DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

PILING WORK CONSTRUCTION

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, expect for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at AHT (NORLAN UNITED) & CARRIAGE SDN. BHD for duration 19 weeks and 4 days starting from 23 AUGUST 2021 and ended on 7 JANUARY 2022. It is submitted as one of the prerequisite requirements of BGN 310 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

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Alhamdullillah, praise to Allah, the Most Merciful, the Most Graceful.
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Finally, I'd like to thank my parents, relatives, and friends for their constant support and encouragement throughout my practical training; without them, it would be difficult for me to complete my internship period, as this is my first time working in the construction sector.

ABSTRACT

Piling is a very important for a high rise building, therefore this report was conducted for the piling work construction that was held for additional block for Hospital Jerantut. The objective of this report is to learn about how the piling work construction work for a building and to know the progress to complete the piling work. To illustrate the function of piling construction as an important aspect to transferring building loads to under the surface and do all the procedure for piling work carefully. By doing all the procedure carefully, the deeper insertion of these parts provides a more stable foundation for the construction project and can avoid anything bad happen for the building.

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CHAPTER 1: INTRODUCTION

What is piling work construction? Piling is a deep foundation construction technique for transferring building loads to deep, solid strata under the surface. A hard bedrock or a compact soil bed can form the strong strata. Piles are cross-section columns of reinforced concrete, timber, or steel-concrete composite materials that are commonly circular or square in shape. They are pushed or nailed into the ground until they reach a firm layer of soil with their tip. The building's foundation is supported by the cap of piles, which are flat surfaces attached to the piles. The weight is subsequently transferred to the strata below trough pipes. Piling work is important because many diverse facilities, particularly those in the industrial sector, must be constructed in areas that are not always suitable for freestanding structures. Terminals and refineries, for example, are frequently placed near rivers, gulfs, and other bodies of water because proximity to waterways facilitates the transportation of industrial products. However, such places frequently have fragile, unstable soil that would be unable to support the tremendous weight of the structures without a robust piling foundation. Similarly, many of these areas are exposed to environmental risks such as high winds and large storms, which could jeopardise the safety and integrity of structures not supported by high-quality pilings.

They are various types of piling which is steel piling, wood or timber piling, composite piling and concrete piling.

What are the differences?

And then you should narrow down your writing to the advantages of top-down method.

At the end of this two-page description, in the last paragraph, please state the aim of your study.

the aim of this report is to discover piling work process in construction.

1.1 Objectives

The objectives of this study are:

1. to investigate the methods of piling work
2. to investigate the piling test method
3. to determine the problems occurred and solutions taken to solve the problems

1.2 Scope of study

The scope of study has been carried out at Taman Jaya 27000 Jerantut, Pahang and located at Hospital Jerantut, Daerah Jerantut, Pahang. The project had started in 20 September 2021. The construction is Additional Block for Hospital Jerantut, Pahang. House and cost Thirty-One Billion and Nine Thousand Ringgit Malaysia (RM31,900,000.00). The project is currently on going. Therefore, the focus of the study is to determine the process of the piling works. Furthermore, the problems and solution also included in this study. Even so, the study does not concentrate on the quantity of manpower or labours, the costs and the duration matters. In order to fulfil the data, there were three methods need to be carried out which is observation, interview, and document reviews. In conclusion, all further explanation relating the above method were explained as below.

1. Observation – The construction methods of piling work were observed on site every day. In addition to that, site visits were carried out when there were specific jobs for example load out and rearranging the piling. The observation include every single works made carried out by the machine operator and general worker. All the data from an observation will be recorded by writing. Other than that, the pictures and video will be record by IPhone 7. This is because by having a pictures and video it will make easier to recall especially when it come for construction method. The observation normally took just like an hour if it has something to know.

2. Interviews – the unstructured interview has been done on site visits. Usually unstructured questions will be pointed to the supervisor, site coordinator machine operator and workers at the construction site, especially if there were something new

work in site started. for example, when the piling work started. Furthermore, the semi-structured questions also been carried out which is the question will be prepared before asking directly to the site supervisor. For example, about the project background the price and others, all the information and data that has been given will be recorded in the notebook. Both the unstructured and semi-structured questions will be conducted at office and at site project which will take from time to time

3. Document reviews – the type of documents that has been refer are site diary which is used to know the progress of project from day to day. Other than that, is company profile which is to know about company background and to know about the completed project and ongoing project. All pertinent information will be noted down in a notebook, while documents containing diagrams, such as architectural and structural plans, will be photographed with an iPhone 7. It's meant to be used in the future if the document isn't available.

CHAPTER 2: COMPANY BACKGROUND

AHT (NORLAN UNITED) & CARRIAGE SDN. BHD. was a wholly owned Bumiputera company incorporated in 1982.The Company's principal activity was project construction and management. The company was registered with Pusat Khidmat Kontraktor (PKK) as a class A (Bumiputera) contractor and also with Lembaga Pembangunan Pembinaan Malaysia (CIDB) grade G7. AHTNUCSB successfully achieved its ISO 9001:2015 on 27th October, 2018, "Provision of Construction of Building, Civil Engineering including Project Management and Road Maintenance. AHTNUCSB has since actively involved in various construction disciplines and engineering supported with experience engineers and technical specialist with diversified engineering and management background.

AHTNUCSB has over the years undertaken and successfully completed project in various locations both for government and private developers. Project completed include those requiring fast-track and special expertise. AHTNUCSB main activities are building construction, mechanical and electrical and infrastructure works. The total value of projects carried out is more than RM 2.5 billion. AHTNUCSB's capabilities in the construction industries and with support from suppliers and financial institution, AHTNUCSB is committed to be one of the leading contractors in providing reliable services and products.

1. Mission of AHT (NORLAN UNITED) & CARRIAGE SDN. BHD
    - to deliver dependable and high-quality services and goods to customers
    - to supply clients with innovative engineering solutions, new approaches, and creative ideas
    - Ensure that the company's growth into a multidisciplinary construction is realised through specialisation and skill.
    - to complete all projects on time and to the quality standards set out
    - Ensure staff development through providing effective, efficient, and high-quality training.

2. Vision of AHT (NORLAN UNITED) & CARRIAGE SDN. BHD
    - establishing the company's reputation as a global leader in construction
    - branched out into multi-disciplinary construction
    - constructing a massive structure that future generations will admire
    - to meet the demand for progress in the future on a national scale

3. AHT (NORLAN UNITED) & CARRIAGE SDN. BHD policy

    AHTNUC is dedicated to meeting the needs of its clients in terms of project completion time, specifications (quality of workmanship), and the efficacy of its quality management system.

2.1 Completed projects

AHT (NORLAN UNITED) & CARRIAGE SDN. BHD has monitored many government projects that have been completed under main contractors as shown in Table 1.

Table 1: Completed project

Project's Name	Contractor's Grade	Price (RM)	Duration	Started	Estimated to Finish
Recommendation of build the toilet and drainage system at scout camp Telaga Batin, Kuala Nerus, Terengganu Darul Iman.	Grade 7	RM 991,000000	16 weeks	Jun 2016	Sept 2016
Construction of Pejabat Jabatan Audit Negara, Negeri Terengganu	Grade 7	RM 17,547,000	120 weeks	Sept 2015	Feb 2018
Recommendation to reconstruct and upgrading Sekolah Daif using IBS at Semenanjung Malaysia (Fase 1) Year 2018 – Negeri Kelantan (Pakej 2)	Grade 7	RM 3,953,000	16 weeks	Mac 2018	Jun 2018

2.2 Ongoing projects

AHT (NORLAN UNITED) & CARRIAGE SDN. BHD monitoring ongoing government projects under main contractors as shown in Table 2.

Table 2: Ongoing projects

Project's Name	Contractor's Grade	Price (RM)	Duration	Started	Estimated To finish
Enhancing route 64 Jalan Benta – Jerantut – Maran fase 3 segment 1	Grade 7	RM 82,000,000	140 weeks	16/8/2021	15/8/2024
Additional block for Hospital Jerantut, Pahang	Grade 7	RM 31,900,000	140 weeks	18/8/2021	15/8/2024

2.3 Organization Chart

At this project, the Project Manager's is Azmi bin Ahmad. He was responsible in planning and developing the project idea. He also has to monitor the progress of project and set the deadline in each work. In addition, he also took responsible in managing the money to make sure the project runs without undue expense.

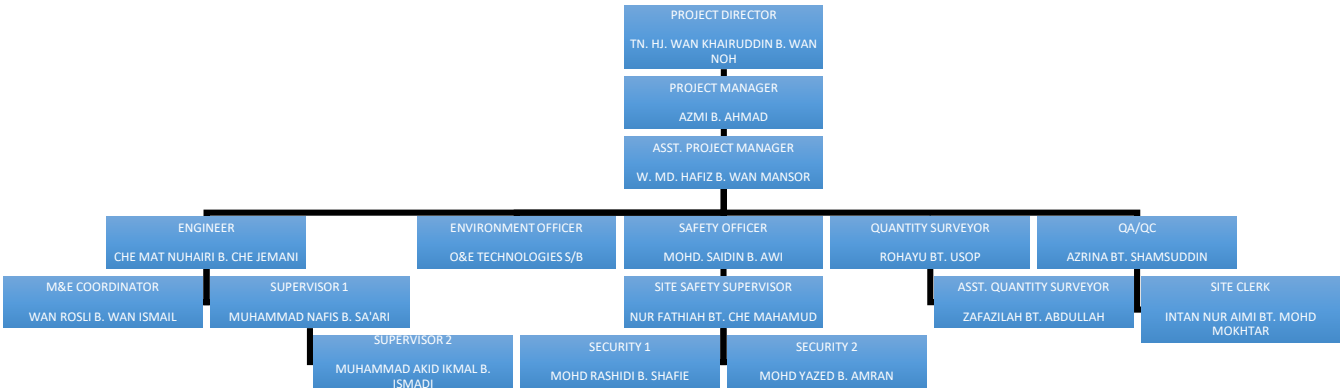

Figure 1: Organization Chart

CHAPTER 3: CASE STUDY

3.1: INTRODUCTION TO CASE STUDY

The case study was about the piling work construction process for additional block for Hospital Jerantut, Pahang. The project has started the construction in 18 August 2021. The cost of construction approximately thirty-one billion and nine hundred thousand Ringgit Malaysia (RM 31,900,000.00). Currently, the project progress is still on going. Thus, the study will be explained not only regarding installation but including the machinery and tools, the piling work process and the problem and solution of the construction. Nevertheless, the study does not concentrate on cost matters and manpower. The site location took place at Taman Jaya, 27000 Jerantut, Pahang.

Figure 2: Project Location

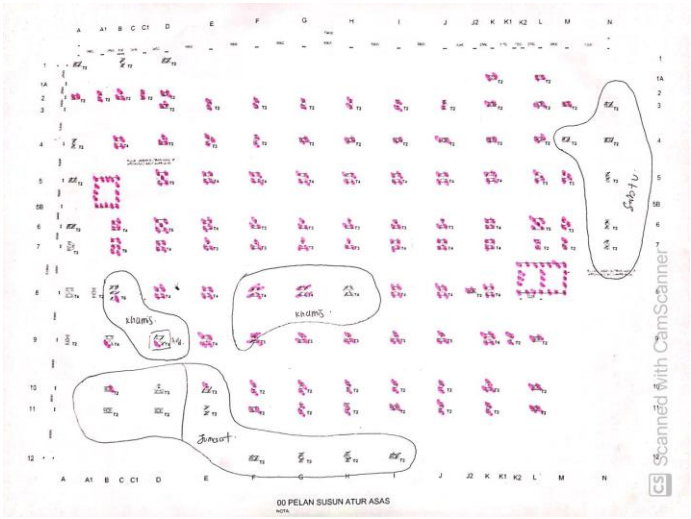

Figure 3: Piling point plan

3.2: INVESTIGATE THE METHOD OF PILING WORK

3.2.1: PILING WORK EQUIPMENT

First and foremost, there was the injection pile with a pile jacking mechanism was required for piling construction and the "gripped" system was utilized. In order to produce the desired counter jacked in force, dead weight will be added. Crane, jackhammer, welding set, hammer, anti-rust paint, diamond cutter and generator set were among the other equipment that needed.

Figure 4: Injection Machine

Figure 5: Crane

Figure 6: Welding set

Figure 7: Hammer

Figure 8: Anti-Rust paint

Figure 9: diamond cutter

Figure 10: Generator set

3.2.2: MATERIALS

Next, the materials that has been used was 250mm x 250mm RC Pile and had two part which is the starter and extension. The starter was nine metres and the extension was six metres long. The RC piles shall be manufactured by SIRIM'S approved plat and manufacture.

Figure 11: 250x250mm RC pile (starter)

Figure 12: 250x250mm RC pile (extension)

3.2.3: SETTING OUT THE PILING POINT

Then, the surveyor will take the job to setting out the point to pile using the theodolite. When the surveyor found the right location, the point will be set out using steel rod and tie with rope to make it easier to locate the point which was shown in Figure 14. The pile then would be pitched and positioned into the exact pile position such that the reference steel rod was equidistant from the pile face

Figure 13: Setting out piling point

Figure 14: Marked point

3.2.4: PILING WORK PROCESS

When everything was ready, all handling and lifting will be at the designed lifting points and support points and ready for pitching, installation of pile, extension and setting the criteria.

During pitching and installation, the verticality will be continuously monitored and plumbed to ensure the pile is central in line with the pile axis to receive the ram to prevent pile whip, twist or rotation. Each pile shall be clearly marked with red ink at 500mm intervals along its length just like shown in figure 15 to enable the jacked in

pressure to be record at every 500mm depth of pile penetration. If the pile will be extended by butt-welding the steel plate on the pile heads.

Figure 15: Marked pile

The vertical support structure of the jacked-in machine is plumbed to ensure verticality. This is achieved by adjusting the four stabilizers. Pile shall be lifted and inserted into the equipment by crane. The pile shall be position into the "grip" of the equipment and gripped the pile body. Once the pile is vertical and in position, jacking commences. During pile installation, the hydraulic pressure of main jacks measured by the pressure gauge, and the corresponding pile penetration are recorded by the site staff at regular intervals. The pile may be extended by means of welding. Each pile was jacked in continuously until the required resistance or penetration is reached or usually called as “set”. The corresponding pressure in the main jacks and the penetration are recorded. The portion of the installed piles which is above ground may be cut to enable movement of rig. The jacked-in force is determined by the JKR Jerantut which was 126 Tonne, once the required pressure correspond to the required jacked-in force is indicated in the pressure gauge, the pressure is held for 30 seconds. The pile will be extended by butt-welding the steel plate on the pile heads. On completion of welding the slag will be chipped off using the diamond cutter and would be brushed by the anti-rust paint.

Figure 16: Piling in griped position

Figure 17: Pressure gauge

Figure 18: Setting out piling on the piling point

Figure 19: installation of extension pile

Figure 20: butt welding

Finally, when the pile has reached its bearing capacity, special attention should be paid to recording the set pile pressure by maintaining the set lifting pressure for 30 seconds according to the established criteria and the balanced piling would be cut by diamond cutter.

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Figure 21: setting up to get criteria

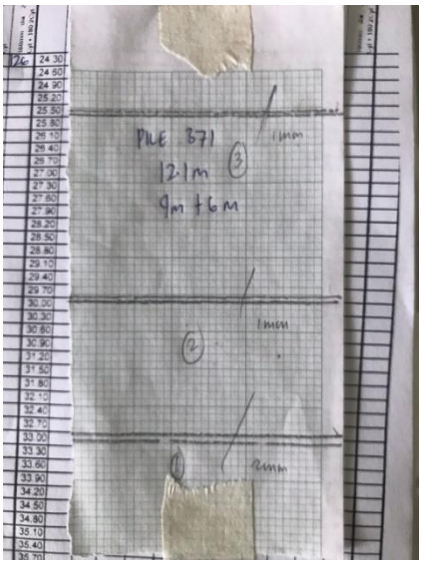

Figure 22: Example for the criteria result

Figure 23: Cutting the balanced piling

3.3: INVESTIGATE THE PILING TEST

After the installation of pile was done, the pile was ready to be test with two types of test which are Maintain Load Test (MLT) and dynamic pile testing using the Pile Driving Analyser (PDA).

3.3.1: MAINTAIN LOAD TEST (MLT)

Following the completion of the main piling operation, chosen piles will be load tested. The test load wouldl be equal to or greater than the required load. The static test will be conducted according to the S.O.'s instructions. accommodate the loading and

settlement measuring equipment and to prevent damage from the concentrated load from the loading equipment, a mild steel plate with a thickness of not less than 10mm will be put on the top of the pile head. The plane surface of the mild steel plate must be parallel to the pile's vertical axis in order for the test load to be distributed equally for the preparation of pile head.

Then, the settlement for measurement will be four dial gauges will be equally spaced around the pile head and would be held by magnetic base and the magnetic bases are attached to the hydraulic jack. The strain that has been imposed on the pile was the hydraulic pile driver machine which the total weight of it was 206.6 Tonne. Next, the selected pile would be jacked for 2 hours and every 15 minutes the data would be recorded and every 2 hours the load would be added. In addition, there would be two time the load would be maintain which were for 12 hours and 24 hours. The load that would be added was already been set by the company that handle the MLT test which was shown in figure 22

JACK	NO	TONNE	PSI	
LOAD	0	0.00	0.00	
LOAD	1	11.25	596.25	
LOAD	2	22.50	1192.50	
LOAD	3	33.75	1788.75	
LOAD	4	45.00	2385.00	(Maintain 12 Hours)
UNLOAD	2	22.50	1192.50	
UNLOAD	0	0.00	0.00	
LOAD	1	11.25	596.25	
LOAD	2	22.50	1192.50	
LOAD	3	33.75	1788.75	
LOAD	4	45.00	2385.00	
LOAD	5	56.25	2981.25	
LOAD	6	67.50	3577.50	
LOAD	7	78.75	4173.75	
LOAD	8	90.00	4770.00	(Maintain 24 Hours)
UNLOAD	1	67.50	3577.50	
UNLOAD	2	45.00	2385.00	
UNLOAD	3	22.50	1192.50	
UNLOAD	4	0.00	0.00	

Figure 24: load and duration for the MLT test

Figure 25: Maintain Load Test (MLT)

Finally, If the settlement is less than the following and the load test is regarded passed:

a. Settlement at working load must be less than 12.5mm.

b. Settlement at twice working load shall be less than as 38mm.

c. After unloading, there must be less than 6.50mm of residual settlement.

3.3.2: Dynamic Pile Testing using the Pile Driving Analyser

The next pile test was the dynamic pile testing using the Pile Driving Analyser which was known as (PDA) test. The objective of this test was to predict pile driving capacity, determines pile driving capacity and pile driving tension, and is used as a quality assurance for pile driving work according to the requirements of the specifications.

The preparation to perform the PDA test was the area of the selected pile needed to di for 1 metre deep.

Figure 26: preparation for PDA test

The apparatus that needed to do the PDA test were hydraulic hammer, Pile driving analyser (Model PAK/PAL/PAX) and the model that has been used in this project was the PAK model it was used to display and recording the data. Other than that, there was also the strain transducer. It was as an accelerometer used to detect induced strain over time in a collision event and to obtain the induced acceleration of pile particles over time in a collision event.

Figure 27: Pile Driving Analyser model (PAK)

Figure 28: Strain Transducers and Accelerometers

Figure 29: Hydraulic hammer

How the PDA test work was the Strain Transducers and Accelerometers need to be prior to the initial driving, three 6mm diameter holes are drilled on opposite sides of the pile and at least two strain transducers and two accelerometers are attached to the pile at the pile head for dynamic testing. The minimum distance from the pile head must be 1.5 times the pile diameter or a safe distance so that the gauges are not damaged during the pile lifting prior to the dynamic test. At least two strain transducers and two accelerometers must be employed. Ramset plugs are used to secure the gauges to the pile. Gauges affixed to the pile will capture dynamic measurements of force and velocity. To avoid damage during pile hoisting, the Strain Transducers and Accelerometers must be installed at or at a safe distance from the pile head. Before raising the pile segment to the installation location, a cable or wireless transmission connects the sensors near the pile head with the Pile Driving Analyser, which is placed a safe distance away from the pile.

Figure 30: Installation of Strain Transducers and Accelerometers

When everything was ready, the customer will provide and operate the machinery for lifting the pile prior to the Dynamic Pile Test, as well as the piling hammer to apply a driving force to the pile. The hammer should be concentric with the pile and axially

aligned with it. To facilitate the placing of the hammer, a secure means of guidance system must be supplied, as well as a suitable hammer and pile cushion to control the driving stress so the worker put some hard soil on top of the pile just like JKR Jerantut command. Before the real test would be done internal calibration test shall be performed to make sure the apparatus work well.

For the real test, the pile hammer hits the top of the pile and the accelerometer and the strain transducers obtained the data and convert it into velocity and force measurements. The measured values are displayed on the pile driving analyser (PDA). The test should be started with a relatively light hammer blow to check the functionality of all test devices and evaluate the measurement data for the first time. Of the initial data based on quality, test equipment and equipment may need to be adjusted or repaired. Then follow the client / consultant / contractor's instructions to provide sufficient impact energy according to the corresponding drop height. The Pile Driving Analyzer (PDA) should collect, record, display, and store dynamic data for each impact at reasonable sampling times according to specified installation criteria.
Force and speed-time signals should be displayed on-site by test equipment to assess load bearing capacity, pile condition, and operating condition.

Figure 31: Setting up of hammer

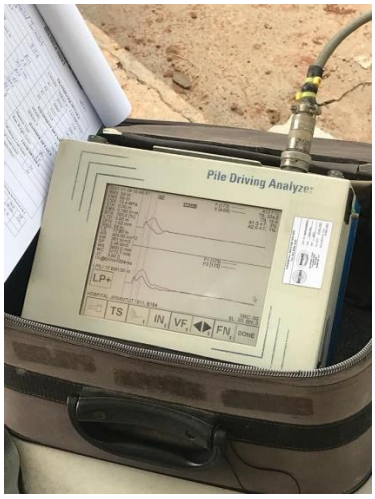

Figure 32: PDA test result after the blow

3.4: DETERMINE THE PROBLEMS OCCURRED AND SOLUTIONS TAKEN TO SOLVE THE PROBLEM

The problems that happened during the piling work were when the piling was being nailed down it hit the underground pipe that didn't have in the plan because it already been there for long ago so which can cause massive leak. The solution for this problem was called the plumber or the Pengurusan Air Pahang Berhad (PAIP) to fix the pipe as soon as possible.

Figure 33: massive leak

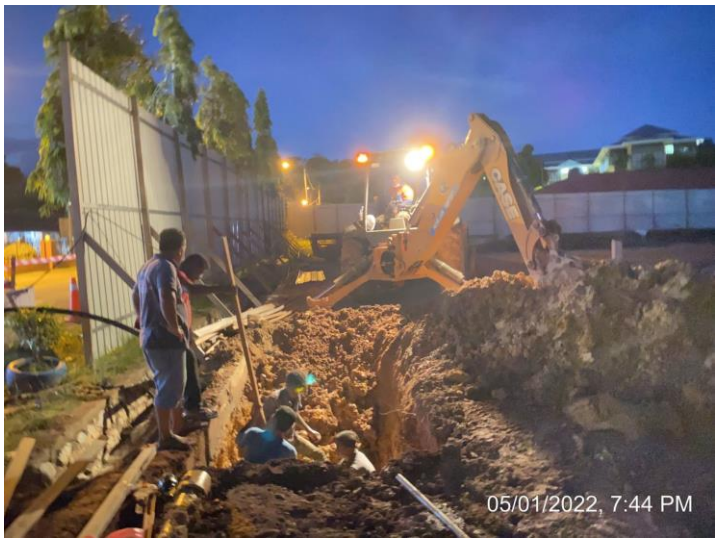

Figure 34: Fixing pipe work

Last but not least, the problem that can happened during piling work was the pile can be fracture under the surface and sometimes the pile can't reach the hard layer or can't be "set". The possible outcome of this problem was because under the soil have something hard such as hard rock and when the pile hit it will be fracture and also under the ground have an underground cave so the pile will always be going in even after being added the extension. The solution for this problem was the surveyor had to redesign a new point.

Figure 35: Fractured pile

4.0: CONCLUSION

In conclusion, the piling work process was an important thing to build a high rise building especially for the project to make additional block for Hospital Jerantut. Because of that, every process and test should be held carefully and full of detailed to make sure any mistake could not be happening. If some problem happened, the problem would be solving calmly and as fast as possible.

Most of the method was similar to the theory but just a little bit different in the equipment, material and other.

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