UNIVERSITI TEKNOLOGI MARA

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

SEPTEMBER 2015

It is recommended that the report of this practical training provided

By

NADIATUL NASUHA BINTI M. MAZHAN

2013403562

entitled

Construction of RC Tower For Elevated Water Tank

accepted in partial fulfilment of requirement has for obtaining 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 Pasir Delima Sdn. Bhd. for duration of 5 months starting from 25 May 2015 and ended at 9 October 2015. It is submitted as one of the prerequisite requirements of DBN307 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : Nadiatul Nasuha Binti M. Mazhan

UiTM ID No : 2013403562

Date : 9th October 2015

ACKNOWLEDGEMENT

Alhamdulillah, I would like to devote my gratitude and humble thankfulness to Allah S.W.T. for the accomplishment of this practical training report. The special thanks for all individual with helpful, and give the cooperation for me to complete this report especially to Encik Dzulkarnaen Bin Ismail as a Supervisor Tranining Lecture, Puan Nurul Huda Binti Abdul Hadi as a Visiting Lecturer, Puan Noor Rizallinda Binti Ishak as a Practical Training Coordinator and Dr. Mohd Rofdzi Bin Abdullah as a Faculty Coordinator, Mr. Muhammad Hisyam Gunasekaran Bin Abdullah as a Project Manager of company, Puan Nor Izazi Binti Yunus as a Project Engineer, Encik Mohd Albaihaki Bin Chesoh and Encik Muhamad Bin Harun as a Project Supervisor. Furthermore, I also would like to award the thanks to all my friends and also my family especially to my father, and my mother, because of their understanding and giving me support the encouragement since I start this practical training. The cooperation is much indeed appreciated.

Thank you.

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LIST OF ABBREVIATIONS

UiTM	Universiti Teknologi Mara
PDSB	Pasir Delima Sdn. Bhd.
STSB	Semenanjung Teguh Sdn. Bhd.
CIDB	Construction Industry Development Board
M&E	Mechanical & Electrical
RC	Reinforced Concrete
PDA	Pile Driving Analyzer
DO	Delivery Order
EWT	Elevated Water Tank
RCC	Reinforced Concrete Cement

CHAPTER 1.0

PREFACE

1.1 INTRODUCTION

Elevated water tank is known as a water tower which is mostly divided into two method of construction. Two methods of construction means the differences of the types of material used. The types of material usually used in construction of elevated water tank is steel structures and reinforced concrete structures. Mostly the elevated water tank used reinforced concrete structures instead of steel structures.

Concrete is arguably the most important building material, playing a part in a building structure. Its ability to be molded to take up the shapes required for the various structural forms. It is also very durable and fire resistance when specification and construction procedures are correct. Concrete can be used for all standard buildings both single store, multistory and containment, retaining structures and bridges. (Nik, 2010). Reinforced concrete (RC) is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength and/or ductility. Modern reinforced concrete can contain varied reinforcing materials. In the United States, the most common methods of doing this are known as pre-tensioning and post-tensioning.

R.C.C. beam is subjected to bending moments and shear. The strength is depends on the composite action of concrete and steels. Column is a vertical structural member. It transmits the load from ceiling/roof slab and beam, including its self-weight to the foundation. Columns may be subjected to a pure compressive load. R.C.C. columns are the most widely used now-a-days. (Khan, 2011)

1.2 OBJECTIVES

The objectives of this report are as the following:

1.2.1 To explain the installation of deep foundation for elevated water tank.

1.2.2 To identify the machineries use during construction of elevated water tank.

1.2.3 To study the method construction of RC tower for elevated water tank

1.2.1 To understand the connections of structure on elevated water tank.

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1.2 SCOPE OF STUDY

This report mainly focused on the structure constructed for elevated water tank which is height of 5 levels using concrete structural and use insitu construction that took place at the project "Cadangan membina dan menyiapkan 118 unit rumah teres, 72 unit rumah berkembar, 4 unit rumah berkelompok kluster, 85 unit rumah mampu milik dan 15 unit rumah kedai 2 tingkat". This site is located at Kelulut, Mukim Pulau Kerengga, Kampung Kelulut Daerah Marang, Terengganu and valued about RM 40,000,000.00 for this project size.

Basically , the construction of elevated water tank used reinforced concrete for their structures which is start with piling , and pile cap foundation for the substructures. Then, the superstructures like columns and beam will construct after that. This site use types of insitu construction for the structures which is reinforced concrete structures. The types of water tank is permastore tank which is the size is 12.8m x 4.3m and for the capacity 115,000 gallon.

Consequently, study is concentrated to the construction of the structural for elevated water tank, the structure connections, the method of construction and the machineries used during construction of elevated water tank.

1.3 METHOD OF STUDY

I. Observation

The first method applied on the site is by observation which is to obtain information on the work done at the site. The writer had been observed on how the workers doing the works on installing the components on the building. Through this method, the writer had gain many knowledge and information about this issue and also the method of construction of water tank from started to the end.

II. Interview

The another method that the writer applied during this practical training is interview. The writer had used this method to interview the Project Manager, Mr. Muhammad Hisyam Gunasekaran Bin Abdullah and also the workers there to obtain more information about this case study. This method was used usually by the writer to ask everything that the writer did not understand to the Project Manager.

III. Literature Review

Literature review is published information several mediums of reading materials. The knowledge are taken from collected information from books, magazines, journal or other reading materials. Literature review also gives clear ideas and information as it has been patterned in organized way that acts as a summary. Application of this method commonly applied to discover the uncertain information and where the other methods could not be implemented.

CHAPTER 2.0

COMPANY BACKROUND

2.1 INTRODUCTION OF COMPANY

Pasir Delima Sdn. Bhd. (387843) was incorporated on 18th May 1996 as a Contractor specializing in Building Construction and Civil Engineering works.

The company is capable of undertaking modest to large scale Construction and Maintenance Works as well as offering Engineering Services to both public and private sectors.

The company was formed by professional businessman and supported by a group of experienced in house engineers, skilled and semi-skilled workforce and specialist contractors, all with years of experience in the respective fields of engineering works and a variety of working environment. This strong bond with the supportive groups has created a cohesive and synergized team capable of accomplishing projects in a competitive time period and meet the expectation and demands of clients with works of high standard of finishing which is only possible from a well-organized, properly structured and constructive team works. We are focused and always strive to meet different demands and needs of our clients and always stay competitive and innovative in our core business of building construction and civil engineering works.

2.2 COMPANY PROFILE

COMPANY NAME	:	PASIR DELIMA SDN. BHD.
REGISTRATION NO	:	387843-K
OPERATION DATE	:	18th May 1996
NATURE OF BUSINESS	:	Development & Building Construction
COMPANY'S SECRETARY	:	Aeon Vantage Advisory Sdn. Bhd. No. 1-23ab, Jalan Desa 1/3 Desa Aman Puri, 52100 Kuala Lumpur
BANKERS	:	Ocbc Bank (M) Berhad – Cawangan Kepong Rhb Bank Berhad – Cawangan K.Terengganu Public Bank Berhad – Cawangan Kepong Public Bank Berhad – Kuala Terengganu
HEAD OFFICE	:	No 38-2 Jalan Prima 2 Pusat Niaga Metro Prima Metro Prima, Kepong 52100 Kuala Lumpur.
TEL. NO	:	
FAKS. NO	:	
BRANCH OFFICE	:	Lot P.T. 8215, Tingkat Bawah, Jalan Kuala Berang, Bukit Payung, 21400 Marang, T'ganu Darul Iman.
TEL. NO	:	
FAKS. NO	:	
E-MEL	:	tkp@pasirdelima.com

2.2.1 Mission Statement

Pasir Delima Sdn. Bhd. values the trust that our customers place in us to provide an environmentally safe and secure work place, and profesional and cost-effective solutions to all engineering/construction services requirements. Our people are hired and trained to protect the resources of our clients and enhance the surroundings of those we serve.

a) Operations-goal

To provide our people with the tools needed to execute their responsibilities in an efficient and effective manner in order to bring value to our clients.

b) Management and Personnel-goal

To attract, develop, and retain high performance people with integrity and enable them to achieve their maximum potential while pursuing our Company's mission.

c) Financial-goal

To maintain strong financial systems to meet or exceed commitments to clients and sufficient to sustain the Company with profitable growth and excess to capital.

d) Sales and Marketing-goal

To establish name recognition, corporate image and growth of our business sufficient to create profits, career growth for our people, and increasing shareholder value.

e) Our Mission

To be the leading provider of managed services consistency meeting the different needs of our customers by integrating all efforts and resources productively, thus producing services that are methodical, affordable, hospitable, immaculate and reliable

2.2.2 Corporate Management Committee

Pasir Delima Sdn. Bhd. divided its business operation into several divisions with each division headed by an experienced engineer and supported by a group semi-skilled, professionals, technicians, supervisors and management staff:

- Mr Tan Thiam Choy - Managing Director
- Mr Tan Leong Heng - Director
- Mr Tan Khiam Heng - Director

2.2.3 List of Suppliers

Table 2.1 The List Of Suppliers of Pasir Delima Sdn. Bhd.

No.	Suppliers
1.	Tekun Concrete (M) Sdn. Bhd.
2.	Zulkiffly Bin Abd Ghani (Zu)
3.	GPQ Sdn. Bhd.
4.	Babena Mix Industries Sdn. Bhd.
5.	Yetta Steel Industries Sdn. Bhd.
6.	East Coast Metals Sdn. Bhd.
7.	YTL Cement Marketing Sdn. Bhd.
8.	Perkayuan Sri Indera
9.	Lama Tile (Timur) Sdn. Bhd.
10.	White Horse Ceramic Industries Sdn. Bhd.
11.	E.D. Wood Marketing Sdn. Bhd.
12.	Hap Seng Clay Products Sdn. Bhd.
13.	EPMS Networking (K.Trg) Sdn. Bhd.
14.	Costa Industries (M) Sdn. Bhd.
15.	Kiong Jaya Machinery Trading
16.	HH Landscape & Concrete
17.	UAC Berhad
18.	Perkayuan Sri Iman Sdn. Bhd.
19.	Meng Sin Hoe Glass & Plywood Trading Sdn. Bhd.
20.	Pak Eng Trading
21.	Maju Jaya Hardware
22.	Insamadu Sdn. Bhd.
23.	HomeEver Marketing Sdn. Bhd.
24.	Asia Roofing Industries Sdn. Bhd.
25.	Zulcikun Enterprise
26.	Prudent Method Sdn. Bhd.
27.	Weida Marketing Sdn. Bhd.

28.	R&D Trading
29.	Industrial Concrete Product Sdn. Bhd.
30.	Bee Leong Brickwork Sdn. Bhd.
31.	Teamware Sdn. Bhd.
32.	RK Kuari Sdn. Bhd.
33.	Weng Jaya Machinery Trading

Source: Pasir Delima Sdn. Bhd. (2015)

2.2.4 List Of Machineries

Table 2.2 The List Of Machineries of Pasir Delima Sdn. Bhd

No.	Machineries
1.	Threading Machine
2.	Drill
3.	Grinder
4.	Compressor
5.	Generator
6.	Welding Machine
7.	Pressure Testing Machine
8.	Conduit Bender
9.	Nitrogen Gas Cylinder C/W Regulator
10.	Air Conditioner Gas Regulator
11.	Hot Torch
12.	Vacuum Pump
13.	Air Blower
14.	Weighing Machine
15.	Clam Type Amp-Meter
16.	Water Pressure Pump
17.	Oxygen & Acetylene Gas Welding
18.	Piping Disk Cutter
19.	Scaffolding
20.	Earth Tester

Source: Pasir Delima Sdn. Bhd. (2015)

2.3 ORGANIZATION CHART

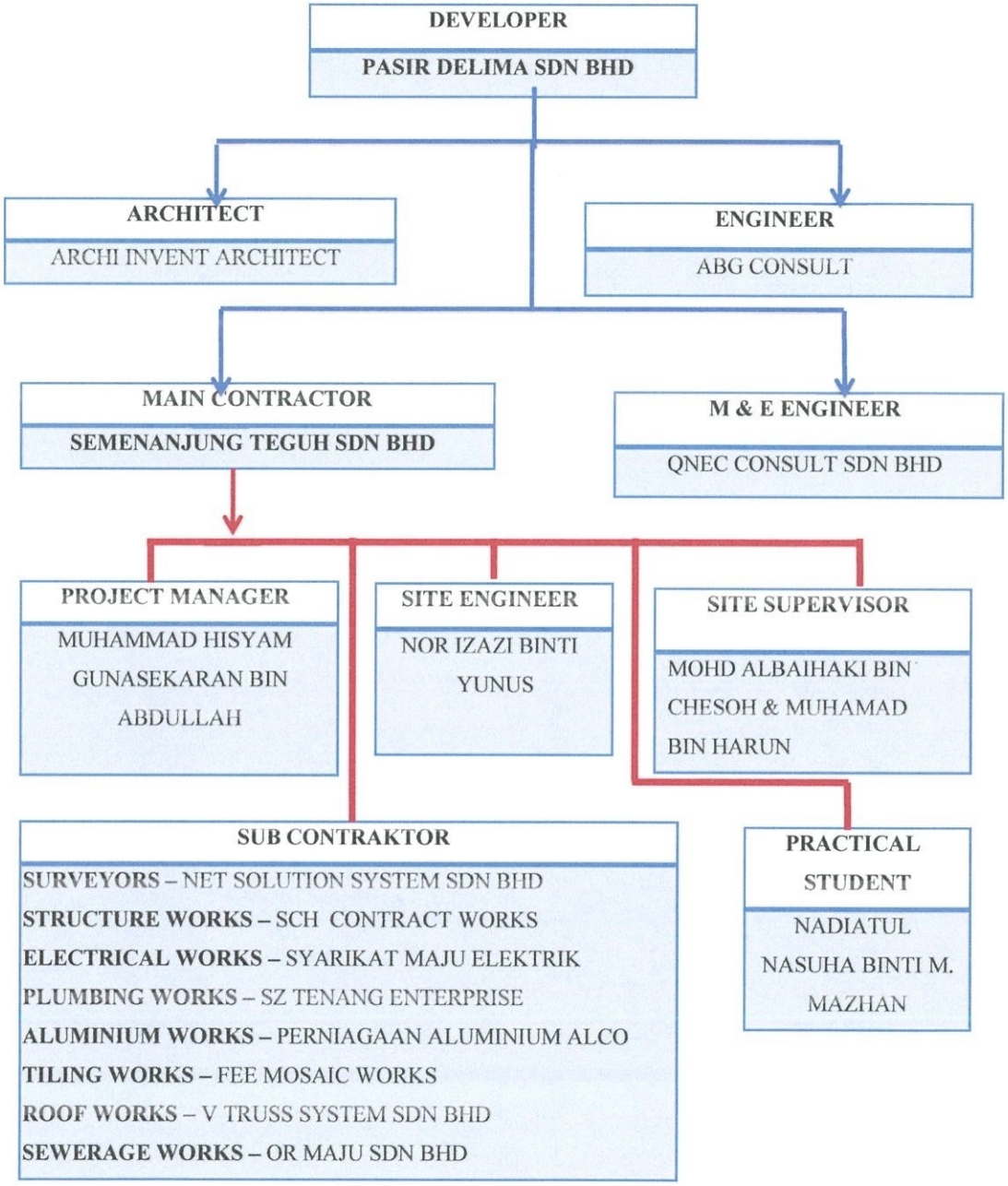

Figure 2.1: Organization chart for Pasir Delima Sdn. Bhd

Source: Pasir Delima Sdn. Bhd. (2015)

2.4 LIST OF PROJECTS

2.4.1 Completed Projects

Table 2.3 The List Of Completed Projects of Pasir Delima Sdn. Bhd.

PROJECT	PERIOD	COMPLETION DATE	CONTRACT AMOUNT
"Cadangan membina dan menyiapkan 1 Blok Bangunan Apartment 11 Tingkat Rumah Guru Seri Seputeh yang mengandungi 80 unit dan kemudahan berkaitan di atas Lot 2302, Seksyen 99, Daerah Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur."	78 weeks	31.10.2011	RM 21,974,725.45
"Membina dan menyiapkan 113 unit Rumah Teres Kos Rendah (RKR) di Kampung Sungai Tong, Daerah Setiu, Terengganu Darul Iman."	78 weeks	10.04.2011	RM 11,500,000.00
"Mereka bentuk, membina dan menyiapkan 2 Blok Pangsapuri Mampu Milik 5 Tingkat (114 unit) serta kerja-kerja yang berkaitan dengannya di kawasan Mengabang Besar Daerah Besut, Terengganu."	2 years	29.02.2012	RM 26,700,000.00

"Cadangan mendirikan 68 unit Rumah Berkembar Setingkat, 46 unit Rumah Berkembar Dua Tingkat, 126 unit Rumah Teres Mampu Milik Setingkat, 97 unit Rumah Teres Kos Sederhana Setingkat, 65 unit Rumah Teres Dua Tingkat di Mukim Binjai, Kemaman, Terengganu Darul Iman." (Building Works)	17 months	28.02.2014	RM 47,527,580

Source: Pasir Delima Sdn. Bhd. (2015)

2.4.2 Project in Progress

Table 2.4 The List Of Projects in Progress of Pasir Delima Sdn. Bhd.

PROJECT	PERIOD	COMPLETION DATE	CONTRACT AMOUNT
"Cadangan membina dan menyiapkan 118 unit rumah teres, 72 unit rumah berkembar, 4 unit rumah berkelompok kluster, 85 unit rumah mampu milik dan 15 unit rumah kedai 2 tingkat di Mukim Pulau Kerengga, Kampung Kelulut Daerah Marang, Terengganu"	3 years	May 2016	RM 40,000,000.00

Source: Pasir Delima Sdn. Bhd. (2015)

CHAPTER 3.0

CONSTRUCTION OF STRUCTURAL FOR ELEVATED WATER TANK

3.1 INTRODUCTION OF PROJECT

Pasir Delima Sdn Bhd current project is "Cadangan membina dan menyiapkan 118 unit rumah teres, 72 unit rumah berkembar, 4 unit rumah berkelompok kluster, 85 unit rumah mampu milik dan 15 unit rumah kedai 2 tingkat". This project cost almost RM 40,000,000.00 and this project involved constructing the elevated water tank of 6 storeys height.

Main parties involved were Pasir Delima Sdn Bhd as the main contractor, ABG Consult Sdn Bhd as the consultant, QMEC Consult Sdn Bhd as the Mechanical and Electrical Engineer and KOPERAT as the client. This project were assisted by Mr. Muhammad Hisyam Gunasekaran Bin Abdullah, the Project Manager, Madam Nor Izazi Binti Yunus as the Site Engineer, and Encik Mohd Albaihaki Bin Chesoh and Encik Muhamad Bin Harun as the Site Supervisor.

The project was expected to complete and handled over on month May 2016 based on the contract.

3.2 CASE STUDY

3.2.1 Method Statement For Piling Works

3.2.1.1 The equipment used for piling works

I. **Hydraulic Hammer** - This is the types of machine usually used for piling works during driven the piles into the ground.

II. **Driving Cap** - Pile head covered while planting a driving cap to absorb some of the blow on it. surface or space between the cap and the head of the pile hooked up with shock absorbing material such as wood, plywood and others. (Bumi Piling Machinery & Supply, 2015)

3.2.1.2 Method of Piling

I. **Chart of Piling Program** - Based on the Main Contractor work programs.

II. **Piling Record** - Every details and data is put into the piling records so that it can be used to process all work demands, orders, turnover and other related matters. (Refer piling record form)

III. **Marking Lines** - Pile marked every feet or meter length from the tip so that it can be read visually for the pile penetration.

IV. **Impact Work** - Pile helmet placed on the ends of the pile and the pile is carried and placed under the ram hammer. Erectness pile on all sides are determined by plumbob. The first pile was hit into the ground and then followed with the next pile. It continues until it reaches the set or specified level

V. **Connection Work** - In this method mild steel plate of both initial and continued piling thick affixed with fillet welding around. (Bumi Piling Machinery & Supply, 2015)

Welding offers a unique and valuable capability to the structural design. It can joint the members of a steel frame as if they were a monolithic whole. Welded connection, properly designed and executed, are stronger than the members they join in resisting both shear and moment forces (Adam, 2009). Often welding and bolting are combined in the same connections to take the advantages of the unique qualities of each.

Electric arc welding is a conceptually simple. An electrical potential is established between the steel pieces to be joined and the metal electrode held either by a machine or a person (Trahair, 2001). When the electrode is held close to the seam between the steel members, a continuous electric arc is established that generate sufficient heat to melt both localized area of the steel members and the tip of the electrode. The molten steel from the electrode merges with that of the members to form a single puddle (Nageim, 2005). The electrode is drawn slowly along the seam, leaving behind a continuous beads of metal that cools and solidifies to form a strong connection between the members. There are several types of welds :

1. Fillet Welds

a) Weld size

Leg length s - The minimum leg length of a fillet weld should not be less than that specified in Table 3.2 and should be able to transmit the calculated stress. For a T-joint the minimum leg length is not required to be greater than the thickness of the thinner part.

Table 3.1 Minimum leg length of a fillet weld

Thickness of the thicker part (mm)	Minimum leg length (for unequal leg weld, the smaller leg length should be considered) (mm)
up to and including 6	3
7 to 13	5
14 to 19	6
over 19	8

Source : http://www.weldingdata.com/fillet_weld_leg_to_throat

For a weld along the edge of a plate:

(i) If the thickness of plate is less than 6 mm, the maximum leg length should be the thickness of the plate.

(ii) If the thickness of the plate is equal to or greater than 6 mm, the maximum leg length should be the thickness of the plate minus 2mm.

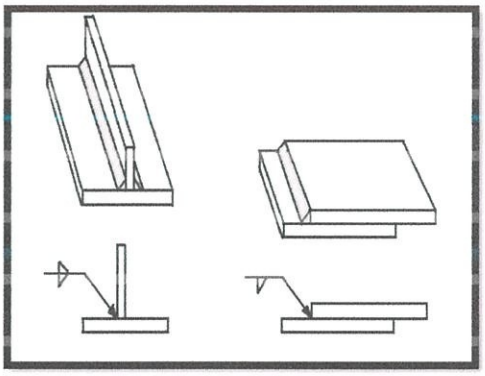

Figure 3.1 Fillet weld notation

Source : Adam (2009)

2. Plug welds

(i) Plug welds are welds that fill up circular or elongated holes. Plug welds should not be used to resist tension and may be used in the following situations:

- to transmit shear on lap joints;
- to prevent buckling or separation of lapped parts; or
- to interconnect the components of built-up members.

(ii) The diameter of a circular hole, or width of an elongated hole, should be at least 8mm larger than the thickness of the element containing the hole.

(iii) The effective shear area of a plug weld can be taken as the nominal area of the hole on the plane of the faying surface.

(iv) The thickness of a plug weld in an element up to 16 mm thickness should be equal to the thickness of the element. In material over 16 mm thick, thickness of a plug weld should be at least half of the thickness of the element but not less than 16 mm.

(v) The minimum center to center spacing of plug welds should be 4 times their diameter but not greater than the distance necessary to prevent local buckling.

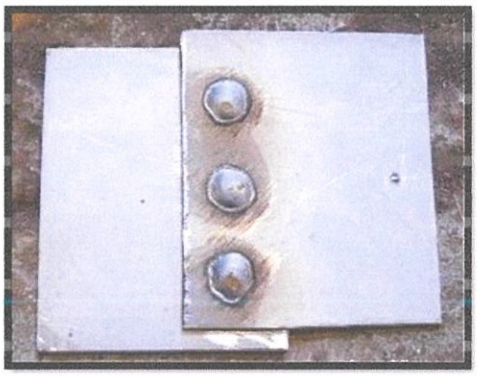

Photo 3.1 Plug weld

Source : http//www.mig-welding.co.uk/plug-weld.htm

3. Slot welds

(i) Slot welds are fillet welds in a slot. Slot welds may be used to transmit shear or to prevent buckling or separation of lapped parts. It should not be used to resist tension.

(ii) The length of the slot should not exceed 10 times the thickness of the weld.

(iii) The width of the slot should not be less than thickness of the element containing it plus 8 mm.

(iv) The ends of the slot should be semi-circular, except for those ends which extend to the edge of the element concerned.

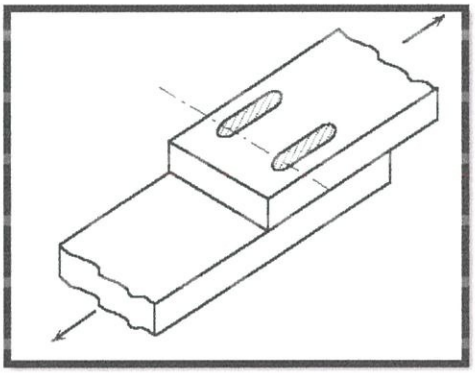

Figure 3.2 Slot weld

Source : Adam (2009)

4. Butt Welds

a) Full penetration welds

The design strength of a full penetration weld, or a butt weld, can be taken as equal to the parent metal if all the following conditions are satisfied:

(i) A full penetration weld should have complete penetration and fusion of weld with parent metal throughout the thickness of the joint.

(ii) Welding consumables should possess mechanical properties not inferior to those specified for the parent metal.

(iii) The backing material should be not inferior to parent material.

The welding of single V, U, J, bevel or square butt welds should follow a proper procedure by depositing a sealing run of weld metal on the back of the joint. When welding is on one side only, facilitating this process by the use of temporary or permanent backing material or by using an approved specialist method without the need of using backing material is acceptable. (Adam, 2009)

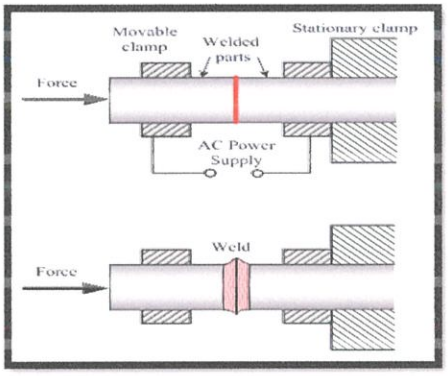

Figure 3.3 Butt weld

Source : http://www.substech.com

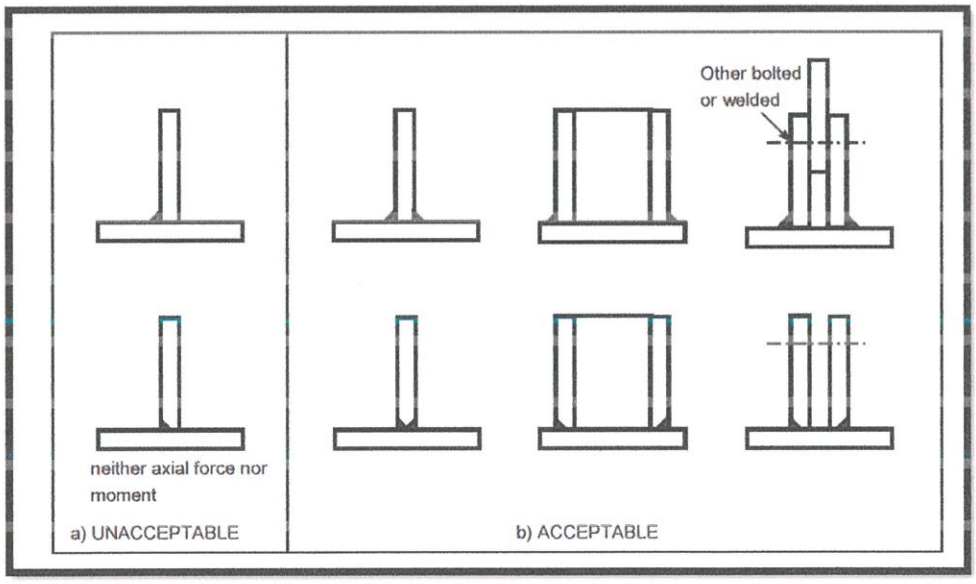

Figure 3.4 Single and double side of butt weld

Source : Adam (2009)

VI. **Taking Set** - Set is the pile penetration calculated for a 10 blows (refer calculation set - Hiley Formula). The method for making set is pencil placed on graph paper, then starting from the left, pencil moved for 10 strokes.

VII. **Cutting off Work** - When piling is completed, the head of the pile to be cut at a level determined by the main contractor or as indicated in the plan

VIII. **Pile Testing** - Pile testing was conducted to test the ability of the piling. Pile elections to be tested is determined by the main contractor. There are two types of pile testing which are :

a) Hydraulic Jack

Enerpas type or power team and deflection gauges (mm/inch size). It is tools that used for carried load test.

b) Pile Driving Analyzer

Pile Driving Analyzer or known as PDA test are more to the use of computer tools such as CAPWAP software. The CAPWAP software are used to analyzed the pile-soil model to determine the activated pile capacity. This test are usually conduct using hammer to provide an impact on to the pile top and measuring the force and velocity signals generated. (Geotech Pile (M) Sdn. Bhd., 2014)

3.2.2 Pile Foundation

Pile foundations means a construction for the foundation of a abutment or pier which is supported on piles. Pile is as like column that is driven into the foundation soil or constructed inside the foundation soil.

Pile foundations used when stratum of required bearing capacity is at greater depth, when the soil is compressible, when the soil water-logged and when the soil is of made-up type. For example piles are used for foundation for heave bridges, for high-rise buildings and for water front installation such as piers, wharf, dorks and others. (Mannan,2015)

3.2.2.1 Types of Piles Based on Function

I. **Bearing Piles**

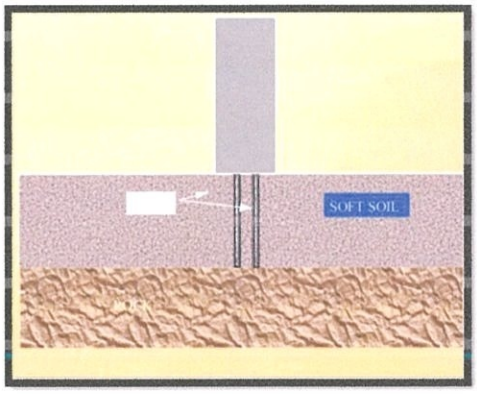

Figure 3.5 The End Bearing Piles
Source: http://www.slideshare.net/

This piles is driven into the ground until a hard stratum is reached. It is acts as pillars supporting the super-structure and transmitting the loads to the ground. (Mannan, 2015). Piles, by themselves do not support the load, rather acts as medium to transmit the load from the foundation to the resisting sub-stratum.

II. Friction Piles

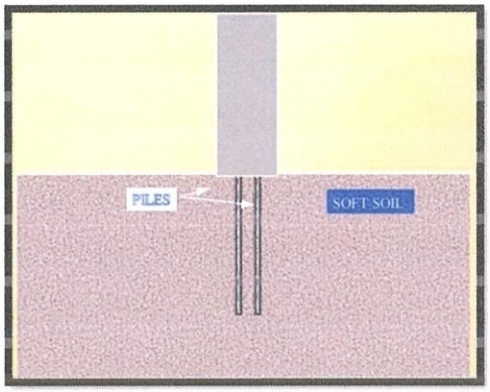

Figure 3.6 The Friction Piles

Source: http://www.slideshare.net/

Piles are driven at the site where soil is weak or soft to a considerable depth and it is not economical or rather possible to rest the bottom end of the on the hard stratum. Load is carried by the friction developed between the side of pile and surrounding ground. The piles are driven up to such a depth that skin friction developed at the sides of the piles equals that load coming on the piles. (Mannan,2015)

Skin friction should be carefully evaluated and suitable factor of safety applied. The load carrying capacity of friction pile can be increased by increasing diameter of the pile, increasing the depth of pile, increasing the number of piles and making surface of the pile rough.

III. Anchor Piles

Piles are used to provide anchorage against horizontal pull from sheet piling wall or other pulling forces.

IV. Batter Piles

Piles are driven at an inclination to resist large horizontal and inclined forces.

V. Fender Piles

Piles are used to protect concrete deck or other water front structures from the abrasion or impact causes from the ships or barges. It is ordinarily made up of timber.

VI. Compaction Piles

When piles are driven in granular soil with the aim of increasing the bearing capacity of the soil, the piles are termed as compaction piles.

VII. Sheet Piles

Sheet piles are never used to provide vertical support but mostly used to act as retaining walls. They are used for the following purposes :

i. To construct retaining walls in docks and other marine works.
ii. To protect erosion of river banks
iii. To retain the sides of foundation trenches
iv. To confine the soil to increase its bearing capacity
v. To protect the foundation of structures from erosion by river or sea.
vi. To isolate foundations from adjacent soils.

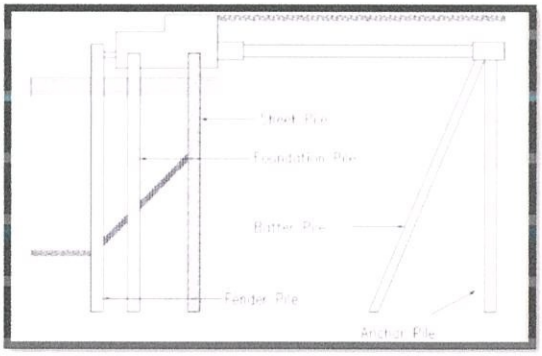

Figure 3.7 The Anchor, Batter, Fender, Compaction and Sheet Piles
Source: http://www.slideshare.net/

3.2.2.3 Types of Piles Based on Materials

I. Timber Piles

To facilitate driving, the lower end is pointed and provided with a cast iron conical shoe. Piles should not be spaced less than 60cm center to center, the best spacing is 90cm center to center. Close spacing destroys frictional resistance. (Smith, n.d.)

The maximum load should not exceed 20 tonnes. Piles are subjected to decay for alternate dry and wet condition. The diameter varies from 30 to 50cm. Length should not be more than 20 times the least sectional dimensions.

Photo 3.2 The timber piles

Source: http://search/AJimage.jhtml?&searchfor=timber+piles&p2

However, there are some advantages and disadvantages using timber piles which are :

Advantages	Disadvantages
i. Economical where timber is easily available.	i. Liable to decay or deteriorate by salts water and insects
ii. Can be driven rapidly & as such saves time	ii. Restricted length.
iii. Elasticity, it is recommended for sites subjected to unusual lateral forces. Examples : ships, ferry, terminal	iii. Low bearing capacity
iv. Do not need heavy machine and expensive technical supervision	iv. Not very durable
v. Being light and easily handled	v. Difficult to drive this piles into hard stratum
vi. Easily withdrawn if needed	

Table 3.2 The Advantages and Disadvantages of Timber Piles

II. Concrete Piles

There are two types of concrete piles which are precast piles and cast in situ piles.

A. Pre-cast piles

It is reinforced concrete piles, molded in circular, square, rectangular or octagonal form. Cast and cured in the casting yard, then transported to the site of driving. If space available it can be cast and cured near the work site. Driven on similar manner as timber piles with the help of piles drivers. Diameter normally varies from 35cm to 65cm, length varies from 4.5m to 30m.

Function of reinforcement in a pre-cast pile is to resist the stresses during handling, driving and final loading on the pile rather than strengthen the pile to act as a column. Longitudinal reinforcements usually 20mm to 50mm to diameter, stirrups 6mm to 10mm in diameter. For 90cm length at head and toe, stirrups spacing is 8cm center to center and for remaining intermediate length it is about 30cm center to center. (Smith, n.d.) concrete cover of 5cm is maintain throughout, over the main steel bars.

Photo 3.3 Precast concrete spun piles

Photo 3.4 Precast concrete square piles

B. Cast in situ piles

Cast in position inside the ground. First of all a bore is dug then the soil from the bore is drawn out. Reinforced cage is placed in and filled with cement concrete.

III. Composition Piles

Piles of two different materials are driven one over the other, so as to enable them to act together to perform the function of single pile. This type of composite pile is used with the object of achieving economy in the cost of piling work.

IV. Steel Piles

Steel piles are of steel section. Useful where driving conditions are difficult and other types of piles are not suitable. Usually used for building and bridge foundations. The piles are in form of I, H sections and steel pipe piles. Steel piles are available in steel H piles, sheet piles, disc piles and screw piles. (Mannan,2015)

Photo 3.5 H steel piles

3.2.2.4 Causes of Failure of Piles

There are some of the causes of failure of piles which are :

a. Load on the pile is more than designed load
b. Defective workmanship during casting on the pile
c. Displacement of reinforcement during casting
d. Bearing pile resting on a soft strata
e. Improper classification of soil
f. Improper choice of the type of pile
g. Insufficient reinforcement in the pile
h. Decay of timber piles due to attack by insects
i. Buckling of piles due to inadequate lateral support
j. Defective method adopted for driving the pile
k. Incorrect assessment of the bearing capacity of the pile
l. Lateral forces not considered in the design of piles (Smith,n.d.)

3.2.2.5 Selection of Type of Pile

The nature on the ground, where piling operation is to be carried out, determines to a large extent the choice of type of pile to be used. In addition, the other important factors which must be considered in this regard are:

a. The nature of the structure
b. Loading conditions
c. Elevation of the ground water level with respect to the pile cap
d. Probable length of the pile required
e. Availability of materials and equipment
f. Factors which may cause deterioration of pile
g. Probable cost of pile (IS: 456-2000)

3.2.3 Machineries and Equipment Used

The machineries and equipment are a common fact that we find a wide variety of construction machines on every construction sites, which make the construction jobs easy, safe and quicker. Depending on the application, construction machines are classified into various categories which are earthmoving equipment, construction vehicles, material handling equipment and construction equipment. There are many types of equipment used for construct elevated water tank which are :

1) Excavators

Excavators are heavy construction equipment consisting of a boom, stick, bucket and cab on a rotating platform (known as the "house"). The house sits atop an undercarriage with tracks or wheels. Excavators are also called diggers. It is used for excavate the soil to the required level of pile cap after piling works done. Moreover, excavators are used in many ways:

i. Digging of trenches, holes, foundations (STSB, 2015)
ii. Material handling
iii. Brush cutting with hydraulic attachments
iv. Forestry work
v. Demolition
vi. General grading/landscaping
vii. Heavy lift, e.g. lifting and placing of pipes
viii. Mining, especially, but not only open-pit mining
ix. River dredging
x. Driving piles, in conjunction with a pile driver

2) Backhoe

A backhoe, also called a rear actor or back actor, is a piece of excavating equipment or digger consisting of a digging bucket on the end of a two- part articulated arm. They are typically mounted on the back of a tractor or front loader.

The section of the arm closest to the vehicle is known as the boom, and the section which carries the bucket is known as the dipper or dipper stick (the terms "boom" and "dipper" having been used previously on steam shovels). The boom is attached to the vehicle through a pivot known as the kingpost, which allows the arm to slew left and right, usually through a total of around 200 degrees. Modern backhoes are powered by hydraulics. (STSB, 2015)

3) Cranes

A crane is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. (Construction Machinery, 2011)

It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a man. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the construction industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment. (STSB, 2015)

4) Concrete Mixer

A concrete mixer (also commonly called a cement mixer) is a device that homogeneously combines cement, aggregate such as sand or gravel, and water to form concrete. A typical concrete mixer uses a revolving drum to mix the components. (STSB, 2015) For smaller volume works portable concrete mixers are often used so that the concrete can be made at the construction site, giving the workers ample time to use the concrete before it hardens.

Special concrete transport trucks (in–transit mixers) are made to transport and mix concrete up to the construction site. They can be charged with dry materials and water, with the mixing occurring during transport.

With this process, the material has already been mixing. The concrete mixing transport truck maintains the materials liquid state through agitation, or turning of the drum, until delivery.

5) Tippers

A truck or lorry the rear platform of which can be raised at the front end to enable the load to be discharged by gravity also called tip truck. (Construction Machinery, 2011)

Tippers are suited for the rough and tumble of mining & quarrying operations, as well as for carrying bulk loads in construction and infrastructure industries. (STSB, 2015). Complete maneuverability, high performance and long-term endurance are common to all trucks, resulting in lower operating costs

6) Compactors

A compactor is a machine or mechanism used to reduce the size of waste material or soil through compaction. In construction, there are three main types of compactor: the plate compactor, the "Jumping Jack" and the road roller. The roller type compactors are used for compacting crushed rock as the base layer underneath concrete or stone foundations or slabs.

The plate compactor has a large vibrating base plate and is suited for creating a level grade, while the jumping jack compactor has a smaller foot. The jumping jack type is mainly used to compact the backfill in narrow trenches for water or gas supply pipes etc. Road rollers may also have vibrating rollers. (STSB, 2015)

3.2.4 Reinforced concrete structure

Reinforced concrete may be the most important material available for construction which is concretes is an artificial stone resulting from hardening of a mixture of a binding material, fine aggregate, coarse aggregate and water in suitable proportions is called concrete. (Tariq, 2010). It is used in one form or another for almost all structures, great or small-buildings, bridges, pavements, dams; retaining walls, tunnels, drainage and irrigation facilities, tanks, and so on. The tremendous success of this universal construction material can be understood quite easily if its numerous advantages are considered. (Kaushal, 2010)

These include the following:

1. It has considerable compressive strength as compared to most other materials.
2. Reinforced concrete has great resistance to the actions of fire and water and, in fact, is the best structural material available for situations where water is present. During fires of average intensity, members with a satisfactory cover of concrete over the reinforcing bars suffer only surface damage without failure.
3. Reinforced concrete structures are very rigid.
4. It is a low-maintenance material. (Nik, 2010)
5. As compared with other materials, it has a very long service life. Under proper conditions, reinforced concrete structures can be used indefinitely without reduce of their load-carrying abilities. This can be explained by the fact that the strength of concrete does not decrease with time.(Usman, 2013)
6. It is usually the only economical material available for footings, basement walls, piers, and similar applications.
7. A special feature of concrete is its ability to be cast into an extraordinary variety of shapes from simple slabs, beams, and columns to great arches and shells.
8. In most areas, concrete takes advantage of inexpensive local materials (sand, gravel, and water) and requires relatively small amounts of cement and rein- forcing steel, which may have to be shipped in from other parts of the country.
9. A lower grade of skilled labor is required for erection as compared to other materials such as structural steel. (Usman, 2013)

10. Strength of concrete is commonly considered its most valuable property, although in many practical cases, other characteristics, such as durability and permeability, may in fact be more important. However, the strength of concrete is almost invariably a vital element of structural design and is specified for compliance purposes. (Kaushal,2010)

The elevated water tank (EWT) in this residential at Taman Koperat Perdana, Marang, Terengganu are mostly used concretes grade 35 for strengthen purposes. This grade of concrete are also used because the structures of this building did not be lay with plaster but nevertheless, the required strength of concrete can be obtained by careful selection of its ingredients, accurate water measurements and adopting good workmanship in mixing, transportation, placing, compaction, finishing and curing of concrete in the construction works.

Besides that, the equipment's usually used in site which also may help for making a good results of the construction structures during concreting process are vibrator poker for compact the concretes, vacuum to minimize the volumes of water in concretes, hand trowel for get a smooth surfaces, concretes bucket to placing concretes and also a mobile cranes for carrying the concretes into the height places.

Photo 3.6 Vibrator poker

Photo 3.7 Concrete bucket

Photo 3.8 Hand trowel

Photo 3.9 Mobile crane

3.2.4.1 Characteristics of good concrete

There are some characteristics of good concretes which may be bring a good result on the construction of the structure :

I. Crushing strength : It should have adequate crushing strength. (Tariq, 2010)

II. Durability : It must be durable enough to resist the effects of weathering agencies.

III. Impermeability : It should have sufficient impermeability or water tightness.

IV. Resistance to abrasion : It should be sufficiently hard and provide enough resistance to abrasion.

V. Resistance to fire : It should have minimum thermal expansion so as to provide good resistance to fire. (Usman, 2013)

VI. Workability: It should have good workability so that it can be readily deposited in position in a uniform layer and also adaptable for ornamental moldings.

VII. Compactness : It must be sufficiently dense. The concrete with greater density will be more compact. (Tariq, 2010)

VIII. Shrinkage : It should have minimum shrinkage when it hardens.

IX. Creep : The continuous strain with time which the concrete undergoes due to application of external load is called creep, time yield or plastic flow., this should be minimum. Economy: It should be economical for the desired strength. (Usman, 2013)

X. Appearance : It should provide the required finish to the concrete structure.

3.3 METHOD STATEMENT

1. Setting Out

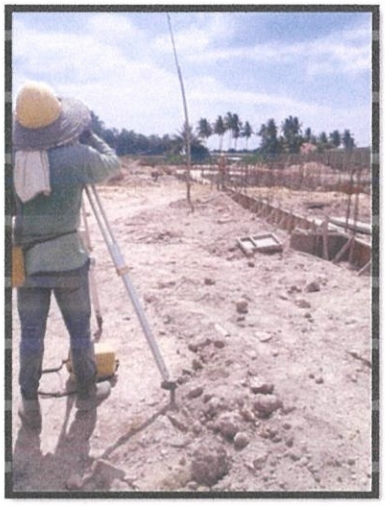

Photo 3.10 Surveying for setting out

The process of obtaining the positions of the structural parts of a building in the geometrical construction. Identify a base line according to the site layout plan. The base line considered as the permanent structures and the relevant distances to structural parts given in the drawing. After established the base line, the main rectangle is set up using the pegs and theodolite.

2. Installation of reinforced concrete piles

2.1 Marking point for piles position

Photo 3.11 Checking the point of piles

The points of each reinforced concrete piles are marked with iron bar after surveying done. The points are marking by the surveyor and the main contractor will make a checking out base on the detail drawing of elevated water tank. The total number of piles used for this building is 112 piles.

2.2 Marking lines for the length of piles

Photo 3.12 Spun piles marked for every feet

Pile marked every feet from the tip so that it can be read visually for the pile penetration. The length of piles used for support load of elevated water tank is 12 meter. The pile type is pre-stressed spun concrete piles with size 250mm diameter as pile details are shown in Table 3.3:

Table 3.3 Pile Details

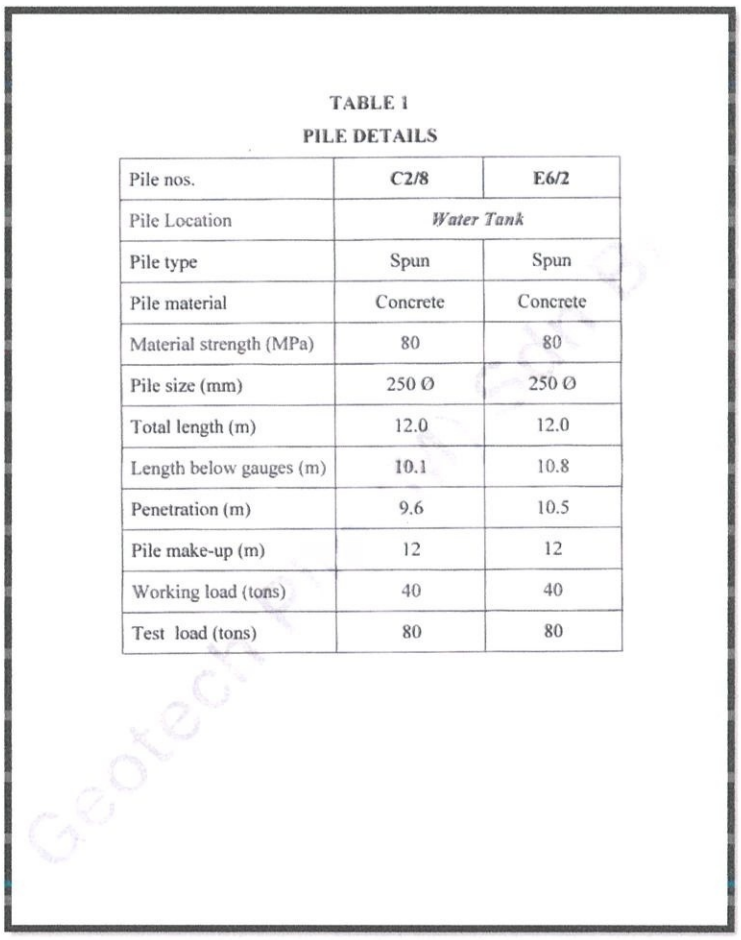

TABLE 1

PILE DETAILS

Pile nos.	C2/8	E6/2
Pile Location	*Water Tank*	
Pile type	Spun	Spun
Pile material	Concrete	Concrete
Material strength (MPa)	80	80
Pile size (mm)	250 Ø	250 Ø
Total length (m)	12.0	12.0
Length below gauges (m)	10.1	10.8
Penetration (m)	9.6	10.5
Pile make-up (m)	12	12
Working load (tons)	40	40
Test load (tons)	80	80

Source: Test Report (High Strain Dynamic Pile Testing), 2015

2.3 The piles driven using hydraulic hammer

Photo 3.13 Hydraulic hammer used for driven piles into ground

Pile helmet placed on the ends of the pile and the pile is carried and placed under the ram hammer. Erectness pile on all sides are determined by plumbob. The first pile was hit into the ground and then followed with the next pile. It continues until it reaches the set or specified level.

The pile is hammered into the ground until it can't be driven into the soil any further. The pile only driven into the soil for less than 25mm depth per 10 blow. The cushion made from plywood placed between the helmet and the pile. The subsoil around the pile shaft is excavated to reduce level for the construction of the pile.

For the important thing of piling works is, every details and data is put into the piling records so that it can be used to process all work demands, orders, turnover and other related matters.

2.4 Pile Driving Analyzer (PDA) test

Photo 3.14 PDA test by Geotech Pile (M) Sdn Bhd using CAPWAP software

Pile Driving Analyzer or known as PDA are tested for the dynamic "high strain" testing of piles involved instrumenting the pile top to obtain dynamic measurements while the pile top was given an impact force from a hammer. Two pairs of strain and accelerometer gauges were attached to opposite sides of the pile, at a minimum of 1.5 times pile diameters below the pile top. These gauges were connected to a Pile Driving Analyzer (PDA) for recording the dynamic signals and field evaluation of data quality, soil resistance and pile integrity.

The dynamic pile testing was conducted on two number of 250mm diameter pre-stressed spun concrete piles type. The dynamic testing was conducted using a 7.0 tons hydraulic hammer to provide an impact on to the pile top and measuring the force and velocity signals generated. Subsequently, the CAPWAP software was used to analyzed the pile-soil model to determine the activated pile capacity.

The CAPWAP analysis results showed that pile nos. Water tank: C2/8 and E6/2 had achieved total capacity of about 114 and 117 tons respectively at the time of testing. Both piles had achieved the required test load of 80 tons (working load = 40 tons) . Details of the results are shown in Table 3.4 and Table 3.5 :

Table 3.4 Summary of Dynamic Testing Field Results

TABLE 2
SUMMARY OF DYNAMIC TESTING FIELD RESULTS

Item	Pile Numbers & (Blow no.)	Pile Location	Maximum Energy Transferred to Pile Head EMX (t•m)	Maximum Measured Pile Top Force FMX (tons)	Maximum Compression Stress at Pile Top CSX (MPa)	Mobilized Capacity By Case Method Jc = 0.5 RMX (tons)	Pile Integrity Evaluation
1	C2/8 (4)	*Water Tank*	0.97	113	33.0	110	Acceptable integrity
2	E6/2 (4)		0.90	125	36.5	108	Acceptable integrity

Table 3.5 Summary of CAPWAP Analysis Results

TABLE 3
SUMMARY OF CAPWAP ANALYSIS RESULTS

Item	Pile Numbers & (Blow no.)	Pile Location	Pile size (mm) & Test Load (tons)	Mobilized Capacity			Pile Top Settlement		Remarks
				Total (tons)	Shaft (tons)	Toe (tons)	@ Working Load (mm)	@ Test Load (mm)	
1	C2/8 (4)	*Water Tank*	250 Ø Spun Pile (80 tons)	113.8	81.4	32.4	2.5	5.4	Test load achieved
2	E6/2 (4)		250 Ø Spun Pile (80 tons)	117.1	83.0	34.1	2.1	4.8	Test load achieved

Source: Test Report (High Strain Dynamic Pile Testing), 2015

2.5 Cutting-off piles

Photo 3.15 Cutting the piles using oxy cutter

Photo 3.16 Completed cutting off piles

The head of the pile to be cut with oxy cutter at a level determined by the main contractor or as indicated in the plan. The cut pile is lifted up and disposed at certain place of the site area. The all piles are done cut for 2 days.

3. Installation of pile cap

Photo 3.17 Erecting formwork for pile cap

Photo 3.18 Installing the reinforced concrete pile cap

Photo 3.19 Fixing pile cap starter bar

Photo 3.20 Placing the reinforced concrete pile cap into the formwork

Photo 3.21 Concreting of pile cap

Photo 3.22 The completed pile cap

Excavation to the required level with open cut slope angle. Blinding layer to foundation level. Erect formwork according to the formwork design. There has 3 types of size which are:

i. P1 for size 1.9m x 2.1m x 0.8m – 6 nos
ii. P2 for size 1.9m x 2.8m x 0.9m – 2 nos
iii. P3 for size 1.9m x 2.8m x 0.9m – 4 nos

Fixing pile cap steel reinforcement or starter bar in pile head to connect to the reinforced concrete pile cap. Then, a reinforced concrete pile cap joints the head of a cluster of piles in order to distribute the load from a column or grade beam equally among the piles.

The reinforced concrete column stump installed and connected to the reinforced concrete pile cap before concreting works for pile cap. Clean up the base before concreting. Concrete discharging point will be established. The pile cap is poured with the ready mixed concrete with grade 35 and for total volume $48m^3$. The volume of concrete for all pile cap was calculated:

i. P1 for size 1.9m x 2.1m x 0.8m x 6 nos = $19.152m^3$
ii. P2 for size 1.9m x 2.8m x 0.9m – 2 nos = $9.576m^3$
iii. P3 for size 1.9m x 2.8m x 0.9m – 4 nos = $19.152m^3$

Sufficient vibrating poker will be used to compact the concrete and hand trowel also will be used to get a smooth surfaces. Next, dismantle the formwork and backfill the pile cap with soil to the required level.

4. Installation of ground beam

Photo 3.23 Setting up the formwork for ground beam

Photo 3.24 The formwork for ground beam being erected

Photo 3.25 Fixing the RC beam into the formwork

Photo 3.26 Concreting the ground beam

Photo 3.27 The completed ground beam

Formwork the ground beam is constructed to create mold for concreting work. The height of formwork is 450mm and 250mm thick of ground beam. However there are two types of length for ground beam which are :

i. Beam A type – 3180mm
ii. Beam B type – 5290mm

The reinforced concrete beam are fixed into the formwork properly with the required size based on the drawing details. The ground beam is then poured with the ready mixed concrete with the grade 35 for strength purpose

as it will support the load above. The total volume for ground beam has been calculated :

i. Beam A type – 3.181m x 0.25m x 0.45m (12 nos) = 4.294m^3
ii. Beam B type – 5.293m x 0.25m x 0.45m (8 nos) = 4.764m^3

The total volume of concrete is 9m^3. The sufficient vibrating poker are used to compact the concrete and hand trowel are also used to get a smooth surfaces. The concrete was then let to dry. Next, the formwork being stripped and dismantled after the concrete was dried.

5. Installation of column stump

Photo 3.28 Setting up the formwork for column stump

Photo 3.29 Erecting the formwork of column stump

Photo 3.30 The column stump poured with concrete

Photo 3.31 The completed column stump

After the formwork for the ground beam dismantled, the formwork for stump being installed on the pile cap with the required size which are the height of column is 2750mm and the size of column is 450mm x 450mm. The stump size shall be appropriate to footing size. The numbers of stump for the elevated water tank is 12.

Then, poured the concrete into the formwork. The concrete used is grade 35 for strength purpose as it will support load above. The total volume of concrete is $7.0m^3$. Then, compact the fresh concrete and did the curing process to avoid evaporation. The compaction of soil is done after the formwork of the stump being dismantled.

6. Installation of first floor RC beam

Photo 3.32 The formwork of first floor beam being installed on the columns

Photo 3.33 The completed formwork for first floor beam

Photo 3.34 Placing the reinforced concrete beam (RC beam)

Photo 3.35 The completed of first floor beam

After the formwork for the column stump dismantled, the formwork for first floor beam being installed on the column stump with the required size which are the height of beam is 450mm and the thickness of beam is 250mm size . The beam size shall be appropriate to the ground beam and stump size.

Then, poured the concrete into the formwork. The total volume of concrete is $8.0m^3$. Then, compact the fresh concrete which used grade 35 for strength purpose as it will support the load above . Hand trowel used to get a smooth surfaces and the vibrator poker also used to compact the concrete. Then the formwork being dismantled.

7. Installation of first floor RC columns

Photo 3.36 Fixing the RC columns

Photo 3.37 The formwork being erected

After the formwork for the first floor beam dismantled, the formwork for first floor columns being installed on the pile cap with the required size which are the height of column is 2750mm and the size of column is 450mm x 450mm. The stump size shall be appropriate to footing size. The numbers of stump for the elevated water tank is 12.

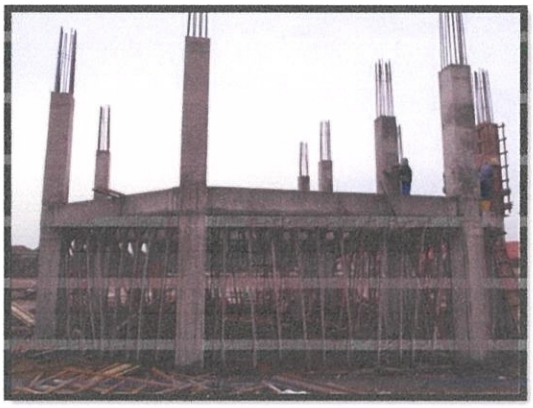

Photo 3.38 The completed of first floor columns

Then, poured the concrete into the formwork. The total volume of concrete is 7.0$m^{3.}$ Then, compact the fresh concrete which used grade 35 for strength purpose as it will support the load above . Hand trowel used to get a smooth surfaces and the vibrator poker also used to compact the concrete. Then the formwork being dismantled.

8. Installation of RC staircases

Photo 3.39 Formwork for landing being fixed

Photo 3.40 Formwork for staircases being erected

Photo 3.41 RC staircases ready for concrete

Photo 3.42 The completed RC staircases

Marked the position of the staircase to be install for first floor of EWT. Measure and confirmed the numbers of staircases, the length of tread and the height of riser and also the slope angle of the stairs. The number of rungs is 19, the size used for tread is 240mm, the riser is 160mm. Install reinforcement bars staircases and erect the formworks for the tread and riser size. Check the slope angle of the stairs for angle 35 degree pitch.

Then, the fresh concrete poured into the formworks. The concrete used is grade 35 for volume $3.0m^3$. The concrete was then let to dry. After the concrete were completely dry, the workers dismantle the formwork.

CHAPTER 4.0

CONCLUSION AND RECOMMENDATION

4.1 SUMMARY OF CONCLUSION

Structures for construct elevated water tank (EWT) is a practical, there are many of structures use for construct this type of buildings such as piles, pad footings for their substructure, then for their superstructure are reinforced concrete column stump, reinforced concrete beam and also reinforced concrete staircases. There are also more advantages using the reinforced concrete structures compared to the steel structure such as crushing strength, durability, impermeability, resistance to abrasion, resistance to fire, workability, compactness, shrinkage, creep, appearance. The builders nowadays prefer to use the concrete structure in the construction as it can more cheap and long lasting compared to the steel structures.

The objectives of this report have been fulfilled. As a conclusion, the writer gets to know more about the structures for construct elevated water tank including the installation, components used, the machineries used, connection between structures to another structures and also the advantages of this construction.

4.2 RECOMMENDATION AND IMPROVEMENT

There are some recommendation for the project to improve the quality of construction.

1) The working space at the site area was limited and it was difficult to make the construction being smooth and also the unplanned work schedule, so the project manager have to pay more attention about the arrangement of the work schedule and the working space to be more wisely to make the construction flow smoothly without any interruption or obstacle.

2) The suppliers of the materials should be responsible to deliver the enough materials as ordered and should be on the time. Sometimes the suppliers were sending the wrong materials and this make the construction flow slowly and did not follow the work schedule as planned.

3) The land surveyor should be leveled the workplace correctly to avoid the building be slanting as it was the problems that always occurred on the buildings.

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APPENDICES

GEOTECH PILE (M) SDN BHD (Company No. 777247-T)
35-2B, 1ST Floor, Sunway Mas Commercial Centre,
Jalan PJU 1/3C, 47301 Petaling Jaya, Selangor D.E

FIELD SHEET FOR DYNAMIC PILE TESTING

Project Location	KELULUT, MARANG
Date of Test	1/6/2015

PILE AND HAMMER DETAILS *(Based On Information Obtain at Project Site)*

Pile ID/Reference		C2/8	E6/2			
Pile Location		WATER TANK				
Pile Type		SPUN	SPUN			
Pile Material		CONCRETE	CONCRETE			
Material Strength (MPa)		80	80			
Pile Size (mm)		250ø	250ø			
Pile Area (cm^2)		337	337			
Total Length (m)		12.0	12.0			
Length Below Gauges (m)		10.1	10.8			
Penetration (m) after excavation *		9.6	10.5*			
Pile Make-Up (m)		12	12			
Working Load (tons)		40	40			
Test Load (tons)		80	80			
Hammer Type		HYD	HYD			
Ram Weight (tons)		7.0	7.0			
Drop Height (m)		0.14	0.14			
Pile Driven Date						
Type of Testing (Please tick)	*Restrike*	/	/			
	End of Drive					
	Monitoring					

SUPPLEMENTAL DATA

Specific Weight Density (t/m^3)	2.60	2.60			
Wave Speed (m/s)	4400	4400			
Remarks					

RESULTS OBTAINED *(Subjected to Final CAPWAP Analysis)*

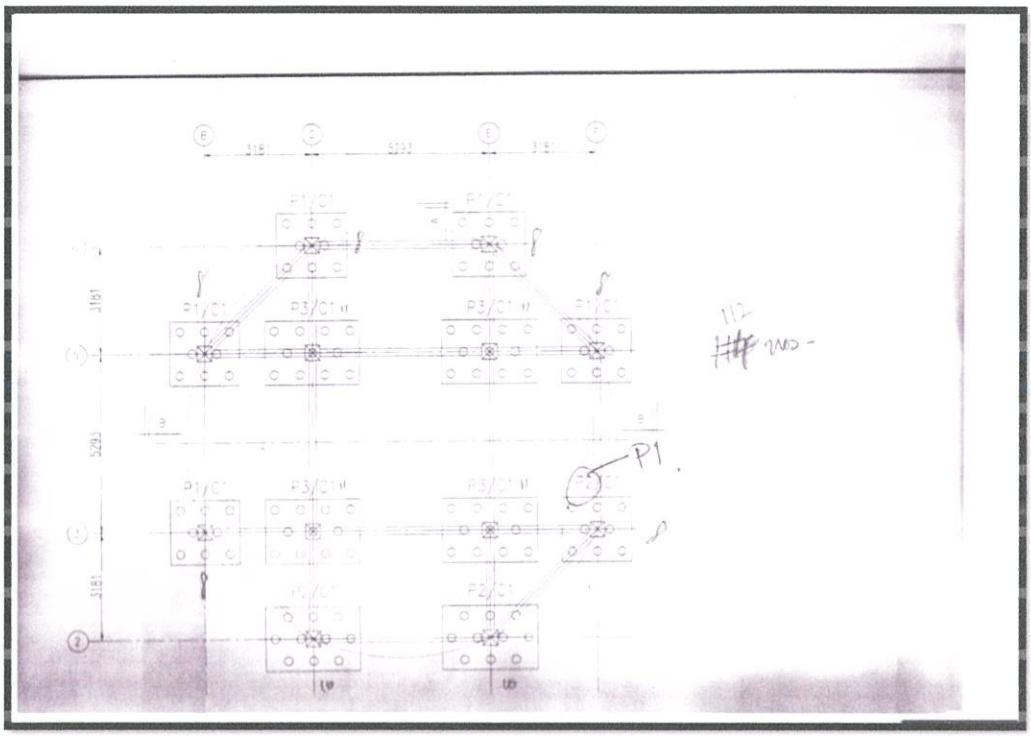
Blows No.					
RMX (tons)	109	108			
FMX (tons)					
CSX (t/m^2)					
EMX (t-m)					
BTA (%)					

Test Personnel	Client / Consultant
Main Contractor	**Piling Contractor**

Note: BTA - Pile Integrity, RMX - Max. Resistance, FMX - Max. Force, CSX - Max. Stress, EMX - Max. Energy At Pile Top

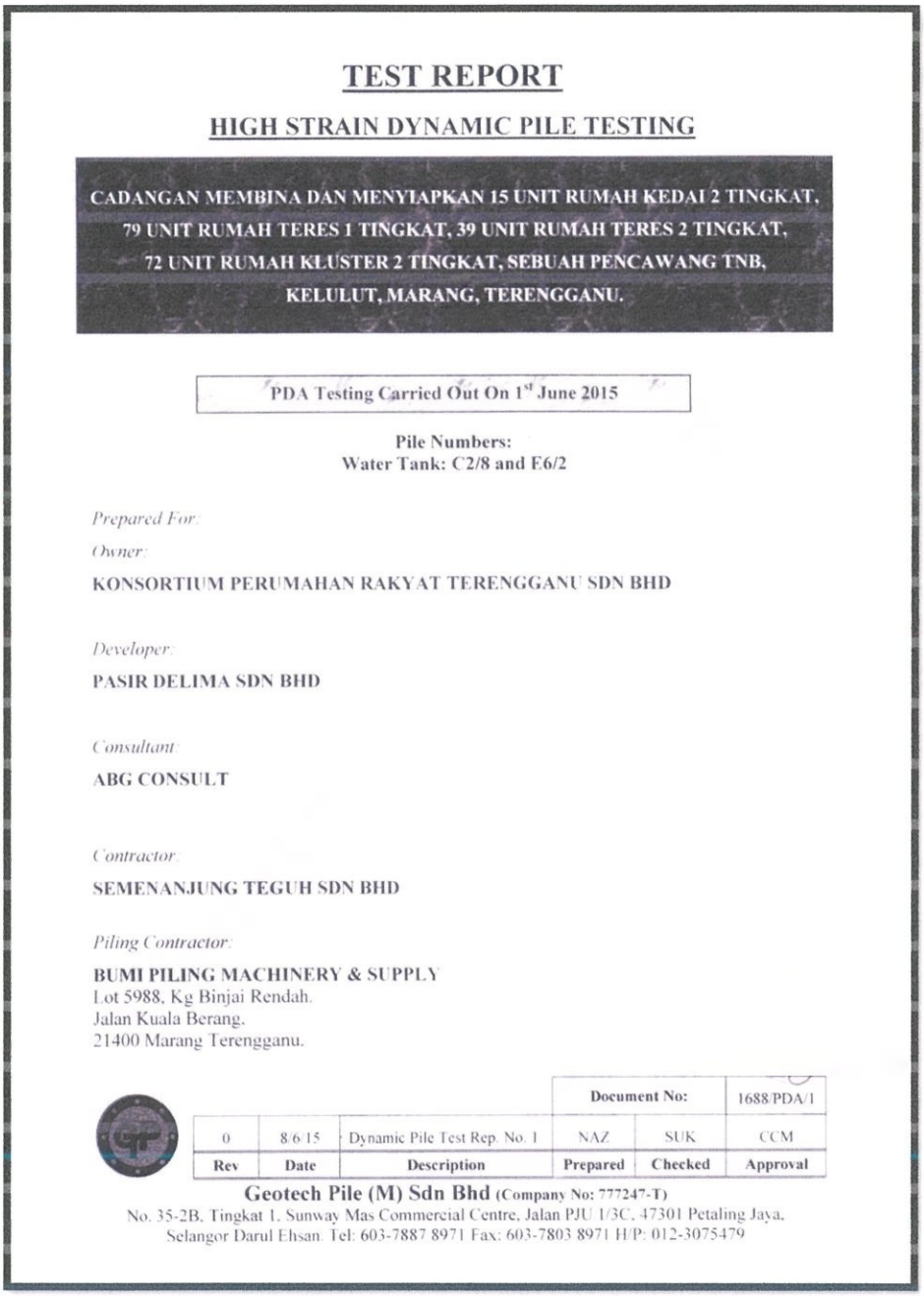
Appendix 1 : Result for Pile Driving Analyzer (PDA) test

Source : Semenanjung Teguh Sdn. Bhd. (2015)



Appendix 2 : Detail layout for points of piles

Source : Semenanjung Teguh Sdn. Bhd. (2015)



TEST REPORT

HIGH STRAIN DYNAMIC PILE TESTING

CADANGAN MEMBINA DAN MENYIAPKAN 15 UNIT RUMAH KEDAI 2 TINGKAT, 79 UNIT RUMAH TERES 1 TINGKAT, 39 UNIT RUMAH TERES 2 TINGKAT, 72 UNIT RUMAH KLUSTER 2 TINGKAT, SEBUAH PENCAWANG TNB, KELULUT, MARANG, TERENGGANU.

PDA Testing Carried Out On 1st June 2015

Pile Numbers:
Water Tank: C2/8 and E6/2

Prepared For:

Owner:

KONSORTIUM PERUMAHAN RAKYAT TERENGGANU SDN BHD

Developer:

PASIR DELIMA SDN BHD

Consultant:

ABG CONSULT

Contractor:

SEMENANJUNG TEGUH SDN BHD

Piling Contractor:

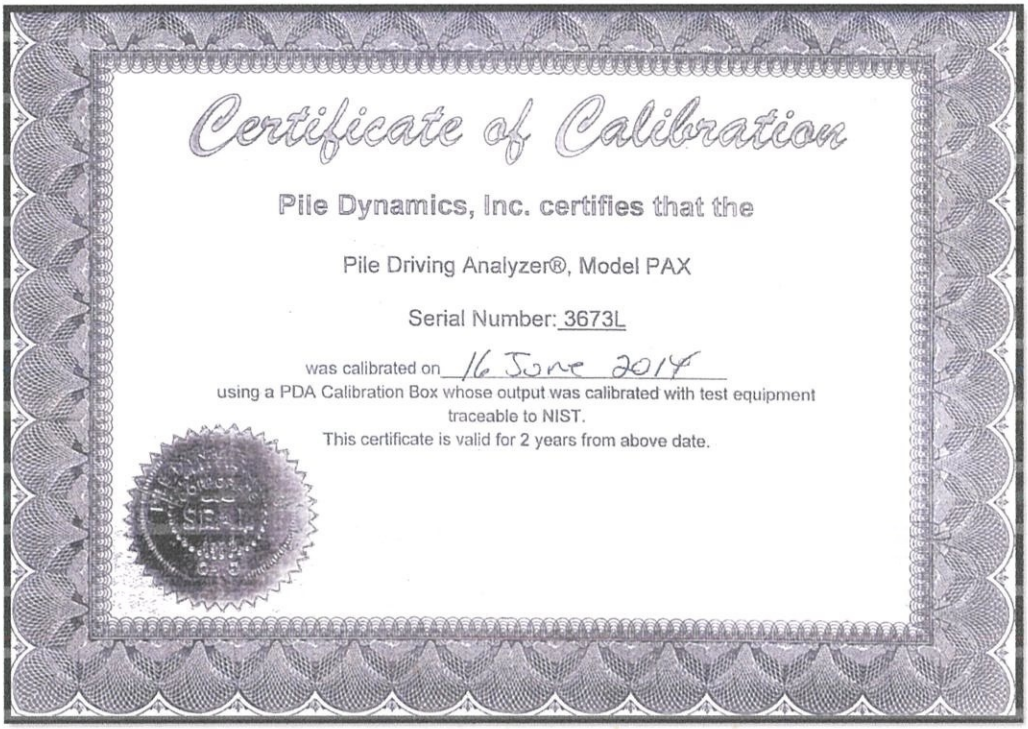
BUMI PILING MACHINERY & SUPPLY
Lot 5988, Kg Binjai Rendah.
Jalan Kuala Berang.
21400 Marang Terengganu.

			Document No:		1688/PDA/1
0	8/6/15	Dynamic Pile Test Rep. No. 1	NAZ	SUK	CCM
Rev	**Date**	**Description**	**Prepared**	**Checked**	**Approval**

Geotech Pile (M) Sdn Bhd (Company No: 777247-T)
No. 35-2B, Tingkat 1, Sunway Mas Commercial Centre, Jalan PJU 1/3C, 47301 Petaling Jaya, Selangor Darul Ehsan. Tel: 603-7887 8971 Fax: 603-7803 8971 H/P: 012-3075479

Appendix 3 : Test Report (High Strain Dynamic Pile Testing)

Source : Semenanjung Teguh Sdn. Bhd. (2015)



Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model PAX

Serial Number: 3673L

was calibrated on 16 June 2014

using a PDA Calibration Box whose output was calibrated with test equipment traceable to NIST.

This certificate is valid for 2 years from above date.

Appendix 4 : Equipment Certificates

Source : Semenanjung Teguh Sdn. Bhd. (2015)