DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

METHOD OF PILING AND PILECAP WORKS ON RECLAMATION LAND

Prepared by:

NUR HAKIMAH BINTI FAZIL

2019239172

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

10 JANUARY 2022

It is recommended that the report of this practical training provided

By

NUE HAKIMAH BINTI FAZIL

2019239172

Entitled

METHOD OF PILING AND PILECAP WORKS ON RECLAMATION LAND

Be accepted in partial fulfillment of requirement has for obtaining Diploma in Building.

Report Supervisor : _____
Cik Nor Azizah Binti Talkis

Practical Training Coordinator : _____
Dr. Nor Asma Hafizah Binti Hadzaman

Programme Coordinator : _____
Dr. Dzulkarnaen Bin Ismail.

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10 JANUARY 2022

STUDENT'S DECLARATION

I hereby to declare that this report is my own work, except for extract and summaries for which the original references stated here in, prepared during a practical training session that I underwent at Kerjaya Prospek Sdn Bhd for duration of 20 weeks starting from 23 August 2021 until 7 January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

…….

Name : NUR HAKIMAH BINTI FAZIL

UiTM ID No : 2019239172

Date : 10 JANUARY 2022

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I'm deeply grateful to company Kerjaya Prospek Sdn Bhd to accept me during my training period from 23 August 2021 till 7 January 2022 in Penang branch.

I would like to extend my grateful to my supervisor, Ms Fatima Izzaati Binti Mohd Fadzil for her guidance, patience and advice throughout along my training period. I would like to thanks to Mr Abdul Muthalib Bin Abdul Kadir, Mr, Mohamad Nurfahmi Bin Kamaruzaman and Mr. Ikmal Shafik Bin Jamaludin have enabled me to learn and fevelop my understanding, knowledge and feel a real time projects and actual works on site construction. I'm indebted to Dr Tee Eng Han for the opportunity given, to conduct my training in his company.

I'm much obliged to all of my friends and all UiTM lecturers that have taught and nurtured me in becoming a better student and person. I would like to extend my deepest appreciation to Dr. Hayroman Bin Ahmad as my report supervisor, Cik Nor Azizah Binti Talkis, Supervising Lecturer, Dr. Nor Asma Hafizah Binti Hadzaman, Practical Training Coordinator and Dr. Dzulkarnaean Bin Ismail, Programme Coordinator to guide me to complete my training, this report and valuable knowledge that have been shared over the last few semesters.

Last but not least, my special thanks to my beloved parents and family for their sacrifice over the years.

Thank you.

ABSTRACT

This report is about the method of piling and pile cap works on reclamation land especially for high rise building. The aim for this is to know the method of piling works. Other than that is to learn the effectiveness to build high rise building on reclamation land. Main objectives for this report is to know the solution for pile that have issue and method of piling and pile cap. Pile Driving Analyzer (PDA) Restrike is one of the method of testing the pile. In conclusion, get to gain new knowledge about the foundation works on the reclamation land.

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CHAPTER 1.0

INTRODUCTION

1.1 Background of Study

As is known in Malaysia there are 3 types of pile that already widely used, driven precast reinforced concrete square piles, bored piles and micro piles. Other than that, other type of pile that used is spun pile. Spun pile in one of the most widely for high-rise building, bridge and wharf foundation. Spun pile is circular precast prestressed pile with hollow inside. It need special attention since it has limited areas compared to other pile such as bored pile.

The high strength prestressed spun concrete piles, commonly driven with hydraulic impact hammers or installed with jacked -in rigs. These piles are widely used in foundation for schools, high-rise buildings, factories, ports, bridges and power plant. Other than that every pile that have done the piling work need to do the Pile Driving Analyzer (PDA) to make sure the pile in a good condition.

1.2 OBJECTIVES

There are 3 objectives on this report:

a) To describe the type of pile use in construction site
b) To analyze the pile using Pile Driving Analyzer (PDA)
c) To understand on how to do pile cap detail after piling works done

1.3 SCOPE OF STUDY

The scope of study only focused is correspondence for site work on piling project. Need to keep up to date with the architect and consultant the latest drawing and detail to send to site workers for "CADANGAN MENDIRIKAN PEMBANGUNAN PANGSAPURI PERKHIDMATAN 35 TINGKAT YANG TERDIRI DARI:

A) FASA 1:

i) 1 TINGKAT TEMPAT LETAK KERETA DI ARAS BAWAH TANAH (BASMEN).

ii) 2 TINGKAT RUANG KEDAI (ANGILARI) DI ARAS BAWAH DAN ARAS 1.

iii) 4 TINGKAT TEMPAT LETAK KERETA DI ARAS BAWAH, 1, 2 & 3.

iv) 1 TINGKAT RUANG KEMUDAHAN DI ARAS 4.

v) MENARA B – SATU BLOK PANGSAPURI PERKHIDMATAN 31 TINGKAT (580) (ARAS 4 – 34) DAN KEMUDAHAN RUANG DI ARAS 34.

B) FASA 2:

v) MENARA A – SATU BLOK PANGSAPURI PERKHIDMATAN 24 TINGKAT (440) (ARAS 4 – 27) DAN RUANG KEMUDAHAN DI ARAS 27 DI ATAS PLOT B (SEBAHAGIAN LOT PT16) KAWASAN TEBUS TANAH SERI TANJUNG PINANG (FASA 2A) DAERAH TIMUR LAUT, PULAU PINANG. UNTUK TETUAN PERSADA MENTARI SDB BHD.

1.4 Method of Study

There are a few methods of study that being used in this study. There are 3 methods of study which is observation, Interviews, and document review.

a. Observation method

The observation method are use to observing the supervisor to submit the correspondence and update the progress work in site and practically help to complete the work and progress work every week. For example, updating the piling done to Microsoft Excel.

b. Interviews

The interview method use to interview the staff or the Project Manager about the related project such as piling method and how to solve the issue on site.

c. Document Review

Document review is refer to construction drawing and keep updating the latest drawing from the architect and consultant. Read the document that been submitted from the email.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company

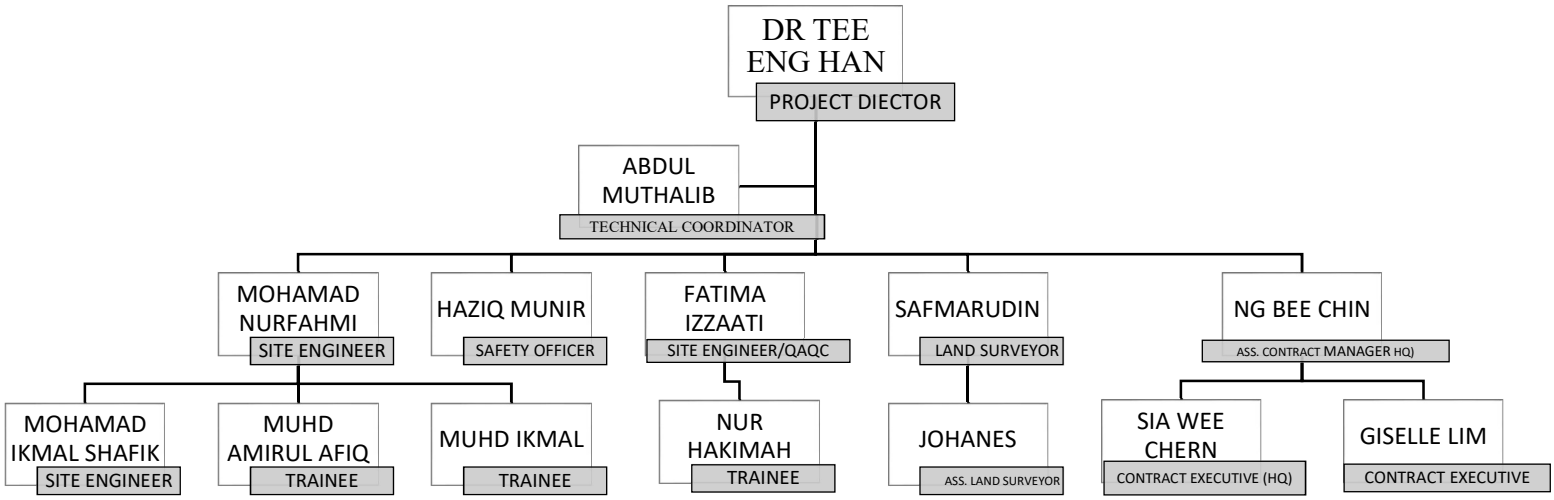
Kerjaya Prospek Group Berhad ("Kerjaya" or "The Group"), formerly known as Fututech Berhad, made its debut on the Main Market of Bursa Malaysia Securities Berhad in 1996. The Group is principally involved in construction of high-end commercial and high-rise residential buildings, property development and manufacturing of lighting and kitchen solutions. The Group improved its track record significantly throughout the years and currently owns a portfolio of various completed and ongoing construction projects. In year 2018, Kerjaya has made its mark as No. 4 biggest construction counter in Bursa Saham Malaysia. Kerjaya Prospek is a Grade 7 contractor registered with the Construction Industry Development Board (CIDB). With this category of grading, it allows Kerjaya Prospek to tender and manage a wide spectrum of contracts in the market with unlimited value. The Group has also been awarded the ISO 9001:2000 Quality Management Systems Certification by UKAS and SIRIM QAS 2008. Acknowledging that there is on-going material and technological advancements in the industry. The Group always noted engineering and value-added design as key components to the services. Most of the construction projects were awarded by blue-chip clientele, amongst others, Eastern & Oriental Berhad, SP Setia Berhad, Eco World Development Group Berhad and many more. In 2014, Kerjaya Prospek (M) Sdn. Bhd. Made a new record in building the tallest building in Malacca – The Shore @ Malacca River, which was awarded with the Best Commercial Landscape Architecture Award Malaysia 2015 – 2016 at the prestigious Asia Pacific Property Award. Moving forth, The Group plans to further develop and expand its construction segment with capabilities in piling and reclamation projects. The Management believes that this will further enhance the Groups's competitive edge within the industry as we continue to grow and strive towards our mission as a top industry player.

2.2 Company Profile

Company Name	**:** KERJAYA PROSPEK (M) SDN BHD
Address	**:** No 1 Jalan Wangsa Permai, 3rd Floor, Bangunan One Wangsa, Taman Wangsa Permai, 52200 Kuala Lumpur
Tel No	**:** 03-62775192
Fax No	**:** 03-62775443 / 5772
Email	**:** kerjayaprospek@yahoo.com
Company Reg. No	**:** 35407 – U
CIDB Grade	**:** Grade 7
Website	**:** www.kerjayagroup.com

2.3 Company Organization Chart

This organization chart show one of the project in Tanjong Tokong, Penang. Dr Tee Eng Han is Project Director for all project in Penang including 9 projects in Tanjong Tokong, Penang 3 projects in Batu Kawan, Penang 1 project in Batu Uban, Penang and 1 project in Georgetown, Penang. Total for all ongoing projects in Penang is 14 project. En. Muthalib Bin Abdul Kadir is as Technical Coordinator for this project and Ms. Fatima Izzaati Binti Mohd Fadzil as QAQC Site Engineer.



2.4 List of Projects

2.4.1 Completed Projects

No.	Project Title	Completion Date	Client
1.	Eco Terraces@ Paya Terubung	June 2019	Eco Terraces Dev Sdn Bhd
2.	The Tamarind Executive Apartments@ Seri Tanjung Pinang	June 2019	E&O Property (Penang) Sdn Bhd
3.	Ariza Seafront@ Seri Tanjung Pinang	May 2019	E&O Property (Penang) Sdn Bhd
4.	Andaman at Quayside @ Seri Tanjung Penang	January 2015	E&O Property (Penang) Sdn Bhd
5.	The Parque Residences	April 2019	Eco Sanctuary Sdn Bhd

Table 2.4.1 Completed Project

2.4.2 Project in Progress

No.	Project Title	Targeted Completion Date	Client
1.	STP 2 Marine Link Bridge@ Seri Tanjung Pinang	January 2022	Tanjung Pinang Dev. Sdn Bhd
2.	Infrastructure Work @ Seri Tanjung Pinang	March 2022	Tanjung Pinang Dev. Sdn Bhd
3.	Vertu Resort @ Batu Kawan, Penang	November 2020	Aspen Vision City Sdn. Bhd
4.	Piling System and Pile Caps Cons. For Two Blocks of 35 Storey Service Apart. @ Seri Tanjung Pinang	May 2022	Persada Mentari Sdn Bhd
5.	Green Water Sewerage Treatment @ Seri Tanjung Pinang	October 2022	Tanjung Pinang Dev. Sdn Bhd

Table 2.4.2 Project in Progress

CHAPTER 3.0

CASE STUDY

3.1 Introduction to Case Study

This project is about piling system and pile caps work and tittle for this project is:

EXECUTION AND COMPLETION OF SITE WORKS AND EARTHWORKS, FOUNDATION PILING SYSTEM AND PILE CAPS CONSTRUCTION AND ALL ASSOCIATED WORKS FOR THE PROPOSED TWO BLOCKS OF 35 STOREY SERVICE APARTMENTS (TOWER A – 440 UNITS, TOWER B – 580 UNITS) WITH 1 LEVEL BASEMENT ON PLOT B (PART OF LOT PT16), KAWASAN TEBUSGUNA TANAH SERI TANJUNG PINANG (FASA 2A) DAERAH TIMUR LAUT, PULAU PINANG UNTUK TETUAN PERSADA MENTARI SDN. BHD.

Progress for this project is piling system and pile caps construction where the contract commencement date is on 31 May 2021. The first pile were driven on 19 July 2021. In contract stated that the completion date for piling and pile caps construction is 30 May 2022, which is the contract period, is 12 months to complete the piling and pile caps works.

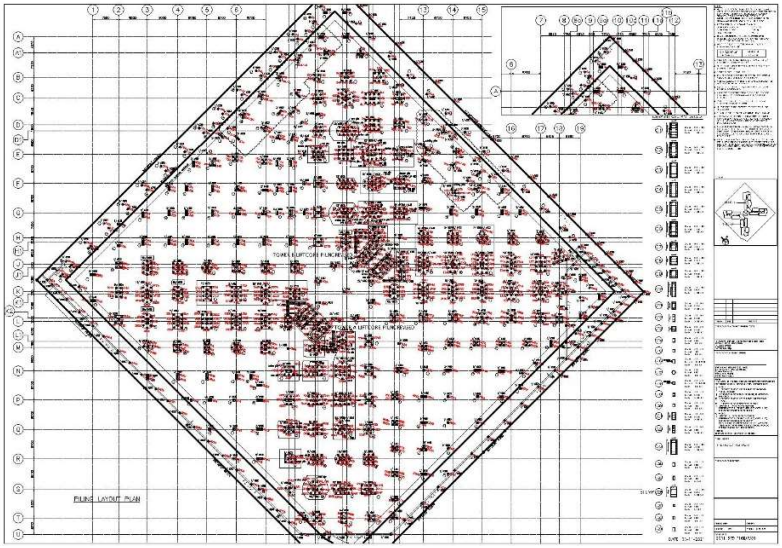


Figure 3.1.1 Layout Plan

The figure above show the layout plan for piling and pile caps works. Total piling for this project is 1490 pile. There are 6 type of size pile that are 500mm, 450mm, 400mm, 350mm, 300mm and 250mm diameter of pile and 2 different length of pile, 12 metre and 6 metre. Total for pile caps for this project is 395 pile caps.

Location for this project is at reclamation land at Seri Tanjung Pinang, Tanjong Tokong, Penang. The project use a portion of 760 acres of this entire reclamation land. There are have other 5 projects on reclamation land such as the Marine Link Bridge that connected from Jalan Seri Tanjung Pinang to the reclamation land, Green Sewerage Treatment Plant (GSTP), Infrastructure works, Sales Gallery and Temporary Gurney Bridge that connecting from reclamation land to Gurney Drive, Penang. Piling and pile caps works located near Temporary Gurney Bridge and next to Sales Gallery.

Figure 3.1.2 Project Location

Before start the piling works, land surveyor will be call to peg the piling point then the piling works are carry out using a piling machine. There two types of piling machine with Hammer Rig 13 Tan and Hammer Rig 11 Tan. Total piling machine in site is 5 machines.

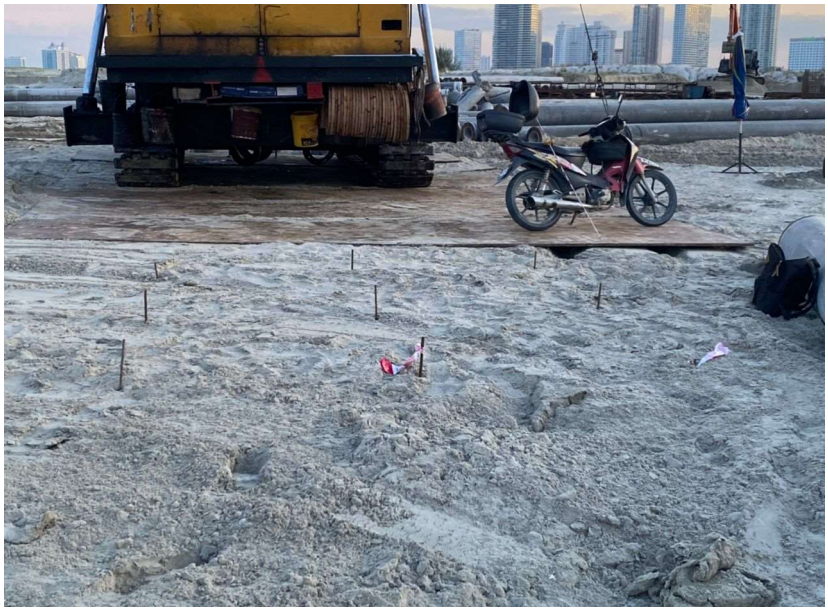


Figure 3.1.3 Piling Peg Point

Figure 3.1.4 Peg Point

After piling works is done, the surveyor will submit the as built drawing to the site engineer. As built drawing ae used to track many changes from the original building plans that take place during the construction of a building.

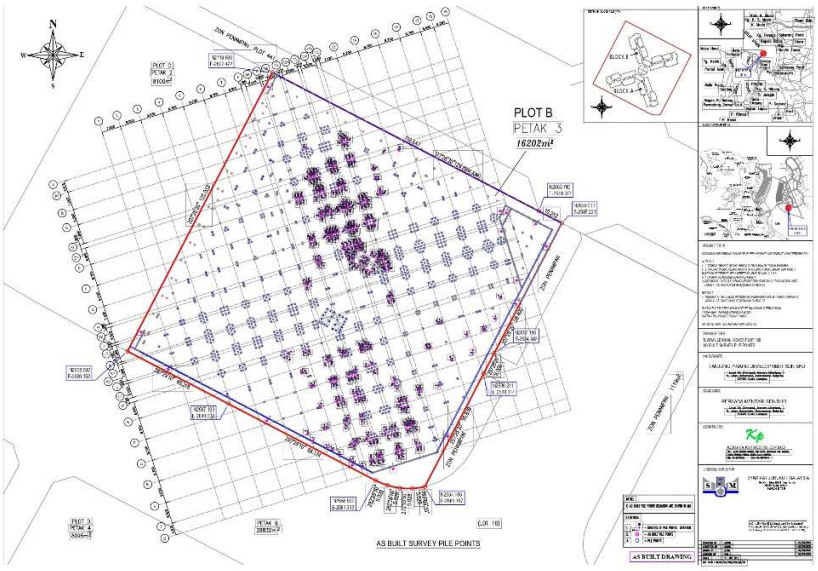


Figure 3.1.5 As Built By Surveyor

All the piling works will have the piling record and need to submit to site office every day after work to keep up to date with site worker how many piling point have done. All the correspondence and updated drawing detail will be done by Ms. Fatima Izzaati and assisted by Nur Hakimah.

Figure 3.1.6 Site Condition

Figure 3.1.7 Piling Works

3.2 Type of Pile Use in Construction

For this construction, type of pile that been use is spun pile. Only one type of pile used in this construction work. Spun piles are hollow, precast and pre-stressed concrete piles. The size of piles generally range from 300 to 1200mm outside diameter that are fabricated by pre-stressing method. In this project, size of piles used is 500mm, 450mm, 400mm, 350mm, 300mm and 250mm with 2 different length 12m and 6m.

The supplier for spun pile on this piling works is Industrial Concrete Products Sdn. Bhd (ICP). ICP Piles will sent out the spun piles to construction site to make sure piling works on site keep on going without delay. One day delay the delivery will caused few piling points did not driven and this will make site work become delay.

Displacement driven piles , namely spun piles and RC square piles and cast-in-situ bored piles are commonly used in Malaysia as foundation to support for heavily loaded structures such as high-rise building and bridges in view of their flexibility if sizes to suit different loads. It is because most of the project by Kerjaya Prospek Sdn Bhd use spun pile as the piling foundation system. On this project, every pile point need 4 extended of spun pile to get set. However, it depends on size of pile, for spun pile dia. 500mm, the total length is 54m which is need 4 spun pile with 12m length and 1 spun pile with 6m length. Each piling point need more than 12m length of pile for every diameter of spun pile. Every joint of pile need to do the welding to keep every pile connected until underneath.

Figure 3.2.1 Arrangement of Pile

3.2.1 Advantages of Spun Pile

Even though spun piles commonly used in Malaysia, there are still have their advantages and disadvantages on using this pile as foundation to support heavy loaded structures such as high-rise building. The advantages of using spun pile is can easily jointed with any combination of length but with the same diameter of piles. Next, it will saves a lot of time as it can get at least 10 piling points per day to be done. From 19 July 2021 until 8 January 2022, 1176 / 1490 no of piling point already done piling work using hammer driven. These spun piles is the economic form of deep foundation and can be drive underwater since this project is on reclamation land.

Figure 3.2.1.1 Pile Welding Joint

3.2.2 Disadvantages of Spun Pile

The disadvantage of using the spun pile is this pile is precast concrete and the piles are heavy in weight. All the spun pile required special machineries such as crawler crane to unload the pile from lorry or move the pile at site. When the crawler crane is broken and need time to repair it will caused the work delay. Other than that, these piles require careful care to prevent the pile from crack when unload or transfer the pile. During piling work also can cause pile broken at underneath or pile head broken and need to repair the pile head.

Figure 3.2.2.1 Pile Head Broken

Figure 3.2.2.2 Unload Pile

3.3 Analyze the Pile using Pile Driving Analyzer (PDA)

Pile Driving Analyzer (PDA) is a tool for inspecting pile installations. The consultant will issue an engineer instruction to run PDA Restrike to pile point that have issues such as pile head broken, short pile penetration and suspect broken pile. Every piling that have done driven will be check by Clerk of Work (COW) represent from consultant on piling record. Through the piling record, the deeper pile is planted the higher number of hammer blow. If the number of blow decreases, COW will suspect the pile broken at underneath and will request to do a PDA Restrike. For short pile penetration, if the pile depth is under 54m such as 30m, 35m and below, COW will request to do a PDA Restrike. PDA Restrike for pile with issue pile head broken will do after the pile head completely repaired. This is to make sure the pile is not broken at underneath.

Figure 3.3.1 Head Crack

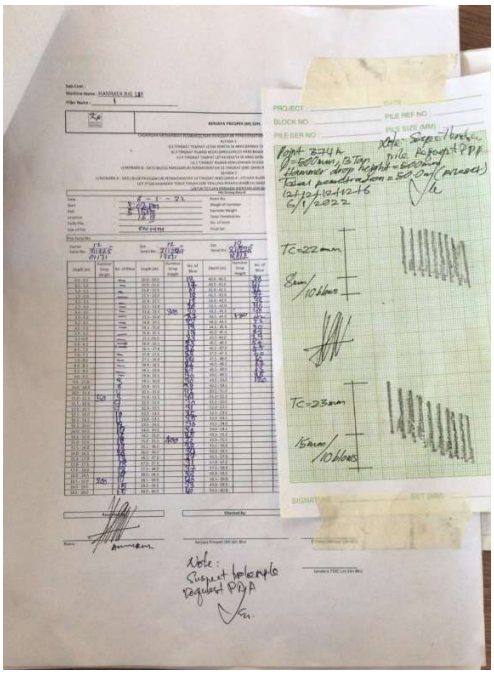


Figure 3.3.2 Piling Record

3.3.1 Procedure

To do the PDA Restrike, firstly need to make sure the pile head levelled and to ensure force from hammer drop been applied centre to the pile. After that, install sensor 200-300mm below hammer cap both side of pile. Double check the sensor can function well or not. If the sensor is not working, rotate the sensor to 360 degree and reinstall the sensor to both side of pile. Once the sensor is functioning well, next proceed with 100mm hammer drop height one time blow. Then change the hammer drop to 600mm with 5 to 10 blows to make sure pile fully mobilize since the pile depth is long around 54m. Check on the monitor the Maximum Case Goble Resistance with field estimate (RMX) and Pile Integrity (BTA), if both fulfil requirement than consider pile is OK. But when either one RMX or BTA is not fulfil the requirement, double check the TSX (Tensile) should be more than 7.5 and if not, continue Restrike and increase hammer drop height to 750mm. The test load should archived double value compared to working load.

Figure 3.3.1.1 PDA Monitor for 100mm Hammer Drop

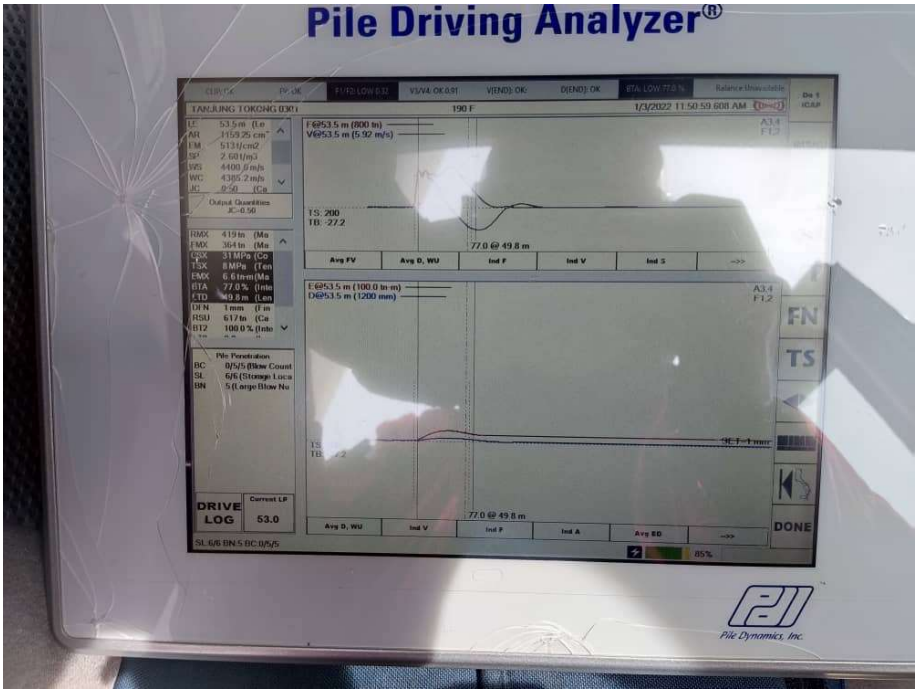
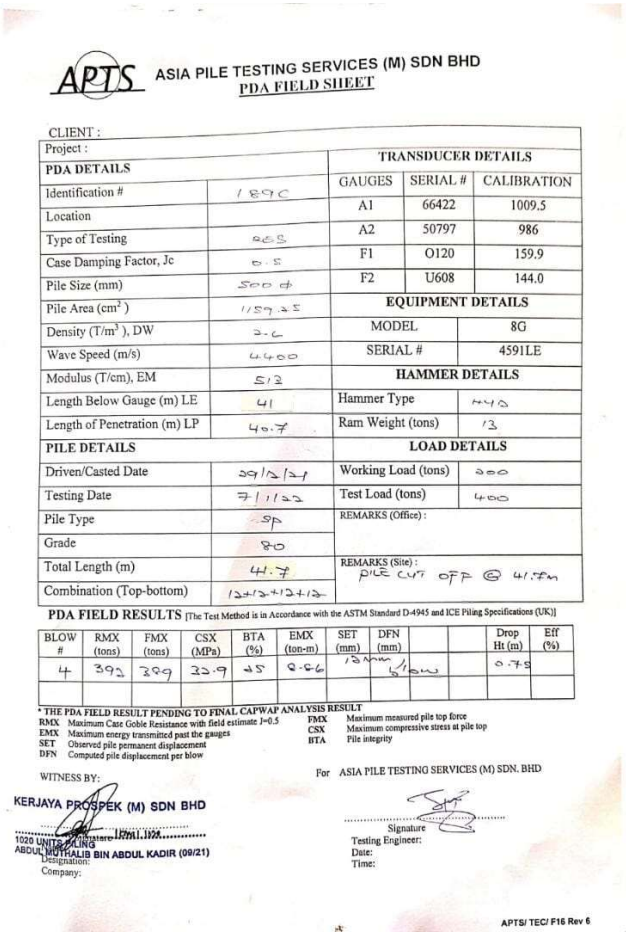


Figure 3.3.1.2 PDA Monitor for 600mm Hammer Drop



APTS ASIA PILE TESTING SERVICES (M) SDN BHD

PDA FIELD SHEET

CLIENT :

Project :		TRANSDUCER DETAILS		
PDA DETAILS		GAUGES	SERIAL #	CALIBRATION
Identification #	189C	A1	66422	1009.5
Location		A2	50797	986
Type of Testing	RSS	F1	O120	159.9
Case Damping Factor, Jc	0.5	F2	U608	144.0
Pile Size (mm)	500 ϕ	**EQUIPMENT DETAILS**		
Pile Area (cm^2)	1159.25	MODEL		8G
Density (T/m^3), DW	2.6	SERIAL #		4591LE
Wave Speed (m/s)	4400	**HAMMER DETAILS**		
Modulus (T/cm), EM	513	Hammer Type		HHO
Length Below Gauge (m) LE	41	Ram Weight (tons)		13
Length of Penetration (m) LP	40.7	**LOAD DETAILS**		
PILE DETAILS		Working Load (tons)		200
Driven/Casted Date	29/12/21	Test Load (tons)		400
Testing Date	7/1/22	REMARKS (Office) :		
Pile Type	SP			
Grade	80			
Total Length (m)	41.7	REMARKS (Site) : PILE CUT OFF @ 41.7m		
Combination (Top-bottom)	12+12+12+12			

PDA FIELD RESULTS [The Test Method is in Accordance with the ASTM Standard D-4945 and ICE Piling Specifications (UK)]

BLOW #	RMX (tons)	FMX (tons)	CSX (MPa)	BTA (%)	EMX (ton-m)	SET (mm)	DFN (mm)			Drop Ht (m)	Eff (%)
4	392	389	32.9	45	8.86	12mm	5 blow			0.75	

* THE PDA FIELD RESULT PENDING TO FINAL CAPWAP ANALYSIS RESULT

RMX Maximum Case Goble Resistance with field estimate J=0.5
EMX Maximum energy transmitted past the gauges
SET Observed pile permanent displacement
DFN Computed pile displacement per blow
FMX Maximum measured pile top force
CSX Maximum compressive stress at pile top
BTA Pile integrity

WITNESS BY:

KERJAYA PROSPEK (M) SDN BHD

Signature
1020 UNITS PILING
ABDUL MUTHALIB BIN ABDUL KADIR (09/21)
Designation:
Company:

For ASIA PILE TESTING SERVICES (M) SDN. BHD

Signature
Testing Engineer:
Date:
Time:

APTS/ TEC/ F16 Rev 6

Figure 3.3.1.3 PDA Record

3.4 Method of Pile Cap Works

The main purpose of the construction of the pile cap is to distribute the load of the column, which is usually too large for large construction, for underlying piles. Pile Caps are thick reinforced concrete mats that rest on top of concrete or piles to offer stability to the foundation. The pile cap is a mat, which is rested on the numerous piles, and it is part of the foundation. The size and plan dimension of the pile cap will depend upon the variety of piles within the group and the spacing between each pile.

Before excavate the pile cap area, need to make sure all as-built had been taken and check the piling either need to do PDA Restrike or any suspect broken pile. Next proceed to excavate based on pile cap detail on drawing the depth of the pile cap. After that, transfer level to pile to know at which level to do cut off pile. Need to make sure the pile in pile cap is around 75mm. However, the pile cap need to install steel plate or sheet pile as temporary shoring to avoid the soil slide down since the soil in reclamation land is fine soil.

Figure 3.4.1 Pile Cap Detail

Figure 3.4.2 Install Pile Cap Rebar

Figure 3.4.3 Pile Cap Concrete

CHAPTER 4.0

CONCLUSION

In the conclusion, piling works usually used in large construction and for high-rise building. The suitable type of piles use is spun pile because it is economic and can save a lot of time in construction. However, spun pile also have the disadvantage of using it in construction. Spun pile is precast concrete pile and need to use heavy machineries such as crawler crane to unload the pile and transfer pile. During piling works, the cause of pile broken at underneath can happen to a lot of pile and need to do the Pile Driving Analyzer (PDA) Restrike to check either the pile is OK or not. Lastly, after all piling works done continue with pile cap work which it used to transfer the loads from superstructure to the piling.

REFERENCE

Journal Articles:

Faisa Hj. Ali & Lee Sieng Kai. (2007). *A New Instrumentation Method for Driven Prestressed Spun Concrete Piles*. 1-2

Candra Irawan, Priyo Suprobo, Gusti Putu Raka & Rudy Djamaluddin. (2015). *A Review of Prestressed Concrete Pile with Circular Hollow Section (Spun Pile).* 116.