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

MUHAMMAD HAZIQ BIN ZAINUL RASHIDI

2017208734

entitled

SUBSTRUCTURE CONSTRUCTION METHOD

be accepted in partial fulfillment of the requirement for obtaining the Diploma In Building.

Report Supervisor	:	Dr Azamuddin Bin Husin
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Programme Coordinator	:	Dr. Dzulkarnaen Bin Ismail.

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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 are stated herein, prepared during a practical training session that I underwent at Nadi Cergas Sdn Bhd for a 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.

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Name : MUHAMMAD HAZIQ BIN ZAINUL RASHIDI

UiTM ID No : 2017208734

Date :

ACKNOWLEDGEMENT

Alhamdulillah. Praise be to Allah, the Most Gracious, and Most Graceful for always helping, protecting, and empowering me during the 20 weeks of practical training. With all the heavy machineries and hazardous equipment that pose a huge risk, I was able to survive and live without any incidents or serious injuries. Therefore, every little scratch was taken in memory of the hardships I experienced. Now my report has been submitted to the Honourable Lecturer, Dr Azamuddin Bin Husin.

I would like to express my sincere gratitude to those involved in helping me complete this practical training report. I would like to thank my supervisor of the organization, Mr Muhammad Syazari Zabaludin from Pusat Kardiologi Hospital Serdang for their continued assistance and supervision through industrial training conducted at Nadi Cergas Sendirian Berhad. Without the instructions and specifications of its inclusion in every point of view, the purpose of preparation would never have been practiced. Many require you to provide a great deal of inspiration, passion and great learning over the past 20 weeks.

In addition, a great deal of thanks and gratefulness to Nadi Cergas Sendirian Berhad family group especially the Construction & Structure Department groups, who helped me a ton during my modern setup. They are determined to explain how they do their job and willing to show all me this while. From their encounters, I learned a lot and they have helped in giving me a clearer perspective on the general work rather than just reading from the manual.

Moreover, I really value my university – Universiti Teknologi Mara (UiTM) for offering this internship course to understudies. This internship program has given me the opportunity to investigate and gain experience in the work environment to build on our work ethic with the goal that we can provide ourselves with the talent we need to work before we embark on our life beyond studies.

Last but not least, my beloved parents and family who have supported me none stop since I was a mere child until now. They gave me a lot of sources and energy to keep me going and not give up. May Allah SWT bless them.

ABSTRACT

Substructure is one of the crucial element in construction, as it function to transfer the load of the building to the ground and to isolate it horizontally from the ground. This report will discuss about substructure construction method at project Centre Cardiology, Hospital Serdang (Design & Build) based on Standard Specification for Building Works 2014. This report was conducted to fulfil the requirements of the current semester's assignment and to give the output or as a result of practical training during the twenty weeks span. The objective of this report is to observe and determine the method, cost, time, workmanship, types of test used for substructure, and problems that occurred during the progress and provides solutions. Lastly, the most important thing for this work is accuracy, for it is crucial to make sure the data collected, the input and output data transferring, and markings are accurate so it will not bring problems to the upcoming procedure ahead of the Substructure construction. The finding shows the Substructure work started without any problem and all the procedures used in this construction were as due to standard construction method.

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CHAPTER 1: INTRODUCTION

1.1 Background and Scope of Study Objectives

The substructure is the lower part of the building built below the ground level. Example, piling, pile cap, stump, foundation, ground beam and ground slab. The function of a substructure is to transfer the load from the superstructure to the underlying soil. Therefore, the substructure is in direct contact with the supporting soil. Substructures involve footing and columns. The structural engineer is responsible for calculating the stresses and loads needed to be supported by the building under consideration. In addition, structural engineers need to understand how to incorporate support beams, columns, and foundations into the design of the substructure.

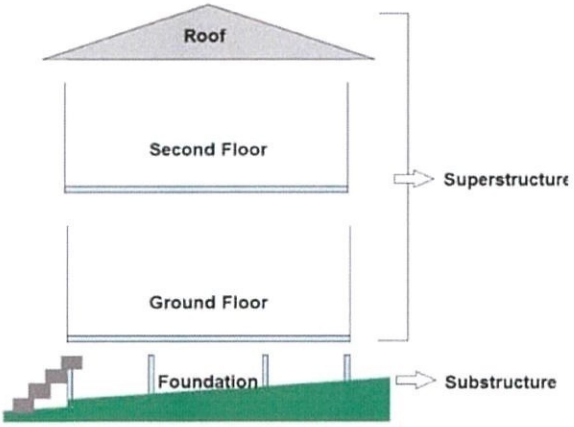


Figure 1.1: Difference between superstructure and substructure (Source: Internet)

Any structure is generally divided into two parts which is Superstructure and Substructure. Superstructure is the part of the structure which is above ground level, and which serves the purpose of its intended use. A part of the superstructure that located between the ground level and the floor level is known as plinth. Plinth is therefore defined as the portion of the structure between the surface of the surrounding ground and surface of the floor, immediately above the ground. The level of the floor is usually known as the plinth level. Meanwhile, Substructure is the lower portion of the building that usually located below the ground level which transmit loads from superstructure to the supporting soil. A foundation is therefore that part of the structure which is in direct contact with the ground to which the loads are transmitted. (Shantanu, 2016)

The difference between a substructure building and a superstructure building is that the substructure is a structural that serves as a support to the superstructure which sits below ground level such as ground floor and the foundation. Compared to superstructures are an upward extension of an existing structure above a baseline called ground level and it usually serves the purpose of the structure's intended use. Building parts located above ground such as column, beam, floor, roof and others. (Graves, 2018) Another difference between the substructure and the superstructure is that the substructure is a transfer load received from the superstructure to the strata base while the superstructure is a transfer load from the top to the substructure.

Therefore, substructures are much more complex and important than superstructure. Substructure is the backbone of any building. Substructure is a complicated way, for substructure design it must consider soil data, soil pressure, earthquake zone, capillary action, chemical reaction and presence. Substructure is mainly for infrastructure strength. Superstructure is to transfer the live and dead loads to the substructure and for aesthetic purposes. Any efficient building is due to the best combination of substructure and superstructure. (Brijesh J. Panchal, 2017).

The study is carried out at Centre Cardiology, Hospital Serdang, Selangor Darul Ehsan. This project using Design and Build contract, with the construction cost RM 289,765,000.00. The scope of study will be focused on the construction of substructure construction method for hospital building. In 20 weeks of practical training, there are a lot of information able to collect and write in the report such as on how the methods and the process of the construction, the needs and requirements, labours involved, instruments used, materials used, the total cost of the structure, time needed, problems and solutions, and also the details of the substructure construction method, including pictures. All the contents in this report are close enough to the actual facts of the substructure construction. Throughout the practical training, the method of construction of substructure was deliberated throughly using several research method such as site observation, verbal discussion and meeting at the site and document review related to procuders, materials used, company profile and project reports.

1.2 Objectives

a) To observe the methods and sequence of Substructure construction work.
b) To investigate the problems of the construction of the Substructure construction method, thus find the solution for any problems that may occur.
c) To examine the types of test for substructure construction work.

1.3 Research Method

1.3.1 Observation

Literatures and writings are used as reference to get additional information of the Substructure construction method. Observation was carried out on site along the practical training period to gain data about the construction methods of substructure works. The pictures and videos were taken using smartphone device. This is because, by collecting data in this way is more effective and will make easier to recall especially when it comes to construction method to refer and used to complement the direct observation. Some info such as site data and drawings can be gain during the process of works being carried out.

1.3.2 Interview

Despite the wide information that Internet and Books provide, practical knowledge is also important to be learned and noted down directly from experienced workers and staffs. The interview was done to gain information about company background with Encik Syazari and Encik Nik (QAQC). This interview was considered as a semi-structured interview as the question were already being prepared beforehand for the site supervisor to answer and a few other questions were also added during the interview happened. The interviews were recorded by written notes by using a pen and a notebook. To get more knowledge about construction life, interviews with supervisors and Inspector of Work has been held in order to accomplish the practical report.

1.3.3 Document reviews

The type of documents that has been refer are construction drawing. Another document is standard operating procedures such as Standard Specifications for Building Works 2014 that used as a guideline to the labour and all staff to accomplish the jobs. Other than that, progress report also been reviews once a month. All of it included progress picture that has been captured by site supervisors before and after the work accomplished. The site supervisor also provides a plan of the site construction and a few pictures during the construction process.

CHAPTER 2: COMPANY BACKGROUND

2.1 Introduction of Company

The story of Gagasan Nadi Cergas. In 1995, Nadi Cergas Sdn Bhd was founded by experienced industry veterans and started a business as a building construction contractor. By leveraging on their expertise and experience, the company of Nadi Cergas Sdn. Bhd. is expanding rapidly from strength to strength, giving high emphasis to delivering high quality work. An excellent track record enables the company to establish long-term business relationships built on trust and enables the company to explore other relevant industries.

Design & Build Specialist

By integrating these companies' capabilities in construction with insightful design, they have leveraged their expertise in building unmatched buildings and infrastructure through the scope of our integrated design & construction services.

The Best Technology for Superior Quality

The idea of Active Pulse also emphasized technological advances, without the investment of advanced machines and applications that reflected the company's excellence. In line with this, Nadi Cergas Sdn Bhd has launched advanced services that help enhance the operational viability and sustainability of their projects. This includes the implementation of modern utility management applications such as Clean Water Supply and Electricity Distribution to optimize and reduce overall electricity consumption.

Having acquired more than RM3 billion in projects across Malaysia over the past two decades, Gagasan Nadi Cergas is proud to see their achievements play a key role in transforming the Malaysian landscape. As a responsible company, Nadi Cergas Sdn Bhd is proud to bring development and progress to as many locations as possible. Through the development of affordable housing projects and concessions, Gagasan Nadi Cergas has changed the lives of Malaysians better.

2.2 Company Particulars

Table 2.1: The table shows the information of the company.

Info	Content
Name	NADI CERGAS SDN. BHD.
Logo	 **Figure 2.1:** Company Logo.
Registration Address	8 Suria, Jalan PJU 1/42, Dataran Prima, 47301 Petaling Jaya, Selangor.
Telephone No.	
Fax No.	
Date Incorporated	26 June 1992
Email Address	hq@nadicergas.com
Company Activities	Provision of Building Construction, Civil Engineering, Landscape and Mechanical, and Engineering Services (M&E).

2.3 Organization Chart

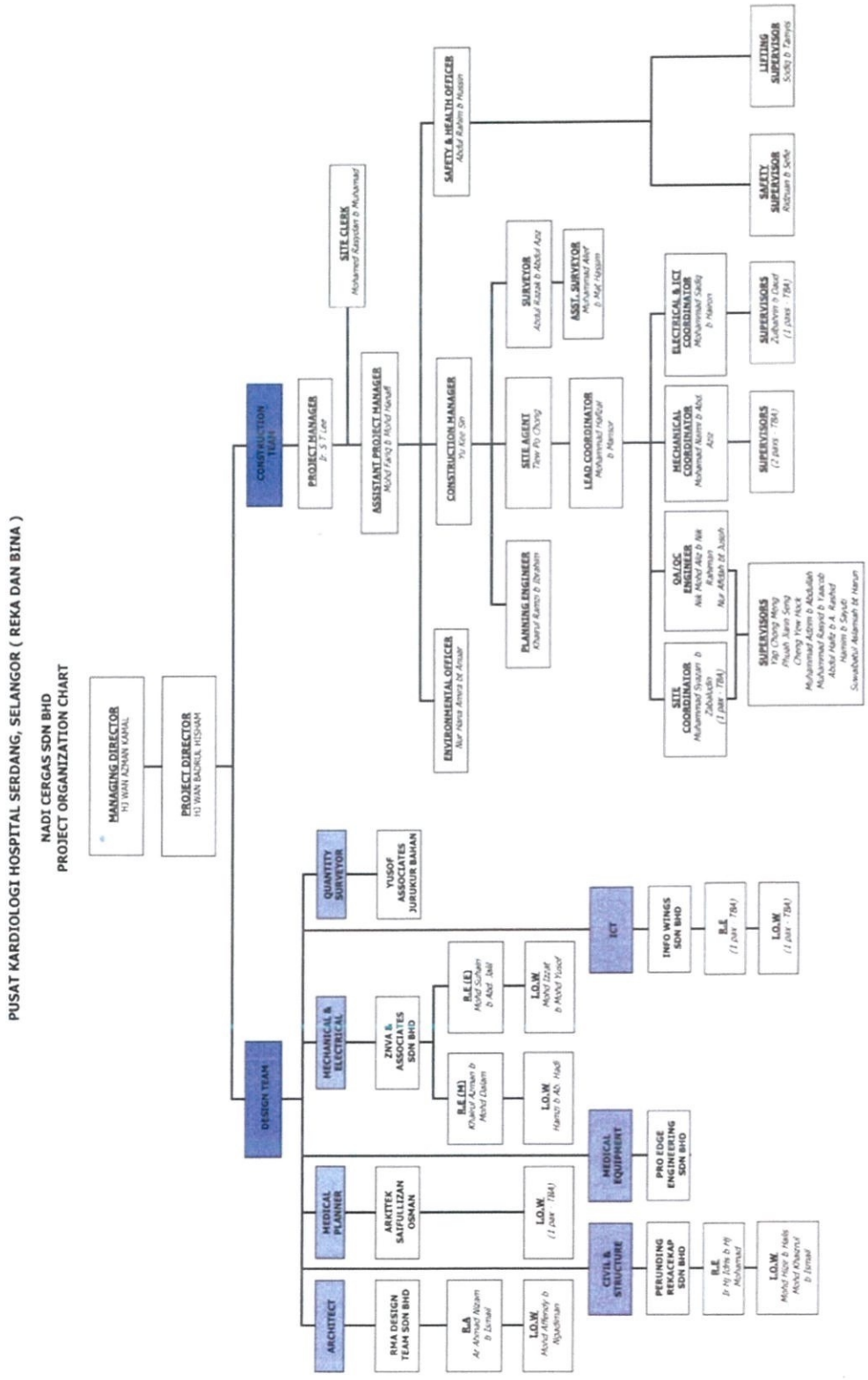


Figure 2.1: *Company Organization Chart*

2.4 List of Project

2.4.1. Completed Projects.

Table 2.2: *The Table shows the list of completed projects for the past 2 years.*

Project	Client	Value	Due date
Germany-Malaysia Institute (GMI) Headquarters, Bangi	Majlis Amanah Rakyat (MARA)	RM 330.23 Million	2008
Malaysian Institute of Aviation Technology (MIAT)	Public Works Department, Malaysia	RM 130.75 Million	2016

2.4.2. On-Going Projects.

Table 2.3: *The Table shows the list of projects currently going on.*

Project	Value	Client	Due Date
Cardiology Centre for Serdang Hospital,Serdang	RM 289,77 Million	Public Works Department, Malaysia	2021

CHAPTER 3.0: CASE STUDY

3.1 Introduction to Case Study

NADICERGAS
SENDIRIAN BERHAD (243249-U)

Figure 3.1: Company logo

Figure 3.2: Eyebird view (Source: Google map)

The case study was done at Pusat Kardiologi Hospital Serdang project and Carpark Pusat Kardiologi Hospital Serdang that using Design and Build contract which located on part of PT 46444, Serdang Hospital, Mukim Dengkil, Daerah Sepang, Selangor. The work carried out under this contract consist of the design and completion of the Cardiology Center Serdang in design and construction. In generally, this construction consists of 2 blocks. The first block is an 8-storey Cardiology Center block with 262 beds. The second block is a 9-storey parking block with M&E space. This project has only one contractor involved. This project is prepared for the client which is Kementerian Kesihatan Malaysia (KKM) and supervision under Jabatan Kerja Raya (JKR).

The project is awarded to the Nadi Cergas Sdn. Bhd as the main contractor to accomplish this project. The contractor accepted the tender, to commence the works on the date of possession stated in the Letter of Acceptance of Tender and to complete and deliver the whole of the work in conformity with the contract document. The contractor need to provide all design, services, labours, materials, contractor's equipment, temporary works, transport to and from the site and everything whether of a temporary or permanent nature required in and for such planning, design, construction, completion, testing and commissioning so far as the necessity for providing the same is specified in or reasonably to be inferred from the contract. Next, the contractor shall take all appropriate measures required of a qualified contractor to ensure that the works comply with the terms and conditions of this contract.

Figure 3.3: Sky view of site. (Source: Drone)

Figure 3.4: Sky view of main block by drone.

Figure 3.5: Sky view of multilevel car park by drone.

This Project duration is about 4 year. The contract duration for this project is 36 months or 156 weeks. It is start at March 2018 and is expected to end at March 2021. The cost of tender and contract for this project are RM 289,765,000.00 (With GST 6%). The default liability period is 24 months and liquidated and ascertained damage is RM 56,822.92 per day. The objectives of this project are to provide parking for public users because the parking space for now is quite limited and wants to build a new heart medical center to replace Institut Jantung Negara (IJN) because the (IJN) is too crowded with patients.

Figure 3.6: Project signboard

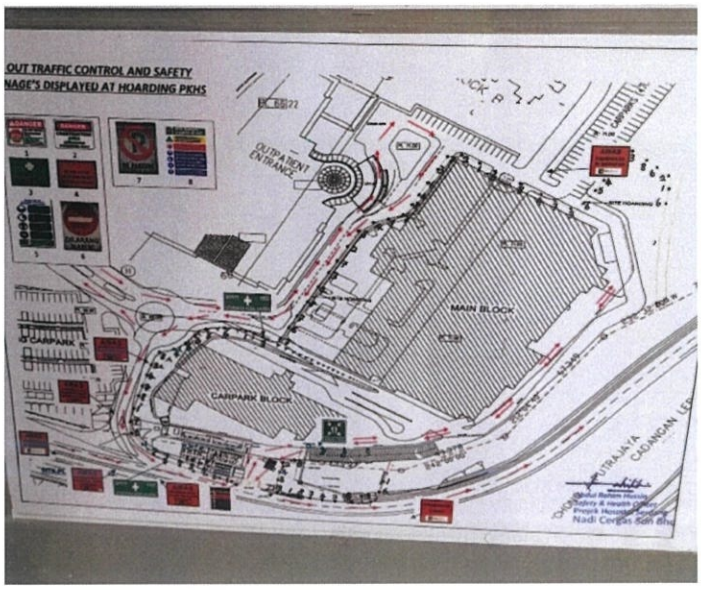


Figure 3.7: Layout control and safety of site.

This construction area is surrounding by existing Hospital Serdang on the right while there is a Temple on the left. This site construction is facing the SKVE highway to Putrajaya and Bangi on the other ways and there is a shopping complex near this site. Vehicles for construction use such as trucks and lorries are having a hard time passing through the road to this site because of the narrow passage due to vehicles parked on the sidewalks due to the limited parking space at the hospital. The land size of the proposed site was 4.38 acre or 17725.23 Sqm.

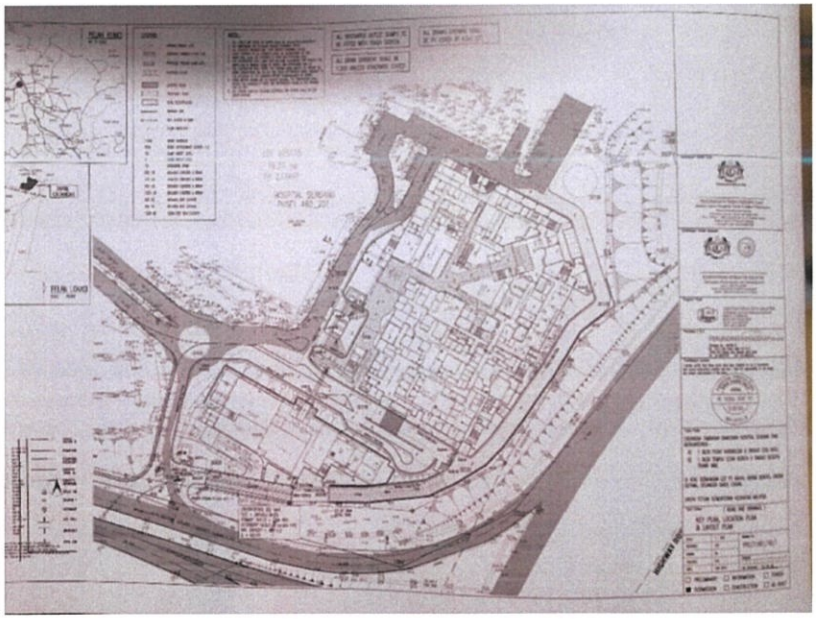


Figure 3.8: Key Plan, Location Plan and Layout Plan

3.2 Method Construction of Substructure Work

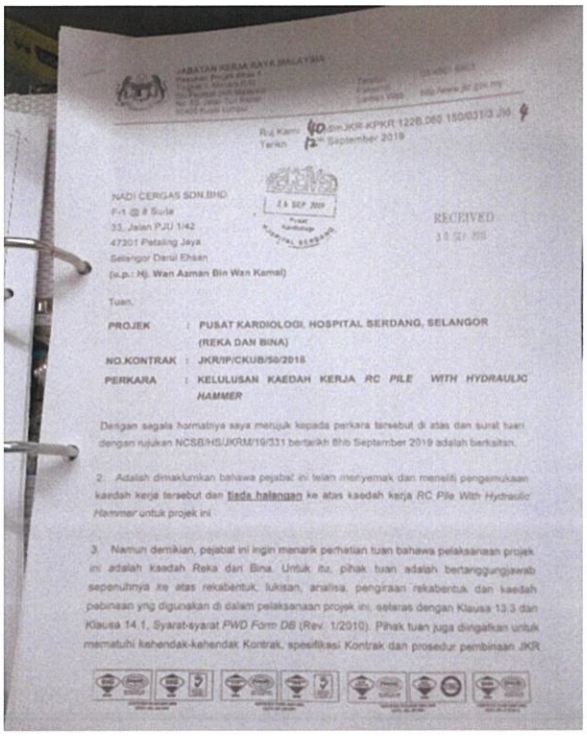
This substructure work for this project was start with piling work, excavation, pile cap, stump, ground beam and finish with ground slab.

3.2.1 Piling work

The word pile is used to describe columns, usually of reinforced concrete, driven into or cast in the ground in order to carry foundation loads to some deep underlying firm stratum or to transmit loads to the subsoil by the friction of their surfaces in contract with the subsoil. Type of pile that used by this project is Reinforcement (RC) Pile as shown in **Figure 3.9**. The construction of the RC Pile is used as foundation elements to carry loads into deeper and stable the soil layers. It is being carried out in a proximity to existing buildings where vibration, dust and noise need to be minimized.

Figure 3.9: RC Pile

For this report, the following action were taken in order to commence the piling works at site. The contractor Nadi Cergas Sdn. Bhd. had submitted "Borang Permohonan Kelulusan" as shown in **Figure 3.10** to the consultant Perunding Reka Cekap Sdn. Bhd. to get approval for the work method statement.



JABATAN KERJA RAYA MALAYSIA

Rujukan Kami: JKR.KPKR.1228.060 15/03/13 J/6
Tarikh: 12th September 2019

NADI CERGAS SDN.BHD
F-1 @ 8 Suria
33, Jalan PJU 1/42
47301 Petaling Jaya
Selangor Darul Ehsan
(u.p.: Hj. Wan Azman Bin Wan Kamal)

RECEIVED

Tuan,

PROJEK : PUSAT KARDIOLOGI, HOSPITAL SERDANG, SELANGOR (REKA DAN BINA)
NO.KONTRAK : JKR/IP/CKUB/50/2018
PERKARA : KELULUSAN KAEDAH KERJA *RC PILE WITH HYDRAULIC HAMMER*

Dengan segala hormatnya saya merujuk kepada perkara tersebut di atas dan surat tuan dengan rujukan NCSB/HS/JKRM/19/331 bertarikh 6hb September 2019 adalah berkaitan.

2. Adalah dimaklumkan bahawa pejabat ini telah meneliti pengemukaan kaedah kerja tersebut dan tiada halangan ke atas kaedah kerja *RC Pile With Hydraulic Hammer* untuk projek ini.

3. Namun demikian, pejabat ini ingin menarik perhatian tuan bahawa pelaksanaan projek ini adalah kaedah Reka dan Bina. Untuk itu, pihak tuan adalah bertanggungjawab sepenuhnya ke atas rekabentuk, lukisan, analisa, pengiraan rekabentuk dan kaedah pembinaan yng digunakan di dalam pelaksanaan projek ini, selaras dengan Klausa 13.3 dan Klausa 14.1, Syarat-syarat *PWD Form D8* (Rev. 1/2010). Pihak tuan juga dingatkan untuk mematuhi kehendak-kehendak Kontrak, spesifikasi Kontrak dan prosedur pembinaan JKR

Figure 3.10: "Borang Permohonan Kelulusan Kerja RC Pile"

The type of rig used to install the piles in this project is hydraulic frame. It is equipped with hydraulic hammer as per shown in Figure 3.11. With this hydraulic system, it enables to provide standard drop height and speed of blows. 2 pilers inclusive of operator will operate the machine.

Figure 3.11: Hydraulic Hammer

The piling rig is set right in front of the pile point (Position of the pile to be installed) on a proper level platform. The position and numbering of the pile points to be set by the surveyor according to the approved drawing as per shown in **Figure 3.12.** Once the pile points already confirmed, the hammer is to be lifted to the top of ladder and the pile to be pitched. The pile head is fixed up with steel helmet with timber and plywood cushion inside to prevent any damage to the pile head due to direct impact of hammer during driving.

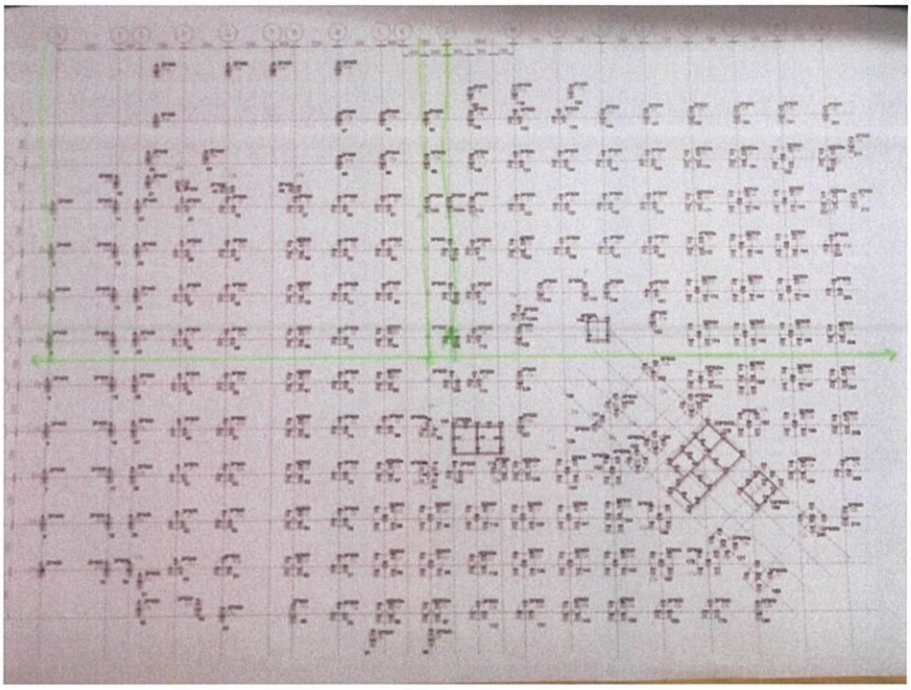
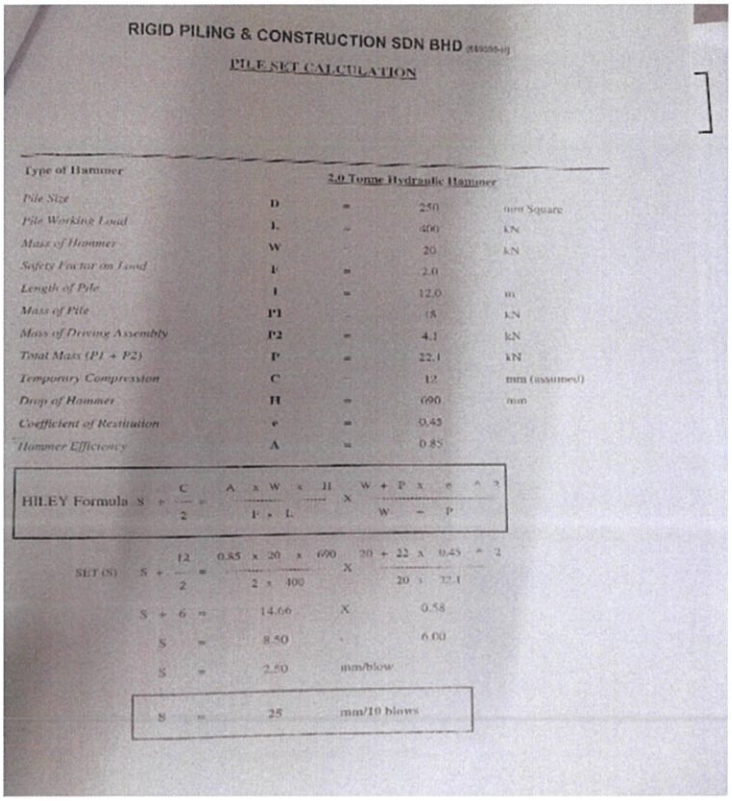


Figure 3.12: Drawing position of pile

After the pile is pitched the vertically of pile is checked with spirit level. The allowable deviation of pile is 1:75. After the verticality has been checked, start driving with the hammer at specified height at drop, which is obtained from the set calculation. This procedure is repeated until the settlement of pile has achieved its set requirement. Refer **Figure 3.13** for the sample of set calculation.



RIGID PILING & CONSTRUCTION SDN BHD

PILE SET CALCULATION

Type of Hammer			2.0 Tonne Hydraulic Hammer	
Pile Size	D	=	250	mm Square
Pile Working Load	L	=	400	kN
Mass of Hammer	W	=	20	kN
Safety Factor on Load	F	=	2.0	
Length of Pile	l	=	12.0	m
Mass of Pile	P1	=	18	kN
Mass of Driving Assembly	P2	=	4.1	kN
Total Mass (P1 + P2)	P	=	22.1	kN
Temporary Compression	C	=	12	mm (assumed)
Drop of Hammer	H	=	690	mm
Coefficient of Restitution	e	=	0.45	
Hammer Efficiency	A	=	0.85	

HILEY Formula $S + \frac{C}{2} = \frac{A \times W \times H}{P + L} \times \frac{W + P \times e^2}{W + P}$

SET (S) $S + \frac{12}{2} = \frac{0.85 \times 20 \times 690}{2 \times 400} \times \frac{20 + 22 \times 0.45^2}{20 + 22}$

$S + 6 = 14.66 \times 0.58$

$S = 8.50 - 6.00$

$S = 2.50$ mm/blow

$S = 25$ mm/10 blows

Figure 3.13: Pile Set Calculation

After that, penetration reading for 10 blows each is to be taken two times (consequently) to reconfirm that the pile has achieved its set requirement and a record is made on the graph paper for piling record purpose. Refer **Figure 3.13.**

Figure 3.14: RC Pile was driven into foundation by using hydraulic hammer

In case the pile does not achieve its set requirement then 1st, 2nd or 3rd length is to be joint up by using joint plate and thereafter, continue with repeat the step above. The record of pile driving is made during installation progress which contained numbers of blow per ½ a metre penetrated length of pile used and a number of joints.

3.2.2 Excavation

Before starting the excavation work, Temporary Bench Mark (TBM) will be established by licence surveyor as shown in **Figure 3.15**. This TBM will be used to transfer the level to the specific working area in which elevations will be taken to set out the level require. Precaution steps to be taken to ensure surface run off water to be diverted to the nearest Temporary earth drain.

Figure 3.15: Temporary Benchmark (Source: Internet)

Prior to excavation of earth, all disposal and unsuitable material to be transferred to designated dumping point by dump trucks. Refer **Figure 3.16**. Upon the completion of site clearing, excavation of earth was beginning. Machineries used for excavation works are excavator or backhoe. All excavated earth loaded directly into dump trucks and transported to designated area within or outside project boundary.

Figure 3.16: Excavate soil was loaded into dump truck by using excavator.

Before starting the work, foundation work will not commence until confirmation that all pre-construction planning and safety checks are completed. Licensed surveyor responsible for setting out the pile cap alignment. Next, excavations were generally be executed in open cut to the size, slope and elevation shown on the construction drawings. Precaution steps to be taken to ensure excavate soil wall in stable condition. Site observation required. Refer **Figure 3.17.** A small bucket or manual digging was used when excavating between piles.

Figure 3.17: Open Cut excavation.

Once the required depth of excavation identified, excavated level will be checked by using a dumpy level. Normally, excavation work were carried out deeper to allow for laying of sand bedding or crusher run. The thickness depend on the design drawings. Next step is to mark the level for cutting of piles. The final bottom founding level under each foundation was inspected by QC and compacted as per design requirements.

After final excavation, the piles were cut down to design pile cut off level as per shown in **Figure 3.18**. Removed sections was lifted out and taken to designated disposal area. After cleaning, the pile head treatment was done to connect pile to foundation.

Figure 3.18: Cut off pile

3.2.3 Pile Cap

Bottom of the excavation was be dry and tamped or compacted to a uniform level before pouring the 50mm thick lean concrete blinding layer. Refer **Figure 3.19.**

Figure 3.19: Lean concrete

Next, the formwork system to be adopted for each pile cap type and size was be as specified in approved construction drawings. Plywood sheathing with timber and steel props was used for formwork and manual labour was used for lifting and placing according to survey lines of the foundation outline. Refer **Figure 3.20.**

Figure 3.20: Formwork for pile cap

Then, the maximum permissible deviation of the center of each finished pile was 75mm in any direction from true position of the same pile. Pile top are within 75mm of the location specified on the drawings. If the eccentricity of pile exceeds 75mm it will be reported directly consultant to redesign the pile cap.

During the installation of rebar, rebar was cut and bent on site and store at bar bender yard. Installation of rebar was begin as soon as blinding concrete has hardened enough for trafficking normally 12 hours. A mobile truck crane or manual workers will be used for rebar installation. Rebar placement sequence was following the latest rebar construction shop drawings. Refer **Figure 3.21.** Suitable concrete spacers were used to achieve the desired covers and additional rebar spacers was installed to maintain support of top steel and any cast-in item.

Figure 3.21: Reinforcement bar installation for pile cap

All pedestal column starter bars were accurately located and securely fixed in the correct position. Location, spacing, vertically and cover was checked during the installation process and QC engineer was make pre-casting inspection. Consultant representative will make final inspection prior to calling up concrete. During concrete work, vibration poker was used for compaction. Keep concrete alive without performing any cold joints. Care should be taken for any formwork leakage during concreting. Manual tools and float are used to finish the top surface. The result for concrete of pile cap work can be seen as per shown in **Figure 3.22.**

Figure 3.22: Result for concrete work for pile cap.

3.2.4 Stump

After pile cap work already done, stump will be added at the top of pile cap. Formwork was placed to column stump as per shown in **Figure 3.23.**

Figure 3.23: Formwork for stump

Consultant representative will make final inspection prior to calling up concrete. Then, concrete was poured to form column stump. The position and size was checked and confirm by surveyor. During concrete work, vibration poker was used for compaction. After concrete was hard, formwork was removed and the result for concrete of stump work can be seen as per shown in **Figure 3.24.**

Figure 3.24: Result after concrete of stump

Before backfilling, formwork will be removed once the concrete had achieved the require strength and QC inspection of foundation is approved. A curing compound was be apply after removal of formwork. 1-ton compaction roller as per shown in **Figure 3.25** was used to achieve the compaction requirements for each layer. Field Density Test (FDT) to be carry out to determine the soil bearing density.

Figure 3.25: 1-Ton compactor

3.2.5 Ground Beam and Ground Slab

Before starting the work, steel bar and brc was requested from factory to be submitted for consultant approval. There are two types of reinforcement used in this construction. That is bar reinforcement and British Reinforcement Concrete (BRC). The reinforcement is used together because it accommodates more material within a structure. The reinforcement can be cut and bent according to the requirements and size used. The reinforcement bar used is a stainless-steel bar that is made of heat and formed in a smooth and twisted surface. The length of steel is made in 5m-12m. This reinforcement is used for poles, beams and stairs. BRC is used for floor structure. It comes with a large area. So, it should be cut to the size you want. Has horizontal and vertical bar reinforcement strips that will create a square shape.

Formwork for ground beam was installed by the workers as per shown in **Figure 3.26** according to the dimension of the beam which was provided in the design drawings. Inspection of formwork was done to make sure that formwork follow drawing and it must be clean before starting the concrete work. Surveyor was checked all beams are construct as per drawing with correct distance and gridline.

Figure 3.26: ground beam formwork

After that, reinforcement bar was installed into the ground beam formwork. Refer **figure 3.27**. Reinforcement bar was also been inspected to make sure grid line follow the structure drawing, to check bar lapping, bar size, link size and spacer between formwork and steel bar.

Figure 3.27: Reinforcement for ground beam

Before placing concrete, all debris was removed. All concrete was delivered in ready mix truck within reasonable time. If segregation has occurred, the material will be rejected. Concrete test cube and slump test was taken on site at the point and time of discharge. Refer **Figure 3.28**. Six 150mm x 150mm x 150mm cubes has been test at 7 days and 28 days.

Figure 3.28: Slump test was done at the site

Adequate equipment and machinery like vibrator were provided to carry out concreting work. Pouring concrete was done by mobile crane or excavator and concrete was compacted by using vibrator. Concrete was protected from contamination by falling earth or rock during and after concreting works. Construction joint was predetermined and prepared cut off formwork for joints. A proposal area for construction joint was be agreed by consultant. Pouring of concrete will stop if heavy rain occurred, and newly laid concrete covered with plastic sheet. Manual tools were used to finish the top surface. Refer to **Figure 3.29.** After concreting work was done, formwork was dismantled after two days of concrete. QC inspection was conducted to decide whether any repairs to the concrete surface are necessary. The concrete surface will be repaired by using non-shrink grout if honeycomb or defects occurred.

Figure 3.29: Ground beam after concrete done

Method for ground slab are same as method for ground beam which consist of formwork work, reinforcement work, and concreting work as per shown in **Figure 3.30, 3.31 and 3.32,** but first it will be lapping with Damp-Proof Membrane (DPM) at the first layer to prevent the concrete from gaining moisture through capillary action. Refer **Figure 3.33.**

Figure 3.30: Formwork for ground slab

Figure 3.31: Reinforcement for ground slab

Figure 42: Ground slab was done concrete

Figure 3.33: Damp-Proof Membrane (DPM)

3.3 Problem and Solution

3.3.1 Problems

Every construction will have problems that occur whether during or after the construction process. There are some common problems that the contractor, clients, labour and other parties involved in the construction must face. There are problems with foreign workers, safety and health, cost overruns, instruction from clients, communication breakdown, ethics, weather condition, duration of the project, site condition and soil condition. Some of the problems occur might have been out of control and handle so it was quite difficult to say that road construction can be carried out smoothly without facing whether any minor or major problems. These problems caused deficiency in the capacity of the piling work unless they have been tackled properly. These are the command problems that occur during the construction at this site as the following:

1. **Foreign worker**

   In this sophisticated era, many construction companies prefer to hire foreign workers due to unpleasant working condition and because of their cheap wage. The numbers of foreign workers were getting increased day by day especially from Indonesia and Bangladesh. According to the supervisor at the site, he said that this site have less problem which related to the foreign workers as they have been working in the company for a long period of time which means that, they have already know about the scope of work , laws and regulation during working.

   Therefore, one of the problems that occur during construction is accident that cause by language problem between fresh foreign workers and contractor. It is because, some of the foreign workers do not working under order, safety rules and they have difficulty in interpreting safety warning signs in construction site. Basically, this is happening to those who are newly arrived to work as they do not know how to communicate with their contractor. For example, accident can happen while they managed to use any of the machineries as they do not know how to handle but cannot ask further to the contractor because have problem in language. Injured, disabled or death can also happen due to this problem and construction productivities will be drop as insufficient workers.

2. **Safety and Health Issues**

From safety and health aspect, the safety officer of this site is very strict in monitoring the workers on whether they look seriously the rules like wearing Personal Protective Equipment (PPE) during doing their work. This is due to labours can exposed to injuries if they ignored the priority of using the safety equipment. The worker's safety and their health are on danger as they are doing intense work that required physical strength and especially the work at the higher level from the ground are extremely hazardous. They were exposed to noise, vibration and dust which can lead them to easily being affected by diseases such as flu, fewer and body injuries.

Other than that, diseases like flu and fever are those diseases that can get worse if the one having it was exposed to the environment and surrounding which is noisy and dusty. As these diseases are easy to spread through air, the other workers might get infected too if there is no precaution taken by the rightful person in-charge on monitoring the worker's health.

3. **Duration**

There is a delay for this project which was caused by weather condition. As there is delay, the project was taking longer than it was planned. When it was raining heavily, the construction work needs to be stop for a moment until the weather condition is suitable to continue working. As it was raining, there are some parts of the construction work needed to be re-do as the might have been damage from heavy rain before. Moreover, the weather condition that were going on like that for a few days has completely delayed the project longer as there is some works needed to be re-do and the one have not started yet need to take some time to be completed.

4. **Ethics**

Some of the ethics problem occurs at the site is that some days, there are workers who did not come to work without any early notice. This caused other problems as the construction is lack of manpower now which makes the delay the project from the due date. There is also the problem of workers who came late to work that has give the certain work need to be done on that day might get delay. Every project has their own schedule on the works that required to be done in that exact time. This is in order to monitor the process of construction to be steady and consistent without any delay which required the project to be given penalty for not completing the works in the supposed time.

5. **Weather condition**

The weather conditions at this site are usually unpredictable. The daily weather condition in this district is usually hot but sometimes during the afternoon to the evening the heavy rain has been occurred. the unpredictable rains make it harder for the labours to construct the building in the subjected time and the work during the rainy conditions is hazardous for them.

This rain condition also made the concreting work delayed as the concrete took a longer duration to setting in before the work to dismantle the formwork can be done. The construction work was technically delayed for some time and has caused to the delay of the completion of the project.

3.3.2 Solutions

In construction, planning is very important to avoid problems. Every problem happens is due to a lack of pre-construction planning. One of the things that every project need to have, before anything starts, is a building agreement which contains all part of project. Solution needs to change from being just the application of good ideas to a process that can be managed, measured and controlled systematically. Consequently, the standard of solution is very important. The key lies in considering solution as a management process. Each part of the company can control and improve different aspects of solutions and integrate them into the rest of the company processes.

1. **Foreign worker**

   Problems can be overcome by using visual method of communication to the foreign works. This is as works are often failed to transfer information properly. So, by using this simple approach it shows that varieties of technique can be used to deliver and give enlightenment to client. Picture or diagram to explain complicated concepts can be used as it is simple method which can be easily being understands. Visual cues are invaluable for getting everyone on the same page, not to mention but to think more creatively about new solutions. Therefore, the other solution is by using repetition. Language barrier or not, people often need to hear something more than once to understand and remember it. It is because, not anyone can remember something that just said once. So, it is very important and need to make it a regular part of communication.

2. **Safety and health issue**

   To make sure that the workers are following the rules, the safety officer required to have an inspection to check every worker's performance. They were also be given some talk about priorities their safety during working at the site to avoid any injuries. At the same time, those that did not obey the rules about wearing safety equipment can get a penalty with the worthy amount for them to be able to follow the rules onwards. The safety officer is also very strict in making sure the workers to obey the regulations all the time, not just for a few days so that the safety at the site can always be maintain without any big injuries happening like provide a notice board in the site. For hazards from any activities done inside the site for example dust which caused any disease need has to overcome by providing the protection like mask and safety attire. For noise

problem, workers can be provided with ear protection like earmuff or ear plug to prevent them from getting hear loss.

3. **Duration**

In order to avoid delaying and dragging the duration of project, the labours must work overtime nearly every day. They were provided with spotlights at every corner of the site in order to be able work till late night. This is to guarantee their safety while doing their works to avoid slipping and falling because of darkness. The overtime works also applies to only some of the labours for every day and then the other group of labours for the next day. There is also a site supervisor that monitoring the labours until late night to ensure their safety and making sure they are doing their works. Effective production planning is also omen of the key to reduce duration time of the project. Production planning is the process in which all contractors, subcontractors, and others involved in construction collaborate to create a realistic schedule. This gives proper timeline of the project so that the delay can always be covered and no other further delay.

4. **Ethics**

These workers that did not come to work without any prior notice have to been given warning letter or salary cuts due to their lack of commitment to present themselves at work. Site supervisor need to always have a toolbox talk with the workers to provide safety info on the site construction especially to new employees as well as to workers who do no understand Malay or English language. They also need to improve patrols and supervision during construction work so that employees are more discipline. In addition, management can provide incentive rewards to disciplined workers by raising workers' allowances, giving a longer rest period to the worker who works well and others, this way can increase the morale of other workers.

5. **Weather condition**

When it is raining heavily, all construction work whether on the building or in machineries must stopped at all cost. The labours dismiss from their workplace to the designated shelter area. This is to avoid the hazards that are greater during the rain for the construction work. After the rain is done, the work for the construction are being resume with precaution taken for the workplace condition whether safe or not after the rain. If the weather is always raining, labour need to be provided a temporary drainage system to prevent floods which can make time become long to complete and provide temporary reservoirs (retention pond). Site supervisor need to provide machinery for the purpose of ensuring safe. If the weather is always hot, labour need to ensure that the roads are washed with water if the weather is hot and dusty to prevent flying dust which will reduce the vision and will slow down time.

In additional, site supervisor need to provide drinking water at construction sites to facilitate workers to get drinking water to give them energy to do their jobs for the quality work and they do not have to go out to the shop during work time just to get the drinking water that will waste time.

3.4 Types of Test for Substructure Construction Work

3.4.1 Tensile Pull Out Test On 50mm x 50mm Mortar

Introduction

The test should be carried out adopted from ASTM D4541 to determine the tensile adhesion bond strength test of mortar.

Equipment

a) 16kN DYNA Pull-Out Tester
b) Metal Dolly (50 mm X 50 mm)

This method is used on the mortar onto the stiffeners to record the maximum load at the manometer. A gradual load should be applied on to the tester via metal dolly to the maximum test load. The mode of failure of test specimen shall then visually inspected and recorded. The pull-out test strength was calculated using equation of:

Pull-out strength (N/mm^2) = Maximum Load (N)/ Area (mm^2) x 1000

Figure 3.34: Result of pull-out test

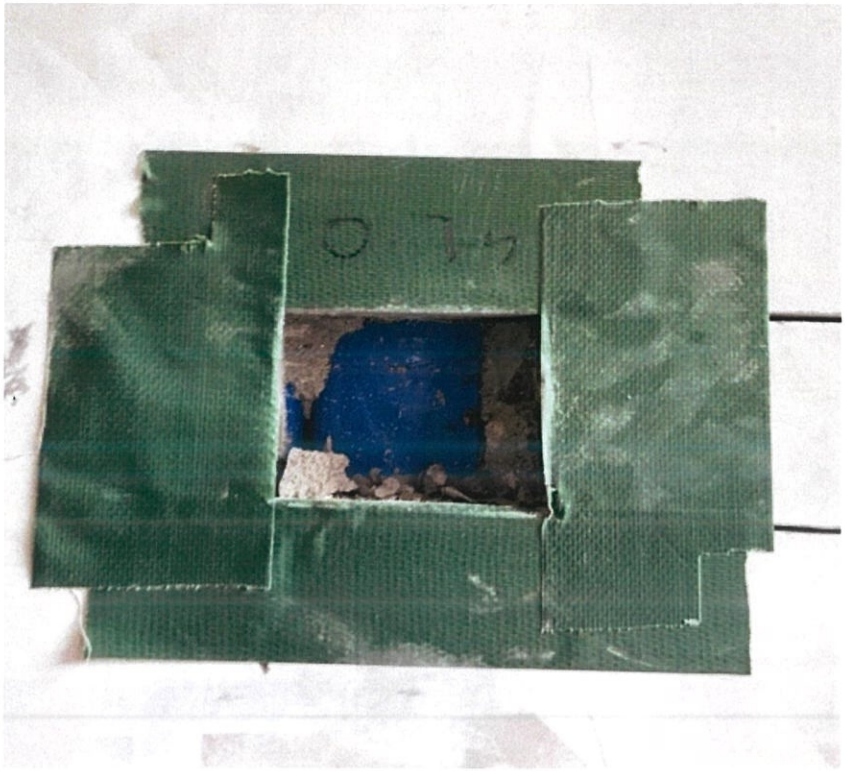


Figure 3.35: After 50mm x 50mm mortar extracted

Figure 3.36: 16kN Pull-out tester

3.4.2 Dynamic Pile Testing

Introduction

Conducted by Foundtest (M) Sdn. Bhd. This organization is specialist contractor, which is a professional engineering firm specialized in providing high strain dynamic load testing, analysis and consulting services for the piling work industry. Dynamic pile testing is performed by well trained and experienced engineers using a Pile Driving Analyzer (PDA) at site and pile wave analysis will be carried out on the signal acquired by using Case Pile Wave Analysis Program (CAPWAP).

Objectives

To predict the pile drivability, determination of pile capacity and driving stresses and as a quality assurance for the piling works as required in the specifications.

Equipment

- Pile driving analyser
- 2 strain transducers
- 2 accelerometers
- 1-4 cable
- 30 m extension cable

Background

Dynamic Pile Testing helps achieve a safe and economical driven pile installation. During construction test programs, Dynamic Pile Testing helps formulate driving criteria. During the installation of production piles, it assures that driving happens in accordance with the established criterion. It gives information on soil resistance at the time of testing and on driving performance. It also reveals driving stresses, helping prevent pile damage.

If damage is imminent, it shows an alert early enough to save the pile from complete destruction. Dynamic Pile Testing happens during driving in real time, without slowing down construction. The real-time on-screen results allow tracing changes in driving characteristic in an easy manner.

Figure 3.37: Data recorded

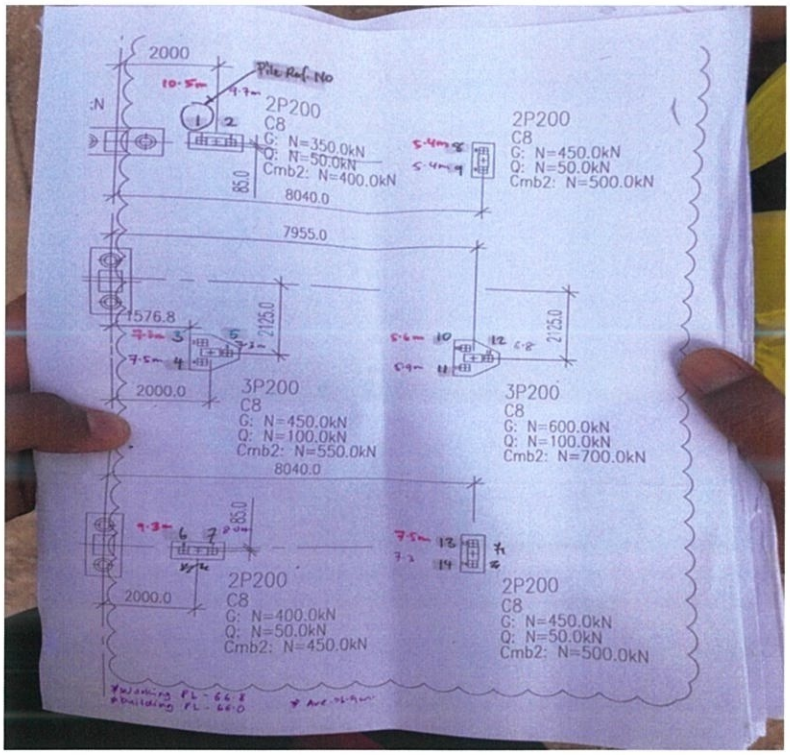


Figure 3.38: Choose minimum depth piling data

Figure 3.39: PDA test ongoing

3.4.3 Pressure Grouting Test

Introduction

Pressure grouting is method of injecting specially formulated cement-based mixes under pressure to improve strength or reduce permeability of concrete structures. Cement grouting is usually performed by drilling holes into application area to intercept open cracks, joints, fissures or cavities, then pumping under pressure balanced and stabilized grout mixes using a combination of cement, water, and additives.

Problem on site

Improper concrete and the result cause big honeycomb.

Materials

a) Sika Grout 215
b) Non shrink grout
c) Potable water

Steps of work

1. Identify area.

2. Clean all the surface.

3. Remove loosen concrete until

4. Patching or grout the area

Figure 3.40: Honeycomb problem

Figure 3.41: Pressure grouting test on going

CHAPTER 4.0: CONCLUSION

4.1 Conclusion

In a nutshell, the study is carried out in the project site where the author was doing his practical training which is at Pusat Kardiologi Hospital Serdang project and Carpark Pusat Kardiologi Hospital Serdang located on part of PT 46444, Serdang Hospital, Mukim Dengkil, Daerah Sepang, Selangor. The project is owned by Kementeran Kesihatan Malaysia (KKM). And now, the project is expected to be finished in March 2021. This project showed the progress of the substructure work including methods, problems, solutions and type of machineries used. This project was started with a land survey and ended with inspection and final walkthrough or hand-over of completed site to client. The process of this substructure work has been investigated throughout the site walk and interview with the site supervisor and successfully discovered the whole project from the starter until finished. The procedures of substructure work were not new where the method was like that of theory where it was continuously built up well. It was very clear that construction of substructure work can be successfully constructed by following the general procedures and requirements. In this construction, the most difficult problem to be solved is weather condition. This just affect the duration of the project to be completed on the supposing date and need to be extended. The problem of weather condition is a little bit hard to solve as it cannot be predicting what will going to happen during the construction work.

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