DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

CONSTRUCTION OF PILE CAP

Prepared by:

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2017208772

DEPARTMENT OF BUILDING

FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

DECEMBER 2019

It is recommended that the report of this practical training provided

By

Nur Syahira Liyana bt Mohd Ghazali

2017208772

entitled

Construction of Pile Cap

accepted in partial fulfillment 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 Exxomas Sdn Bhd for duration of 20 weeks starting from 5 August 2019 and ended on 20 December 2019. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

Name : Nur Syahira Liyana bt Mohd Ghazali

UiTM ID No : 2017208772

Date : December 2019

ACKNOWLEDGEMENT

Alhamdullillah, praise to Allah, the Most Merciful, the Most Graceful.
It was indeed a great experience as I got the opportunity to learn so many things throughout the programme. Firstly, I would like to take this opportunity to express my sincere gratitude to En Hishamsadi and En Jayaganesh for giving me the opportunity to be part of the team, as an intern, within the organization.

I would also like to extend my heartfelt gratitude to my supervisor during the entire period of training, En Masrizal bin Misnan, the Site Agent of Pembinaan Shamsadi Sdn. Bhd. for guiding me patiently throughout the internship duration and all the people that worked in the office for their patience and openness to create an enjoyable working environment. Also, on behalf of their abundant of advices, knowledges and making sure that I understand the process on site and giving me overview of working in the related industry.

Lastly, special thanks to UiTM lecturers that have supported and encouraged me in becoming a better student. I would also like to extend my deepest appreciation to the lecturers who are directly involved during my practical training period. To En Muhammad Naim bin Mahyuddin, Supervising Lecturer and Practical Training Coordinator, Puan Dr Asmat binti Ibrahim, Visiting Lecturer, and Dr. Dzulkarnaen bin Ismail, Programme Coordinator. I appreciate the time, efforts and advices that have helped me completing this report and my practical training effectively.

Last but not least, my special gratitude to my beloved parents for their sacrifices over the years.

Thank you so much.

ABSTRACT

Pile caps act as a raft foundation that embedded on piles. For economical purpose, group of piles that are closely penetrated were provided one large cap instead of individually, thus forming a piled raft foundation. The purpose of this report is to have better perception upon the construction process of pile caps at Bukit Teratai, Cheras, Selangor as well as to investigate the problems occurred caused by weather and also unfortunate accidents on site and few actions taken to solve them. Spun piles were used and penetrated into the soil by means of 9T IPH hydraulic hammer and reinforced cast in-situ pile caps were constructed on site. To conclude, structure of pile caps is hidden and covered by soil as it is almost immediately backfilled, therefore, it is difficult to get insight on the structure of pile to pile caps connections. Thus, this research can provide overview of the structure of pile caps.

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CHAPTER 1.0

INTRODUCTION

1.1 Background and Scope of Study

Pile cap is a concrete mat that embedded on piles either concrete or timber that are driven into unbalanced soil condition where the bearing capacity of soil is inadequate for spread footing, then piles are used to transfer the load to lowest and hard strata.

Pile caps can be precast or cast in-situ. Precast concrete is experimentally shown that precast pile cap can provide similar manner as compared to conventional cast in-situ. Hence, using precast pile caps can escalate the construction process and thus prevent the risk of exposure to rain and may cause failure of possible failure (TK Chan, 2000)

Piles are frequently used for high-rise buildings, bridges and other construction that involved large structures. This is because the piles can withstand horizontal forces which are caused by earthquakes, wind and wave action. Study has shown that the pile cap connection with the piles can escalate the resistance to these horizontal forces which were provided by the foundation structure. For instance, a pile cap that have fixed-boundary can produce a firmer load-deflection curve than pile cap that permits rotation.

Design supposing a pinned connection which fails to resist load may outcome in a very high price over design. Studies and test done has proved that piles inserted with inadequate depth into the pile cap provide only resistance to shear and axial loads whereas piles that inserted adequately, can effectively resist moments and also reduce horizontal deflections Therefore, the connection between piles pile caps must capable to develop the piles's capacity while resisting horizontal forces and moments.(Rollins, 2010) However, the aims of this research is to have better understanding on the method of construction and connection of pile and pile caps.

Scope of Study

This research has been undertaken at Bukit Teratai, Cheras, Selangor, which constructed in the project of "Proposed Construction of Toll Plaza at Main Road of Sungai Besi – Ulu Kelang Elevated Expressway (SUKE)

This report is focused on to better understanding in the construction of pile cap connections. The connection involved excavating, surveying and drive method for piling work. Whereas, concrete compaction and curing were involved during the pile caps construction. In this study, spun piles with size of 500mm x 500mm are driven by means of hydraulic hammer. Lastly, problems occurred and the solutions taken for broken pile and sedimentation of soil are studied.

1.2 Objectives

i. To identify the method of pile caps.

ii. To identify the problems occured and solutions taken in the construction of pile cap.

1.3 Method of Study

i. Observation

By observing the ongoing construction of pile caps on site, the process of understanding the steps became easier. For instance, witnessing rebar installation, erecting of formwork and concreting process during construction. During the observation, several pictures and videos were taken for report purposes.

ii. Interviews

Unstructured interviews were commonly done during site visits with Site Agent and Site Supervisor. Several questions were asked while witnessing the ongoing works and they will spontaneously answer to the questions and even give wider perspective from their experiences. Short notes were jotted down to be kept as reminder.

iii. Document reviews

Moreover, several documents were referred to for instance, construction drawings for detailed information on the design layout. Also, as overall view at the structure. Monthly progress reports were also referred to get information regarding the company. The documents were of course taken under the consent of the employees first.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 INTRODUCTION OF COMPANY

Pembinaan Shamsadi Sdn. Bhd. is a diverse construction company. The company specializes in construction, oil and gas engineering works as well as scaffolding. Pembinaan Shamsadi offers general construction, civil and infrastructure works, architecture works, mechanical and electrical works.

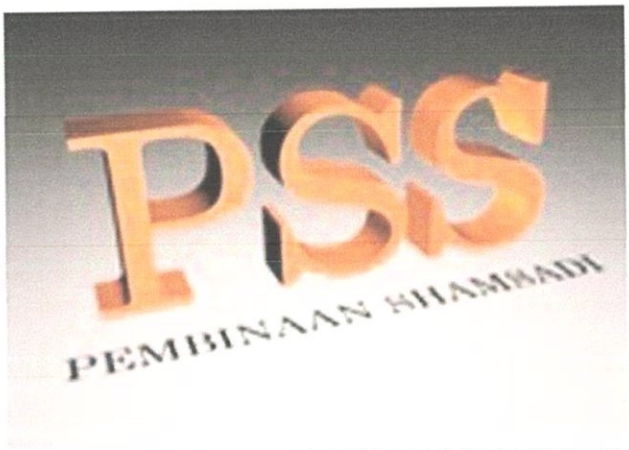
Pembinaan Shamsadi is found by En. Hishamudin bin Mohd Sadi and the company was established in the 31st January 2003 and registered with Construction Industry Development Board (CIDB) as grade 5. It was initially operated as a small scale construction based business and eventually, the company had evolved through 16 years of experience in construction and high tech engineering works, and supplying and providing services for scaffolding.

Pembinaan Shamsadi Sdn. Bhd. headquarter is located at LOT.7775, Kampung Chelet, Batu 16 Jalan Sepang, 71800 Nilai, Negeri Sembilan.

The company separate their services in two main departments which is construction department under Pembinaan Shamsadi and scaffolding and engineering works under Labu Scaffold. Where Labu Scaffold provides several services.

Labu Scaffold had been involved in scaffolding industry with over 7 years of experience. The department provide scaffolding services for construction, maintenance, shutdown, turn around works for oil & gas and industrial sectors, inclusive of onshore & offshore projects. Labu Scaffold have adequate experience and capability in the design, supply, erect, adapt and dismantle of scaffolding. Furthermore, it provides skilled, trained and certified manpower supply for all type of scaffolding works.

2.2 COMPANY PROFILE



PEMBINAAN SHAMSADI SDN BHD
(1083940-A)

COMPANY NAME	: PEMBINAAN SHAMSADI SDN BHD
COMPANY REGISTER NO	: 1083940 – A
BUSINESS ADDRESS	: LOT.7775, Kampung Chelet, Batu 16 Jalan Sepang, 71800 Nilai, Negeri Sembilan.
COMPANY ACTIVITY	: a) Kontraktor Sivil & Bangunan Berdaftar dengan Pusat Khidmat & CIDB G5 b) Kontraktor Membekal dan Menyelenggara yang berdaftar dengan MOF c) Scaffolding & Engineering Work

2.3 ORGANIZATON CHART

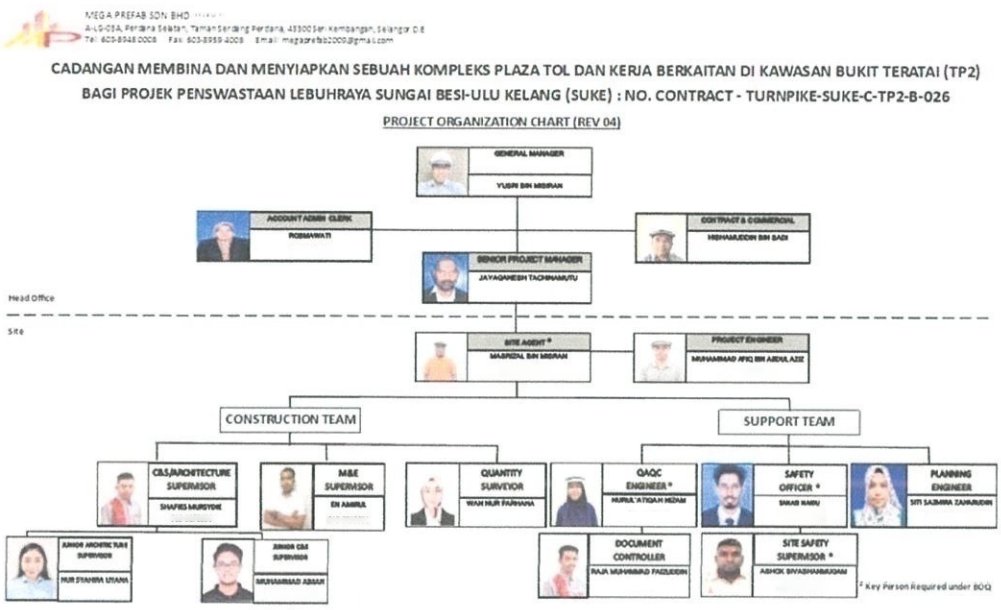


Table 2.3(a) : Project Organization Chart

(Source: Courtesy of Pembinaan Shamsadi Sdn. Bhd.)

2.4 LIST OF PROJECTS

2.4.1 COMPLETED PROJECTS

Project Details	Agency	Value (RM)	Year
Construction and Completion of Medan Infodesa and Others Associated Works (Regional version) at Kg. Batu 3, Mukim Temoh, Daerah Batang Padang	Kementerian Luar Bandar dan Wilayah (KKLW)	170,800.00	2006
Proposed Construction of Polytechnic of *Nilai, at Parts of Lot Pt. 23743, Mukim* Labu, Daerah Seremban, Negeri Sembilan. a) 40 Unit of Room, Double Storey Building Lodge (Block C) b) 3 Storey Building (Block T1)	Mega Tribute *Sdn. Bhd.*	1,255,942.20	2009
Proposed Completion Project of SMK *Complex Tok Adis Under the Influence* of the 9th Malaysia Plan.	Stabil Wirajaya *Sdn. Bhd.*	7,500,000.00	2012
Proposed Construction of 1 Hotel Unit with total of 3 storeys at Lot 9415, Mukim Panchang Bendena, Sg. Besar, Daerah Sabak Bernam, Selangor Darul Ehsan.	Bintang Terbaik Sdn. Bhd.	1,330,000.00	2014-2015

Table 2.4.1(a) : Completed Projects

2.4.2 ONGOING PROJECTS

Project Details	Agency	Value (RM)	Year
Proposed Renovations of Hostel at Institute Kemajuan Desa (Infra) Bangi	INFRA	30,000.00	2018-2019
Proposed Construction of 3 storeys Office, 1 Controlled Unit, 1 Waste Chamber, Shah Alam Selangor.	Velocity Construction Sdn. Bhd.	3,050,000.00	2017-2019
Proposed Construction of Toll Plaza at Main Road of Sungai Besi – Ulu Kelang Elevated Expressway (SUKE)	Turnpike Synergy	20,814,401.34	2018-2020

Table 2.4.2 (a): Ongoing projects

CHAPTER 3

CASE STUDY

Figure 3.1(a) : Project Signboard

The project is 'Proposed Construction of Toll Plaza at Main Road of Sungai Besi – Ulu Kelang Elevated Expressway (SUKE)'. SUKE highway is built to reduce 35% of traffic congestion occuring on MRR2 highway, where MRR2 highway make routes around Kuala Lumpur. MRR2 highway had received many complains due to its period of peak congestion which is at early morning and evening, where it is mainly influenced by the working hours. The congestion can even last for one hour.

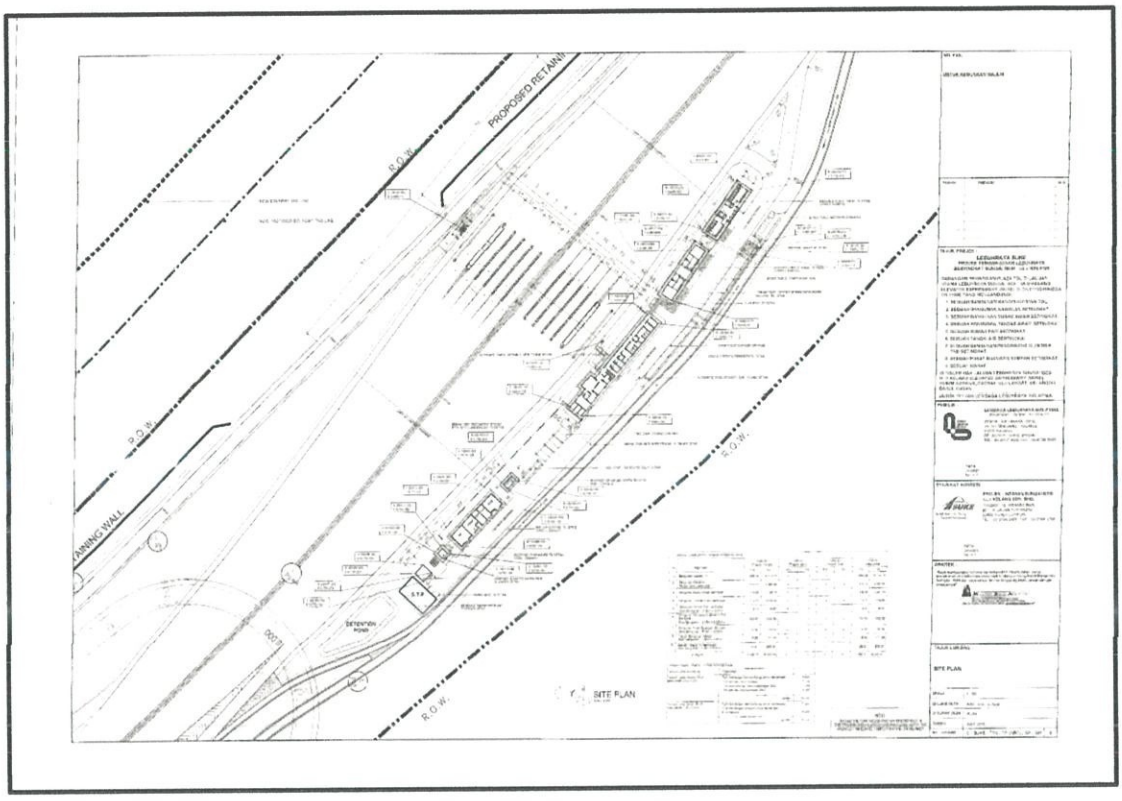


Figure 3.1(b) : Site Layout

(Source: Courtesy of Pembinaan Shamsadi Sdn Bhd)

The project value is worth RM20,814,401.34. It is initially started on 23rd July 2018 and expected to be completed on 22nd December 2019. The project consist of constructing a Toll Canopy, Supervision Building, Public *Surau,* Public Toilet, Pump House, Elevated Watertank, TNB Substation, Refuse Bin Centre and *Wakaf* (as shown on Figure 2). However, the main focus of this report is only on the structure of pile caps at Elevated Watertank.

The surrounding of the site is not congested and easy to work with as it is not constructed near the busy road, where vehicles constantly passing by. However, there are few challenges faced at the construction that was taking place. For instant, sedimentation due to weather and lack of ingress for rainwater from the hills.

3.2 METHOD CONSTRUCTION OF ELEVATED WATERTANK

1. Site Excavation

Topsoil were initially excavated by using an excavator to create a workable base for construction work. It also includes getting rid of any obstruction on site such as any kinds of vegetations, trees and bushes. Therefore, the soil is capable and safe to bear structural loads. The depth of excavation on site is two (2) meters.

Figure 3.2.1(a): Excavation work on site

2. Installation of Piling

Internal pile positions were initially marked by using pegs done by project surveyor using a Total Station by referring upon details in the design layout of piles. All the survey data which includes the piling as-built work carried out by surveyor on site were then compared with the copy of piling as-built plan by *Consultant Engineer to ensure the piling points were correct and piling works* can be carried out. Results of survey drawing is shown in Appendix 1

Figure 3.2.2(a): Surveying work

Types of pile used on site are spun piles which has the diameter of 500mmx500mm. The method used are drive method using a 9T IPH hydraulic hammer. Other equipment and machineries involved during the process were mobile crane, generator set, oxyacetylene cutting equipment and welding machine.

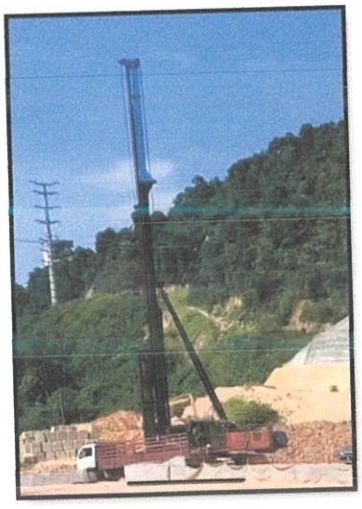


Figure 3.2.2(b): 9T IPH Hydraulic Hammer driving pile

Firstly, the pile (WT1) was tightened with cable then pitched and inserted in the helmet before lifted with the hammer. Before driving, workers ensure the

hammer, helmet and pile were aligned and stable in vertical position. The piles were then driven until the pile finally set on bedrock.

Process repeated for each piling points (WT1, WT2, WT3, WT4, WT5, WT6, WT7, WT8, WT4A, WT4B). There has been suspected broken pile on WT4 Therefore, there was addition of piles (WT4A, WT4B) where new surveying work was done to mark new points.

Figure 3.2.2(c): Drive of addition pile

3. Excavation for Pile Caps

Then, the site was excavated to install pile caps. The site was excavated for 1.5m using an excavator, revealing the piles.

Figure 3.2.3(a): Excavation work for pile caps

4. Compaction of soil

The surface was compacted using roller compactor to create a dense and compacted soil where there are no voids in the soil.

Figure 3.2.4(a): Compaction of soil

5. Cutting of the piles

The piles were then cut by using oxyacetylene cutting machine. The piles were cut leaving only 300mm above ground level.

Figure 3.2.5(a): Cutting of spun piles

6. Application of anti-termite

Anti-termite sprayed to positions of pile caps before laying lean concrete.

Figure 3.2.6(a): Spraying curing compound

7. Laying of lean concrete

Lean concrete was mixed using a concrete mixer. The mixture consist of cement, fine aggregate and coarse aggregate with the ratio of 1:4:8 respectively. Then, concrete were poured at the positions of pile caps by excavator. Next, the concrete was screeded using trowel to create a flat and edged base. The lean concrete were installed with the depth of 50mm.

Figure 3.2.7(a): Lean Concrete for Pile Caps

8. Installation of formwork for pile cap

Formwork were constructed in accordance to the shape, orientation, level, height and size as outlined in the construction drawings. The formwork erected had sufficient thickness and timber framing as well as strutting to withstand the pressure during concreting.

Figure 3.2.8(a): Process of erecting of formwork for pile caps

There was a total of four (4) pile caps. Three (3) of them consist of two (2) piles, however, one (1) of the pile cap was erected differently and as bigger as it consists of four (4) piles due to the failure in piling. The process continued with installation of reinforcement bar for pile cap and column stump then the work was inspected by the Inspection of Work (IOW) person. After that, concreting work began.

Figure 3.2.8(b): Formwork of pile cap

9. Installation of reinforcement bar

The rebar for column stump were made beforehand and inserted into the piles

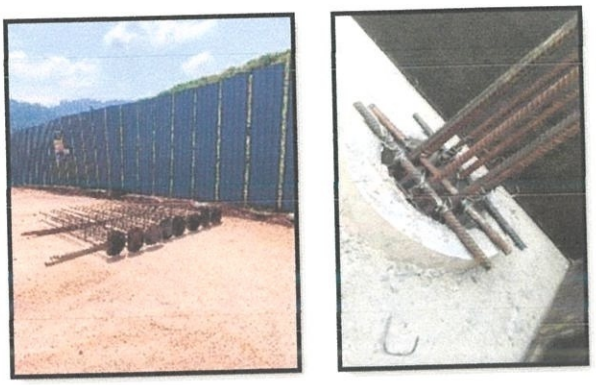


Figure 3.2.9(a): Premade Reinforcement bar at pile to column stump

The respective member bars were placed into its position with spacer blocks for raft foundation. Spacer blocks are used to avoid the steel bar from touching the ground or formwork. Reinforcement steel were kept clean so the shear strength of the rebar will not reduce after concrete.

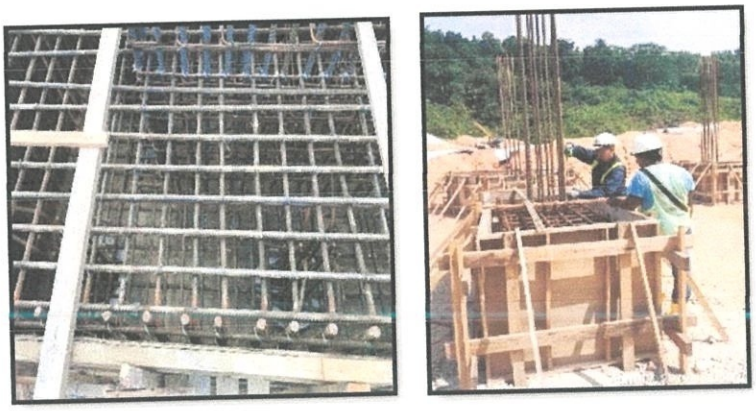


Figure 3.2.9(b): Reinforcement bar for pile cap

10. Concreting pile caps

Lorry concrete mixer transfer the concrete slurry to the excavator to be filled sufficiently into the formwork of the pile caps. The concrete used on site are Grade 40 (G40) as it is crucial that they received high strength concrete. After pouring, the concrete was compacted using poker vibrator to ensure the pour is free of air bubbles and evenly spread in the formwork.

Figure 3.2.10(a): Concreting work for pile cap

11. Curing Pile Caps

Shortly after compaction, curing process was done using curing compound sprayed to the exposed concrete surface to protect it from weather and prevent cracking.

Figure 3.2.11(a): Spraying curing compound to pile cap

12. Dismantle of formwork

Dismantling of formwork were done after eight (8) days after supervisor had checked and approved the concrete integrity and strength is up to requirement.

13. Backfilling of Pile Caps

The pile caps were then covered by backfilling using an excavator.

Figure 3.2.13(a): Pile caps Backfilled

3.3. Problems & Solutions

1. Broken Pile

There was suspected of broken pile at WT4 as it was not getting set and had crossed depth limit of the soil as stated in the profile of soil provided by Jabatan Tanah Malaysia.

Solutions:

- Technical Query (TQ) was then sent to consultant to provide advices upon the matter.
- A new design and layout for the piling points and pile cap shape were solved by specialist (as shown in Appendix 2). Driving new piling points consist of two (2) piles which were WT4A and WT4B with the manner to ensure the pilings are coordinated with the drawings. WT4A and WT4B were driven both side of the failed pile.
- Whereas, the failed pile was still connected to the column stump and WT4A and WT4B will support the pile cap and structural loads.

2. **Sedimentation (weather)**

Sedimentation of soil occurred due to rainy weather. It has caused delay of work on site as it is dangerous to start excavating on a loose soil.

Figure 3.3(a): Sedimentation of soil

Solutions:

- Geotextiles were laid to the slopes as geotextile can develop the soil characteristics.
- The excavation continued after few days when the condition of the soil had improved and safe to work with.

Figure 3.3(b): Geotextile laid to slopes

CONCLUSION

In a nutshell, pile cap is very effective in resisting both horizontal and vertical forces. This research is conducted at Bukit Teratai, Cheras, Selangor. Where the method used is drive method by means of hydraulic hammer.

Throughout the process of the construction of pile to pile cap have been challenging due to problems occurred on site. However, the problems had been handled successfully.

Pile cap also give advantage instead of just embedded on piles. It is practically used on most sites where there are piling work involved especially for large, heavy structures or buildings.

REFERENCES

Books

Chan, T.K. and Poh, C.K., 2000. Behaviour of precast reinforced concrete pile caps. *Construction and building materials*, *14*(2), pp.73-78

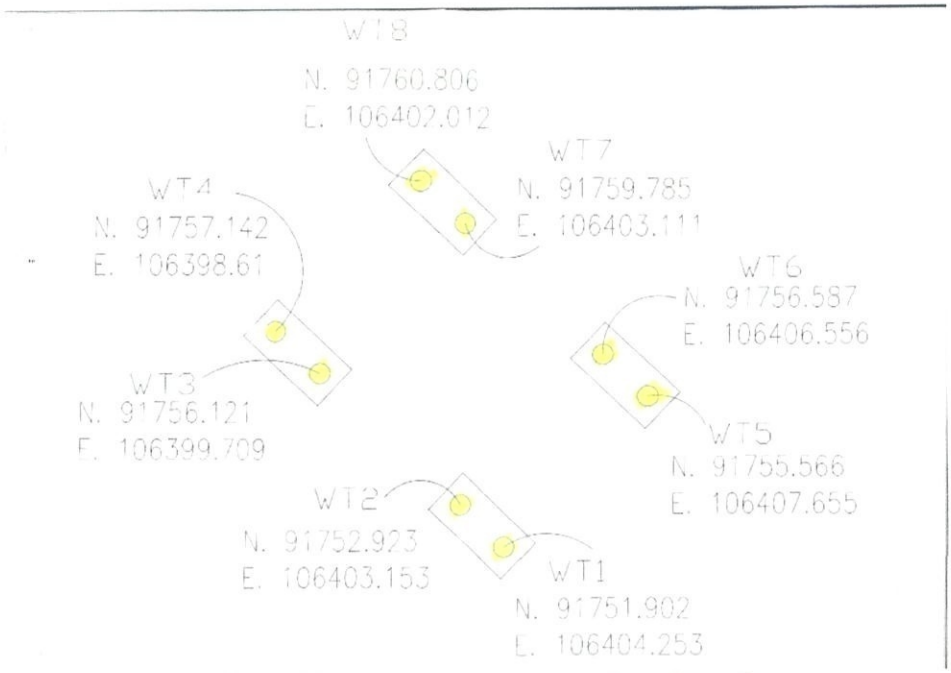
Rollins, K.M. and Stenlund, T.E., 2010. *Laterally loaded pile cap connections* (No. UT-10.16). Utah. Dept. of Transportation. Research Division.

Web Site:

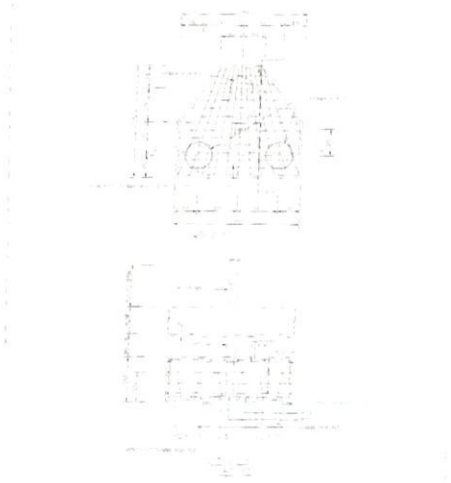
https://www.thebalancesmb.com/common-pile-driving-problems-and-solutions-844786

https://theconstructor.org/geotechnical/piles-and-pile-caps/6162/

APPENDIX



Appendix 1: Surveyor drawing on the piling layout



Appendix 2: New Piling Layout for Pile Cap