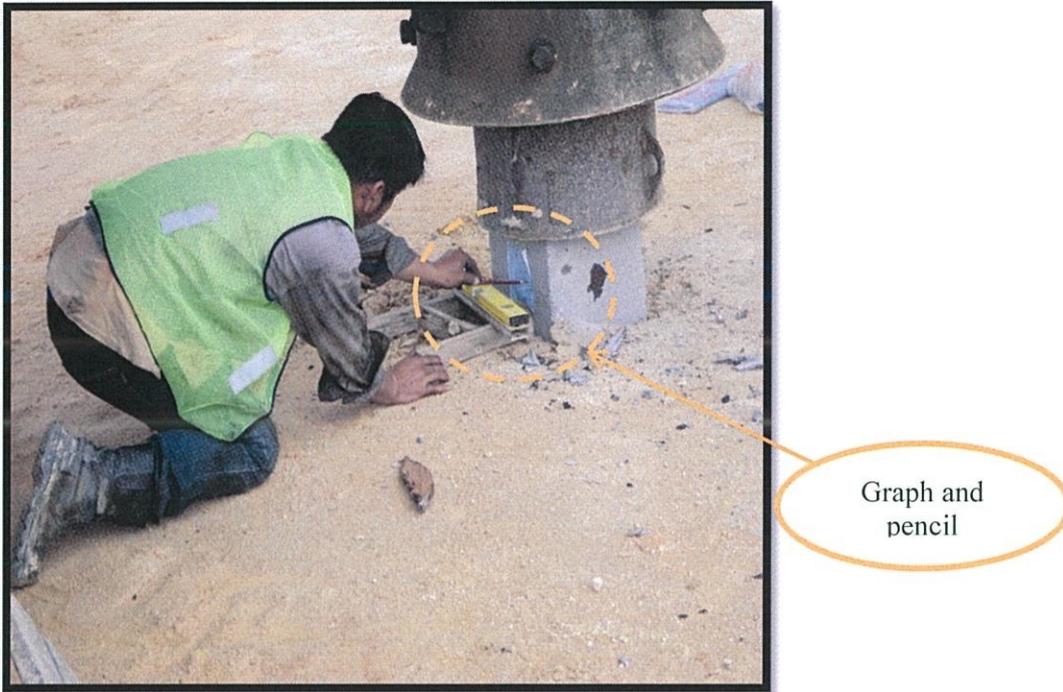
Picture 3.6 Pile welding and coating

Next step is welding and coating. Welding and coating is necessary be done when the pile need to be add. To achieve 24 m depth of penetration, numbers of existing piles before EI-4 is 6 m + 6 m + 3 m make the total is 15 m depth of penetration that need to add another two pile which height are 6 m and 3 m each piles. While the additional point required a pile which height are 6 m + 6 m + 6 m + 6 m to make the total is 24 m depth of penetration. When the first 6 m of pile are placing in the ground, the process of listing the next piles is similar to the earlier. On the pile head had a small hole and at pile shoe had a steel dowel bar. The second pile is placed

slowly on top of the first pile. The steel dowel at the shoe of the second pile is positioning in the hole at the head of the first pile.

After the positioning complete, the perimeter of pile joints between two piles are clean from the dust or others unwanted material by a brush. When the surface is clean from all the debris, using a welding along the perimeter of the pile joints to ensure that piles are permanently attached together. Worker who is doing the welding must wear a visor mask and hand glove to protect them from a flame or spark during welding. Done with welding, the perimeter of the pile joints are applied with a welding coat consists of double layer coating. These weld coat is apply to the surface of welding as a protective layer from corrosion. When the welding is done, piles are ready to continue its blow. The process of pile driven is repeating until achieve 24 m depth of penetration below the ground level.

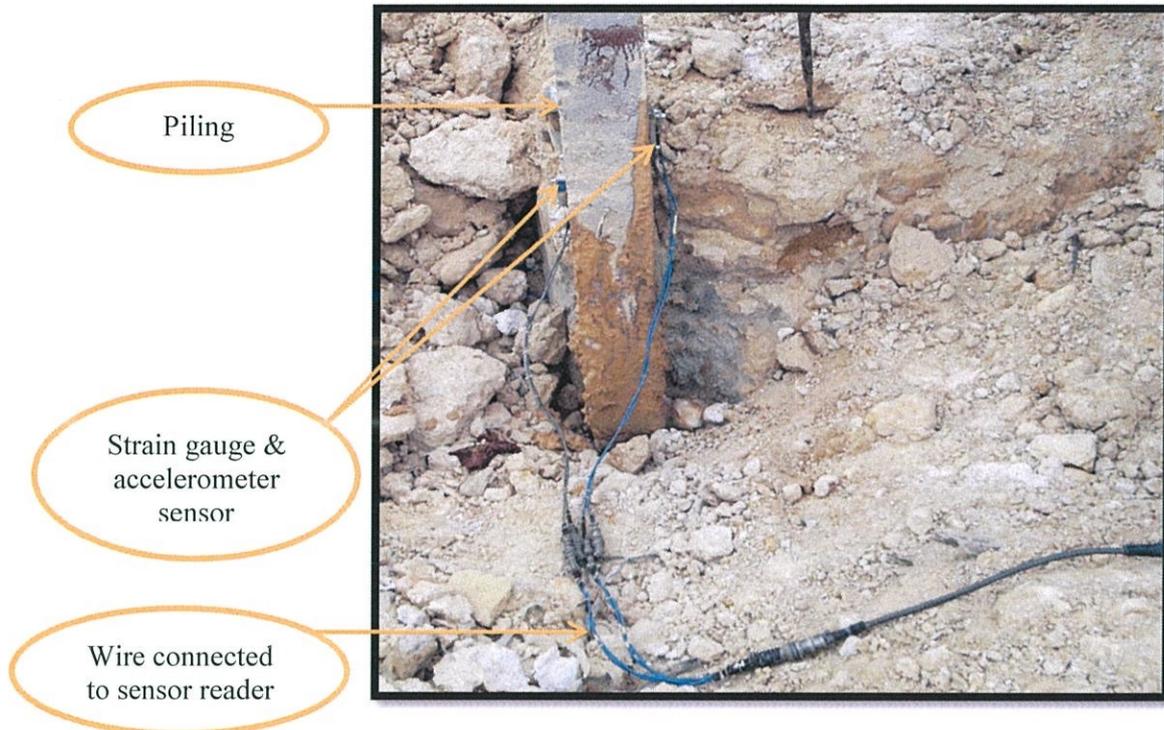
d) Penetration set



Picture 3.7 Draw the penetration graph

When piles almost achieve 24 m depth, a worker take out a graph and staked it at the side of pile, hold a pencil horizontally, quietly without moving. Then, an operator blows the pile. During a blow, the graph that staked at pile is moved down due to the hammer blow while the pencil holds by a worker still in a same position. These situations create a graph that shows a guarantee that the piles are meeting the penetration. A ten numbers of hammer blow per mm is enough to meet the satisfying. A graph reading must be below than 20 mm with a 3 ton of hammer blow per single blow, where the hammer lifting is 200 mm height. The graph is keep with the form of piling that represented the piling number as a record.

4. Pile testing



Picture 3.8 PDA tested on pile

Pile tested should be complete after the work about pile drive is finish. Dynamic pile testing was carried out using a Pile Driving Analyser (PDA). The piles for the test shall be randomly selected by the Engineer-in-Charge. PDA test accomplished by attaching two sets of sensor called as strain gauge and accelerometer. These two sets of sensor are attached on the diametrically opposite sides of each pile above the ground level. Drill is used in making a small hole as for place to attach the sensor sets at pile.

During each hammer impact, the PDA processed the recorded strains and accelerations and calculated values for the maximum hammer transferred energy, maximum driving stress in the pile and an evaluation of the pile mobilised static bearing capacity. Force and velocity records from the PDA were viewed on a visual

screen to evaluate data quality, pile integrity and aspects of soil resistance. Conditioned analogue signals from the gauges were digitised and stored in memory for further analysis.

The piles were installed using a hydraulic piling machine, while a 3 ton drop hammer suspended from a crane was used to provide the impacts. Hammer drop heights of about 0.20m were used in the test. The designed working load for each pile is 30 ton

5. Pile cutting



Picture 3.9 Pile cutting work

After the pile test work did, and the results gained are much satisfying, an Engineer-in-Charge will allowed the next work to proceed. The next work is pile cutting. Pile cutting need soil to be excavate to the cut-off level that stated in a drawing. The excavation of soil is about 1400 mm depth from a ground level. Then, the excessive

pile must to be cut in order to allow a pile cap construction run. Pile cutting should be done properly to avoid the pile crack inside the soil below.

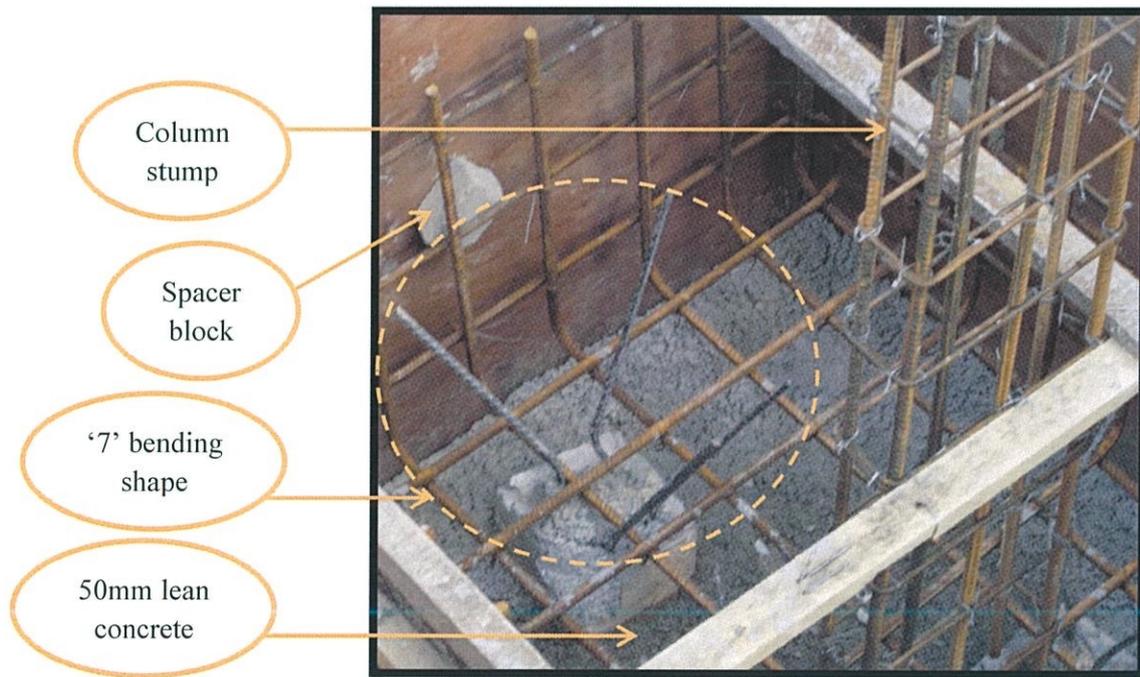
Pneumatic power cutter or diamond cutter is equipment used to cutting the piles. Mark a cut-off level on the pile and cut a bit the pile on the marking level using a pneumatic power cutter. Then, hammer is used to punch down the concrete in pile until reinforcement bar and links can be seen. Steel cutter used to cut off the exposed reinforcement bar and links. A 550mm length of reinforcement bar from pile being exposed similar with the length that stated in drawing.

6. Pile cap construction



Picture 3.10 Pile cap timber formwork

Once the pile cutting work is finished, all the waste from the work of pile cutting must be clear first before timber formwork can be start. A formwork made by timber is used as a pile cap mould for concreting work. Formwork must be support by a timber struts to strengthen itself. While workers prepare a timber formwork, other workers prepare a reinforcement bar at bar bending area located besides the pile area. When the formwork is finished construct, a 50mm thick lean concrete is lay as pile cap base and the reinforcement bar is only wait to be placed inside the formwork. Move and lifting the reinforcement bar is using a mobile crane form a bar bending area to the pile area.



Pictures 3.11 Pile cap reinforcement bar

During a lifting reinforcement bar, two workers are carefully handling the reinforcement bar and slowly placed inside the formwork. Once the reinforcement bar already inside the pile cap timber formwork, the spacer block been insert in the gap in between reinforcement bar and timber formwork. A 50mm spacer block function to give cover to reinforcement bars from exposing after concrete harden in both horizontal and vertical applications. The reinforcement bars inside RC piles that

exposed after piles cutting work are bending similar to ‘number seven shape’. Then, reinforcement bars for column stump is install on top of pile cap reinforcement bars for column stump erection after the pile cap concreting work. Before concreting work, inspection of pile cap is compulsory be done. Inspection of pile cap is conducted by engineer-in-charge together with clerk of work. Whole aspect should be inspecting such as dimension and positioning of pile cap, reinforcement bars diameter and lapping, spacer blocks, dimension and positioning of column stump.

7. Pile cap concreting work

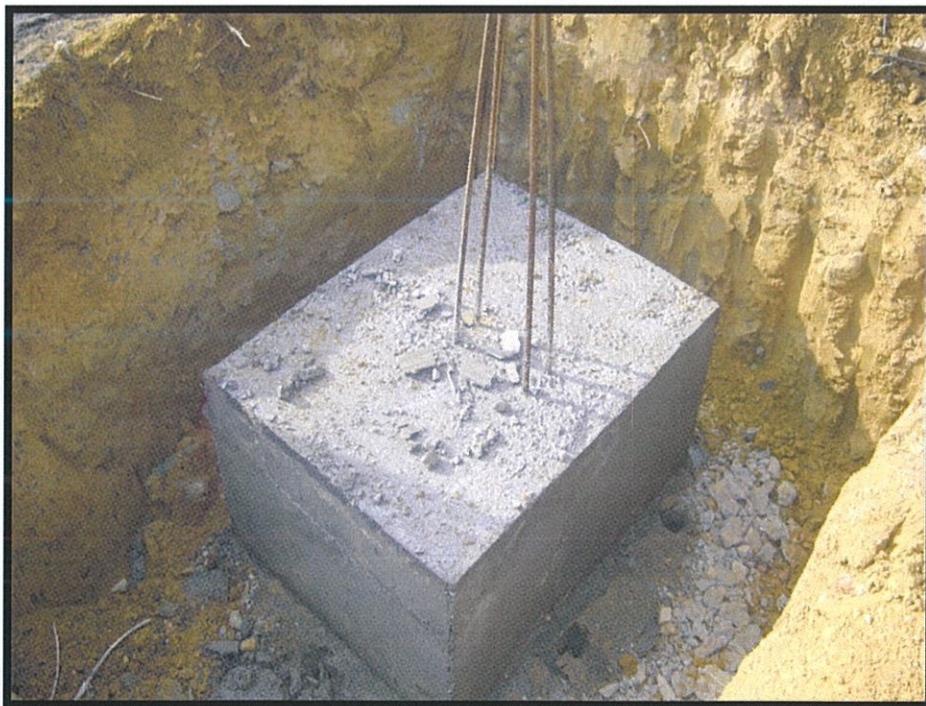


Picture 3.12 Pile cap concreting work

Finally, the last schemes in RC pile work are only the concrete casting work remains. After the engineer-in-charge with clerk of work approved the inspection and permissible the pile cap for concreting. A 25 grade of wet concrete was order from a batching plant located at Jalan Batu Arang. A moment when concrete lorry entering

the construction site, these concrete must be test before allowed to poured. Two test should be performed, this test is slump and cube test. These tests conduct to ensure the concrete workability and strength. If the workability of concrete is good then the concrete is allowed to be poured.

Wet concrete from concrete lorry fill in a bucket that later lift by a mobile crane. Three workers involved at this process. One worker as a signal man for mobile crane operator, another two workers doing concrete pouring and compacting the wet concrete using vibrator machine. Compaction of wet concrete is to ensure that the wet concrete is fill in all the space and left nothing hollowness or void to prevent honeycomb. After concreting done, the wet concrete will be left until the concrete are harden before the work of timber formwork dismantling. Lastly, the harden concrete of pile cap with extension of column stump is ready to construct another sub-structure above the pile cap level such as column stump and ground beam.



Picture 3.13 Pile cap complete

3.4 Chronology in Method of RC Pile Work

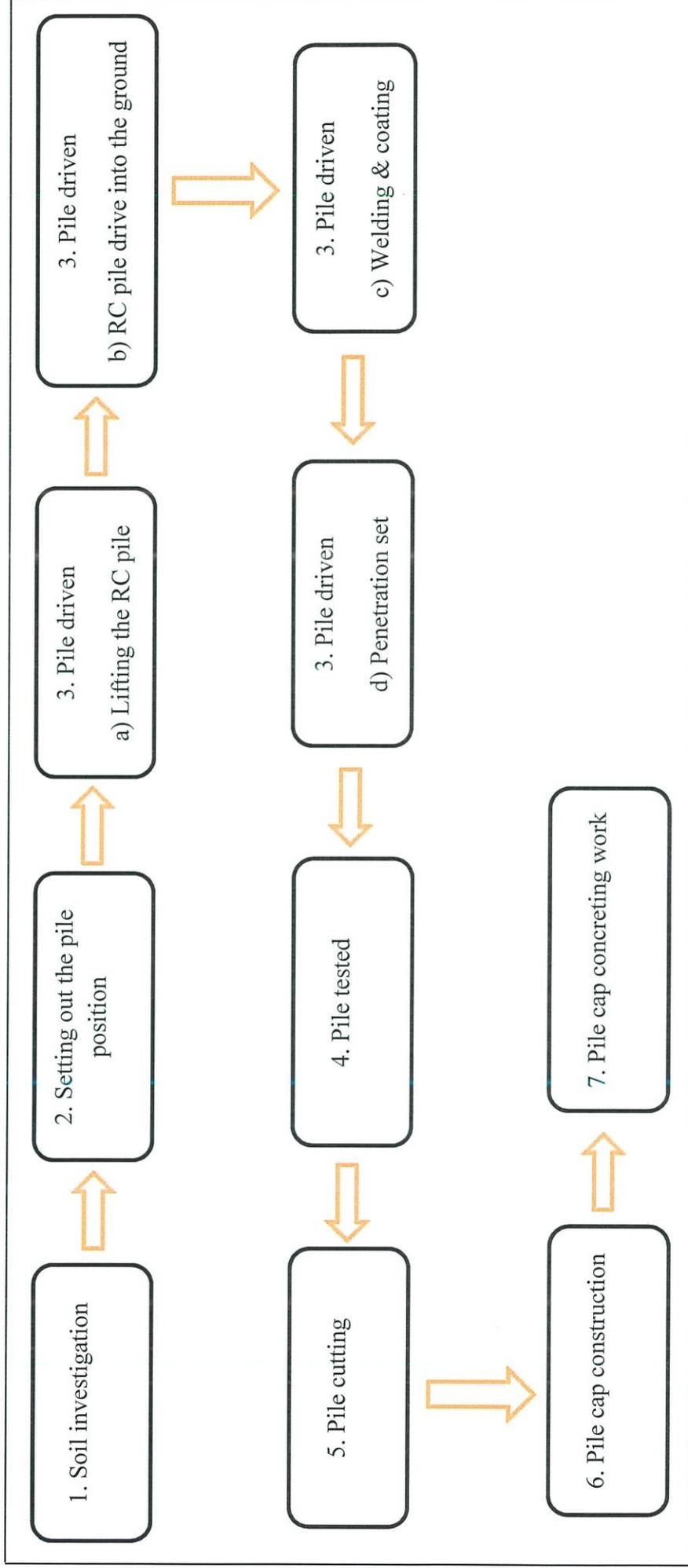
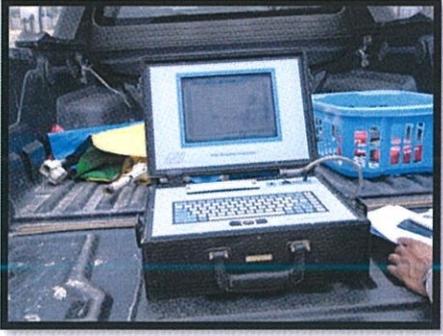


Figure 3.1 Chronology in method of RC pile work

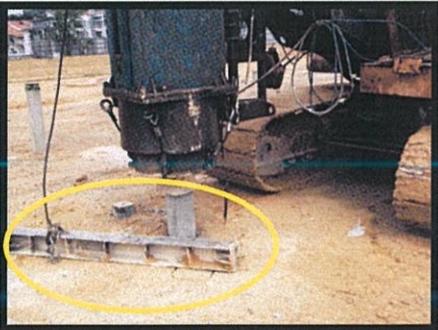
3.5 Types of equipment, materials, plants and machineries used.

3.5.1 Types of equipment and materials used.

Table 3.2 Equipment and material used

No	Photo	Description
1.	<p>Precast concrete pile</p> 	<p>Precast concrete pile is a type of pile used in this project. Sejati Konkrit Sdn. Bhd. as a supplier for precast concrete pile. Each pile consists of 6m length and 3m length.</p>
2.	<p>Pile driving analyser equipment</p>  <p>Sensor reader</p>  <p>Accelerometers & strain transducers</p>	<p>i. Sensor is equipment that read the velocity and load penetration when the pile being attached by accelerometers & strain transducers.</p> <p>ii. Accelerometers & strain transducers attached to side of pile and collect a data obtained when the pile being hammer down then send to sensor.</p>

No	Photo	Description
2.	Pile driving analyser equipment  <p style="text-align: center;">Drill</p>	iii. Drill is used to make a small hole in side of pile for Accelerometers & strain transducers to attach.
3.	Welding equipment 	Welding equipment used to joint between 2 precast concrete piles at the side it attached.
4.	Brush & Weld cat 	A brush used to clean the surface of pile that need to weld before the pile is allowed to welding. A weld cat is applied to the surface of welding pile as a protection to the surfaces.

No	Photo	Description
5.	Pneumatic power cutter 	Pneumatic power cutter used to cut the precast pile to the level of pile cap or to change the damaged pile head.
6.	Hammer and steel cutter blade 	Hammer used to punch down the concrete in piles. Steel cutter blade used as a cutter the reinforcement bar or links inside the piles.
7.	Extension steel pile (Dummy) 	Extension steel pile (Dummy) used to driving the precast concrete pile into the ground when it's no need to add another one pile or when the hammer achieved it limit and unable to go down anymore.

No	Photo	Description
8.	Timber formwork 	A mould use to create a form of pile cap is a timber formwork.

3.5.2 Types of plants and machineries used.

Table 3.3 Plants and machineries used

No	Photo	Description
1.	Hydraulic piling machine 	Hydraulic piling machine is a type of piling machine used in this project to embed the precast concrete piles.
2.	Backhoe 	Backhoe used to excavate a soil in order to construct pile caps.

No	Photo	Description
3.	Batching plant 	<p>Sunway Alam Suria provides no batching plant at site. Therefore, Sunway Alam Suria was order a ready mix concrete from a batching plant near the Jalan Batu Arang. It more economical to ordering a concrete from to own a batching plant in this project.</p>
4.	Lorry concrete 	<p>Lorry concrete carry a ready mix concrete from a batching plant to construction site.</p>
5.	Mobile crane 	<p>Mobile crane use to lifting a concrete bucket when the work of concreting a pile caps. Or to transfer and place reinforcement bar into a pile caps.</p>

No	Photo	Description
6.	Concrete bucket 	During a concreting work, concrete bucket is full with wet concrete and lifting by mobile crane.
7.	Vibrator 	Vibrator used to compact a wet concrete to prevent honeycomb and help to binding the ingredients in a wet concrete.

CHAPTER 4

4.0 CONCLUSION & RECOMMENDATION

As a conclusion of this report about RC pile there a several factor in considering the design and its depth of settlement. After conducting a study on the construction of RC pile work, there a lot of information and knowledge about this system in the construction field. This report conducted at the residential area in Sunway Alam Suria, Shah Alam. Where this project consists of 144 units double storey cluster home and 8 units of double storey semi-detached home. A real view experience gives me an invaluable knowledge about the RC pile works. Begin with setting out up to identifying machineries and equipment needed in RC pile works. During the works, it's involved a lot of process to achieve the successful ending.

All the information and knowledge gained through the interviews, observation, internet and books. Therefore, the construction of RC pile work can be explained in detail herein. Before my life view experience, its look like the construction of RC pile work is not too tough. But after my life view experience, it's truly change my mind set about the construction of RC pile work. Through this study, it clearly adds some knowledge to me about construction of RC pile system. With helps from interviews, internet and books, this report finally properly completed. Based on the information and knowledge gained, stated herein is recommendation about the construction of RC pile to overcome the difficulty occur during the construction. The recommendation is:

From a case study about the work of RC pile, a few aspects need to be highlight is the design of the pile foundation itself. At this Sunway Alam Suria project, the design of pile foundation for 8 units of semi-detached home is about 150 mm x 150 mm size respectively. It the smaller size for a deep foundation. Due to this design, there are many pile that crack when the work of embedded the pile into the ground below. Force an engineer to add another two pile to replaced one damage pile. Recommendation here it's the size of pile supposed to be much bigger than the origin. Size of 200 mm x 200 mm of RC pile is much satisfying.

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APPENDICES

BERAKAN JURUTERA PERUNDING SDN. BHD. (84417-M)
(CHARTERED CIVIL & STRUCTURAL ENGINEERS)

69A, JALAN SS25/2, TAMAN BUKIT EMAS, 47301 PETALING JAYA, SELANGOR.

TEL:

FAX: 03-7803 4796

Project: PHASE 2C & 3 - CADANGAN PEMBANGUNAN 144 UNIT RUMAH BERKELOMPOK DUA TINGKAT DAN 8 UNIT RUMAH BERKEMBAR, DUA UNIT PENCAWANG ELEKTRIK TNB DI ATAS SEBAHAGIAN LOT PT 3789, SUNWAY ALAM SURIA, SEKSYEN U10, 40170 SHAH ALAM, SELANGOR DARUL EHSAN UNTUK TETUAN SUNWAY CITY BHD

Job Ref.: B736 / Phase 2C&3/ SECT2 / E.I. / 5

ENGINEER'S INSTRUCTION NO. 5

To : Sunway Construction SDN BHD
Level 9, Menara Sunway, Jalan Lagoon Timur,
Bandar Sunway, 46150 Petaling Jaya,
Selangor Darul Ehsan.
Tel :
Mr. C C Tan

Date : 16th July 2013

Fax : 019- 3333 460

Instructions constituting a variation is prefixed "V.O.". The contractor must notify the Engineer in writing within 7 days if he considers that any instruction not so prefixed constitutes a variation. The contractor is to acknowledge receipt of this instruction.

SERIAL NO.	STATE IF VARIATION V.O.	INSTRUCTIONS
5	-	<p><u>Driving Unset Additional Piles and Re-drive of false set piles till 24m</u></p> <p>With reference to the above, the previous E.I. No. 4 stated that re-drive of false set pile to be driven by taking last 10 blows till set. However, if the re-drive pile does not set after 10 blows, hence you are required to drive the pile until the penetration length of 24m. This situation also applies for driving additional piles.</p> <p>The above said does not include cracking/slanting pile. Kindly inform us any slanting/cracking piles as we need to redesign the foundation.</p>



MS ISO 9001:2000
 REF: 7.5.1 & 7.5.2

FIELD SHEET FOR DYNAMIC PILE TESTING

DOC. REF :
 TBSB/OPS/PDA

Client Name : Amika Wang Bina Jaya Date : 29/7/13
 Project Name : Phase 3 - 8 unit Semi D - Acah Sini

Test Personnel : MFI Ant
 PDA Equipment Set No: 7 Transducers & Accelerometer Set No: 7

Pile ID	PT 19541	PT 19542	PT 19543	PT 19546	PT 19547
Pile Details	P-278A	P-221A	P-182A	P-64A	P-30
Pile Type	RC	RC	RC	RC	RC
Pile Size (mm)	150x150	150x150	150x150	150x150	150x150
Temporary Casing (m)	-	-	-	-	-
Permanent Casing (m)	-	-	-	-	-
Section Area (cm ²)	225	225	225	225	225
Material Strength (MPa)	45	45	45	45	45
Total Pile Length (m)	21	12	12	18+30	12
Penetration Length (m)	17.5	10.5	10	18	7
Length Below Gauges (m)	18.0	11.0	10.5	18.5	7.5
Pile Make-up (m) [top-btm]	6+3+6+6	6+6	6+6	6+6+6	6+6
Working load (tonne)	15	15	15	15	15
Required Test Load (tonne)	30	30	30	30	30

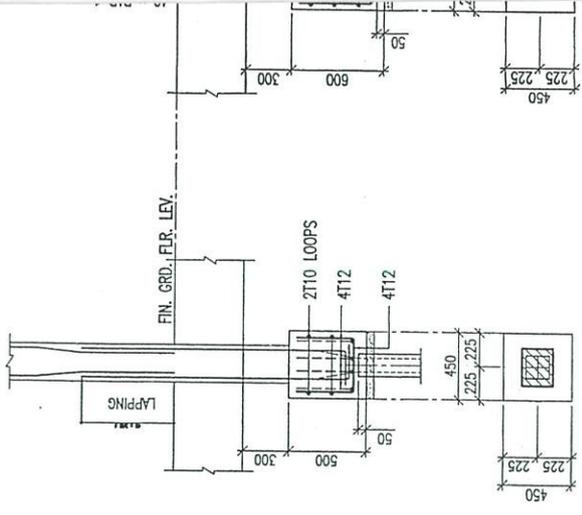
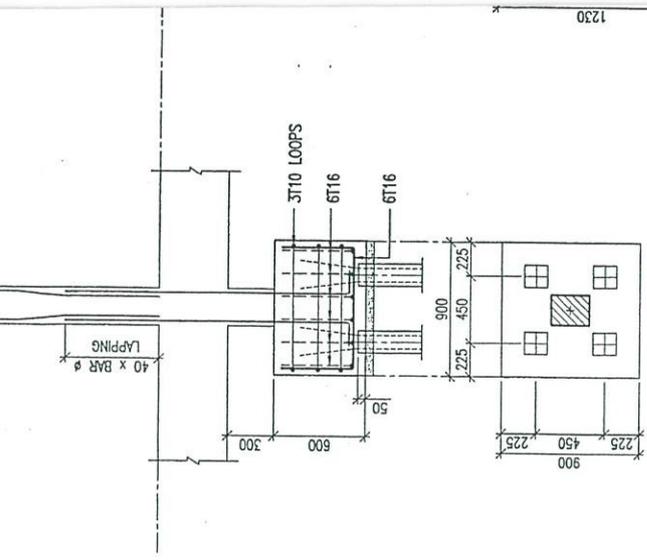
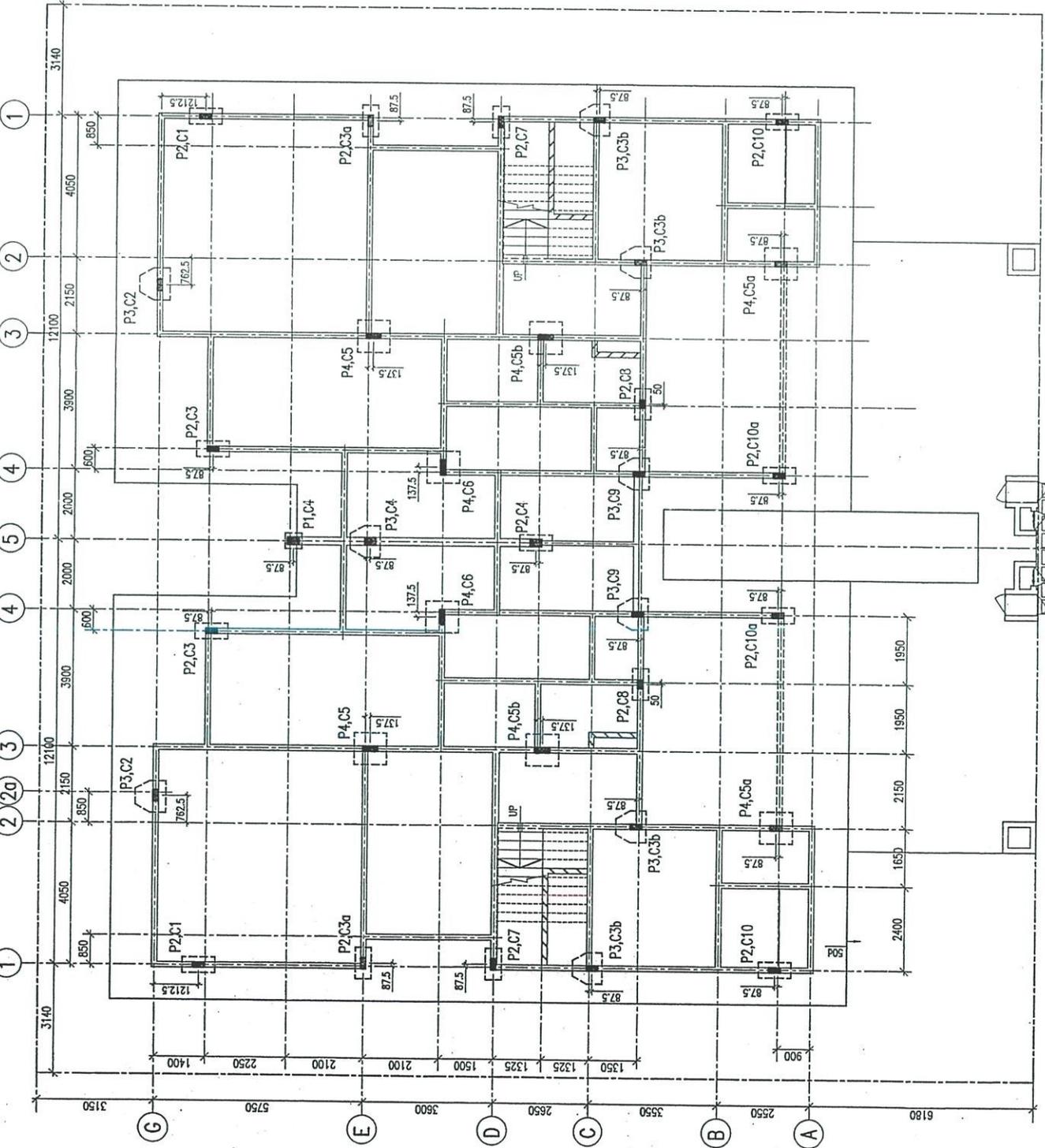
Hammer Details					
Hammer Type	Hyd	Hyd	Hyd	Hyd	Hyd
Ram Weight (tonne)	2.555	2.555	2.555	2.5	2.5
Drop Height (m)	0.2	0.2	0.2	0.2	0.2

Results below are indicative. CAPWAP Analysis required to be carried out on collected wave traces

PDA Field Results					
RMX (tonne)	60	61	63	59	32
RSU (tonne) / RA2 (tonne)	57	43	52	58	26
FMX (tonne)	58	58	61	56	32
CSX (Mpa) / TSX (Mpa)	25.7 / 17.8	25.2 / 14.0	26.7 / 15.0	24.5 / 6.7	14.1 / 8.3
EMX (t-m)	0.57	0.57	0.36	0.41	0.13
Integrity	BT1 90% @ 11.8	100%	100%	100%	69% @ 1.5
BT2					
Supplemental Data					
DFN	1/m / blow	1/m / blow	1/m / blow	1/m / blow	1/m / blow
Wave Speed (m/s)	3800	3800	3800	3800	3800
Density (t/cm ³)	2.45	2.45	2.45	2.45	2.45
Measured Set (mm)	1 blows	1 blows	1 blows	1 blows	1 blows
Date Driven/ Casting	13/7/13	27/7/13	27/7/13	18/7/13	22/7/13

TESTING WITNESSED BY :

Company : Suncity S/B. Company : Suncity Construction S/B
 Name : JAAHAR Name : Kong Kok Meng
 Signature : 29/7/13 Signature : [Signature]



PILECAP LAYOUT PLAN.

