



**DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)**

**TITLE:
STATIC LOAD TEST FOR SPUN PILE PILING**

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DECEMBER 2018**

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STATIC LOAD TEST FOR SPUN PILE PILING**

accepted in partial fulfilment of requirement has for obtaining Diploma in Building

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein. I prepared this report during the practical training session that I underwent at Jabatan Kerja Raya for duration of 14 weeks starting from 12 September 2017 and ended 10 December 2017. It is submitted as one of the prerequisite requirements of DBG307 and accepted as a partial fulfilment of the requirements for obtaining the Diploma in Building.

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Putting in a nutshell, my special thanks to my beloved parents for their sacrifices over the years.Thank you so much.

ABSTRACT

Piling is one of the elements that are vital in the building construction. Therefore, this report will discuss about the test that are use in construction piling based on the project at Jabatan Kerja Raya Kota Bharu, Kelantan. This report explain about the test of piling used in the construction and the sequence of the piling used. In order to complete this report, an observation and an interview with the person in charged has been done. In conclusion, this report will state the overall element about the piling test at Jabatan Kerja Raya Kota Bharu, Kelantan. There is an information that can be taken from this research which is this test is important for check the strength for piling

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CHAPTER 1

1.1 Introduction

Static Load Test or the other name is Maintain load testing is an in situ type of load testing used in geotechnical investigation to determine the bearing capacity of deep foundations prior to the construction of a building. It differs from the state dynamic load test and dynamic load testing in that the pressure applied to the pile is slower.

A pile load test is a direct method of determining the ultimate geotechnical capacity of a pile. Static and dynamic pile load tests can be performed on drilled or driven piles to evaluate either axial or lateral capacities. Static tests consist of loading piles and measuring deflection. Dynamic tests attempt to obtain static pile capacities generally using stress wave analyses of pile deflection caused by dynamic loads. The typical means and methods used in static tests and various dynamic pile load test methods, which are generally easier to perform and more economical, are discussed in the sections below.

As mentioned earlier, pile load tests are generally performed to either prove that piles are capable of sustaining the ultimate design load proof test or to gain more detailed information that will enable a more efficient design load-deformation test. For a proof test, a test pile is loaded to the ultimate design load (allowable design load times the factor of safety) and the deflection is measured at the pile head. If the deflection is within allowable levels, the test has proved that the pile is acceptable. Proof tests are generally performed during construction as the piles are installed. (Wikipedia,2013)

1.1.2 Objectives

The objective of industrial training are as follow:

- i. To identify the component of Static Load Test.
- ii. To identify the procedure of Static Load test for spun pile piling
- iii. To determine the advantages and disadvantages on using Static Load Test on Spun Pile

1.2 Scope of Study

For this construction, it has been carried out at Penambang, Kota Bharu, Kelantan and this construction is to build Klinik Kesihatan Jenis 3. For this report, this focus on piling load test, from the start of the test work until the end or the piling test for piling work at this construction site.

For this piling work, this have study that it is important to do the piling test before the structure work. It need a lot of energy with is from the workers and from the machine and also it is costly. For piling load test, it need specific machine and tools make the piling work done perfectly and without any error. It also need a specialist workers with means, it need professional worker or professional labours to do the piling load test because to control the machine of the piling is hard to be handle and only the professional labours or experience labours can use the machine. This piling test is using on concrete type of piling and it is a spun piling type which is the type of piling load test is Static Load Test.

The machine used for this test which is Static load test is Hydraulic Jack in pile machine, hydraulic pump machine and another components which is dial gauge, and connector (dolly).

1.3 Method of Study

i. Observations

The observation make at Klinik Kesihatan Jenis 3 about the method of test for the pile by using Maintain Load Test. The observation was taking out in 1 weeks including 3 days 2 nights at site to see the progress of the test with the specialist in piling. The observation was attached with notes, pictures and a video.

ii. Interviews

The interviews was taking out with two person which is the Project Manager of the company and the labour that are control and record the Maintain Load Test which is from sub-contractor, KELPILE. The location for Static Load Test is located at TNB Sub-station with help from project manager. When the test is start, it used to unstructured-interviews with the labour that are controlled the test with some questions about the test.

iii. Document reviews

There are some documents that are used as a references which is drawing and plan of site construction, tender of the project, the data of the test, and some pictures at site.

CHAPTER 2.0

COMPANY BACKGROUND

2.1 Introduction of Company



Figure 2.1 Logo of JKR Kota Bharu (JKR Kota Bharu)

While Kelantan JKR was established in 1938 that works to provide infrastructure and land improvements. Some of the tasks associated with the Department of construction works drainage and irrigation has been isolated for the establishment of the Drainage and Irrigation Department -DID (JPT -Shake Drainage and Irrigation which is now known as the Department of Irrigation and Drainage -JPS) in 1956. In Kelantan JKR its early stage, headed by a 'State Engineer' has branch offices are divided into three areas, namely West Kelantan JKR, Kelantan JKR Central and North Kelantan JKR headed by an Executive Engineer prior to the establishment of the Office of the PWD PWD Colony and later the Office foreach District The State is headed by the District Engineer.

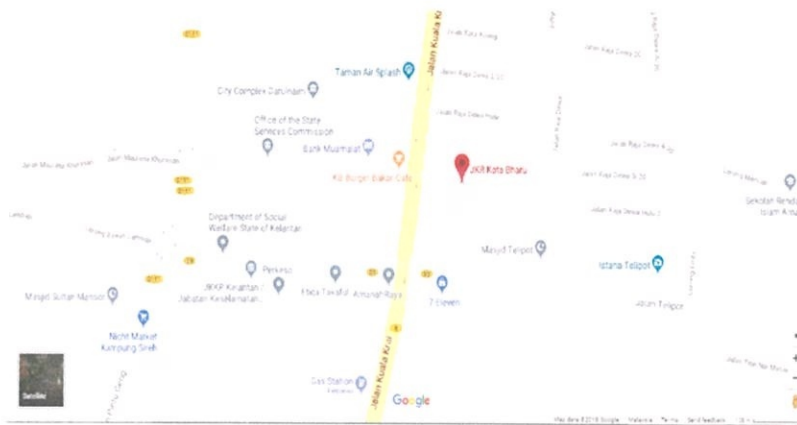


Figure 2.2 The location of the company's office.

(Source: Google Map)



Figure 2.3 The building of the company

(Source: Google Earth)

2.2 Company Profile

VISION

To become a world-class service provider and center of excellence in asset management, project management and engineering services for the development of the nation's infrastructure through creative and innovative human capital and state-of-the-art technology.

MISSION

PWD mission is to be a factor to national improvement by:

- i. Helping our customers grasp the basic information and providing services through collaborations as a strategic partner.
- ii. Standardized our procedures and systems to deliver results dependable services.
- iii. Provides asset management services and an effective and pioneering project.
- iv. Strengthen existing engineering expertise.
- v. Developing human capital and new competencies.
- vi. Prioritizing integrity in delivering the service.
- vii. Fostering a well-proportioned relationship with the community.
- viii. Preserving the environment in service delivery.

2.3 Organization Chart

CARTA ORGANISASI BAHAGIAN BANGUNAN JKR KOTA BHARU

2.3 Organisation Chart

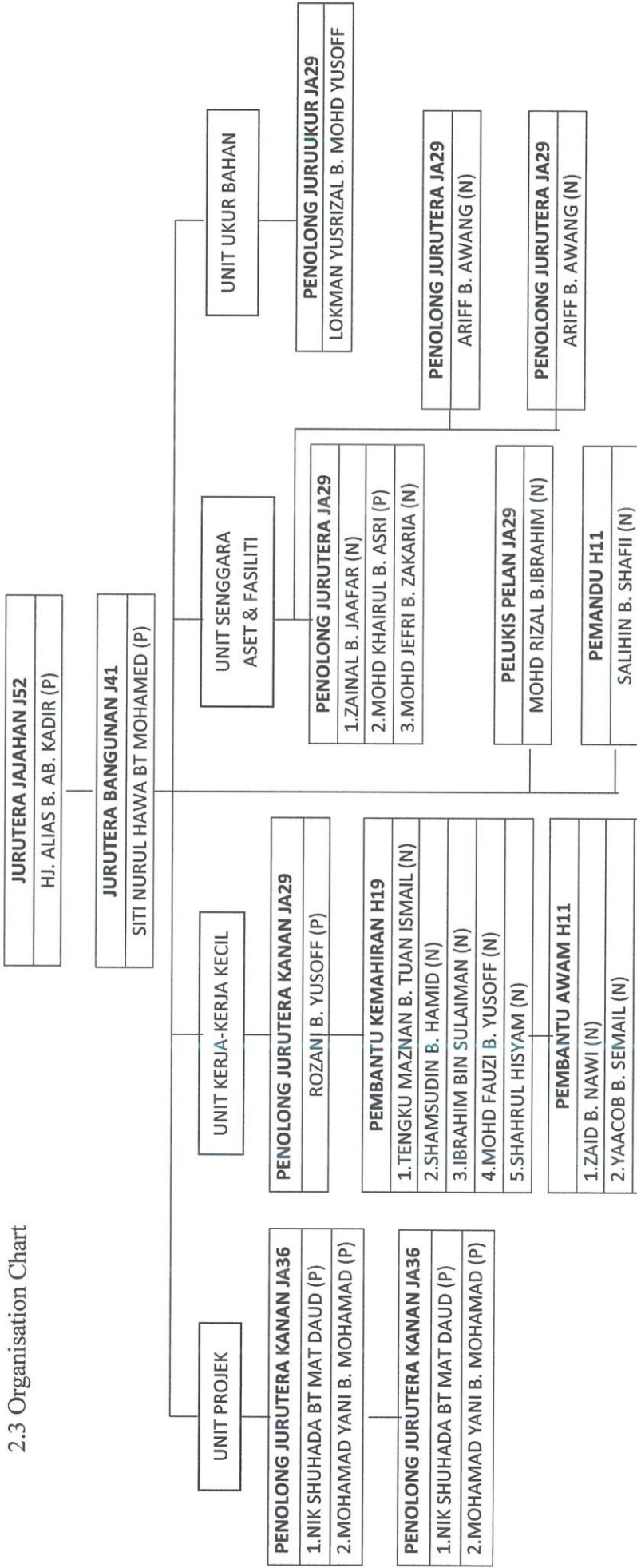


Figure 2.4 The organization chart of JKR Kota Bharu

2.4 List of Project

Table 2.4.1 The completed project

No.	List of Contracts or Project	Cost	Date of Commencing/ Completion.
1.	Kerj-kerja baikpulih struktur bumbung bangunan serta kerja-kerja yang berkaitan di Sek.Keb.Sabak, Kota Bharu	RM 248,000.00	15.03.2018 / 27.05.2018
2.	Kerja-kerja baikpulihstruktur bangunan serta kerj-kerja yang berkaitan di Sek. Keb. Kg. Sireh, Kota Bharu	RM 200,000.00	29.04.2018/ 11.07.2018
3.	Kerja-kerja baikpulih struktur bumbung blok kantin serta kerja-kerja yang berkaitan Sek. Men. Keb. Pengkalan Chepa, Kota Bharu	RM307,400.00	29.04.2018/ 18.08.2018
4.	Pembinaan Padang Bola Sepak Tiruan (Artificial Turf) Di Komplek Sukan Padang Perdana,Kota Bharu , Kelantan	RM 4.134 million	10.01.2018/ 08.01.2018

Table 2.1

Table 2.4.2 The project in progress/ upcoming project

No.	List of Contracts and Projects	Cost	Date of Possession/Completion
1.	Klinik Kesihatan (Jenis 3) Penambang, Kota Bharu, Kelantan	RM 21,344 million	11.12.2018/ 29.12.2019
2.	Projek Mahkamah Kota Bharu, Kelantan	RM 100 million	30.08.2016/ 01.04.2020
3.	Cadangan Membina Dan Meroboh Sebuah Bangunan Tambahan Jabatan Perubatan Transfusi, Hospital Raja Perempuan Zainab 2, Kota Bharu, Kelantan	RM 6,643 million	2.05.2017/ -
4.	Pembinaan Tapak Perkhemahan Di Tapak Pusat Latihan Pasir Mas Kelantan	RM 3,371 million	-
5.	Klinik Kesihatan (Jenis 3) Dengan Kuarters Kok Lanas, Kota Bharu, Kelantan	RM 30 million	-

Table 2.2

CHAPTER 3.0

CASE STUDY

3.1 Introduction to Project

A building or structure's soundness starts with a strong foundation, especially the piles. As a part of foundation's quality assurance, Static Load Test, also known as Static Load Test is necessary to ensure the pile that was driven could take the design load of the structure. During this test, load would be applied on the selected pile and the pile settlement under the acting load would be recorded. As a common practice, pile would be loaded up to twice of the working load, which is regarded as the Test Load of the pile. (Leav ,2013)

Prior testing, the pile head shall be cut off or built up to the necessary elevation and shall be capped appropriately to produce a bearing surface perpendicular to the axis of the pile. The arrangement shall be such that none of the test load is carried by the ground under the cap. (Wikipedia,2012)

As in the project for Klinik Kesihatan Jenis 3 Penampang, a piling which is spun pile with the length of initial pile is 12m and length of extension is 6m with diameter of 350mm are used at the site at TNB Sub-Station place after severe calculation for the load need to be transmitted from the civil engineer, works are then been proceed. Static Load Test are using High Jack In Pile machine for 1 piling cap for the test.

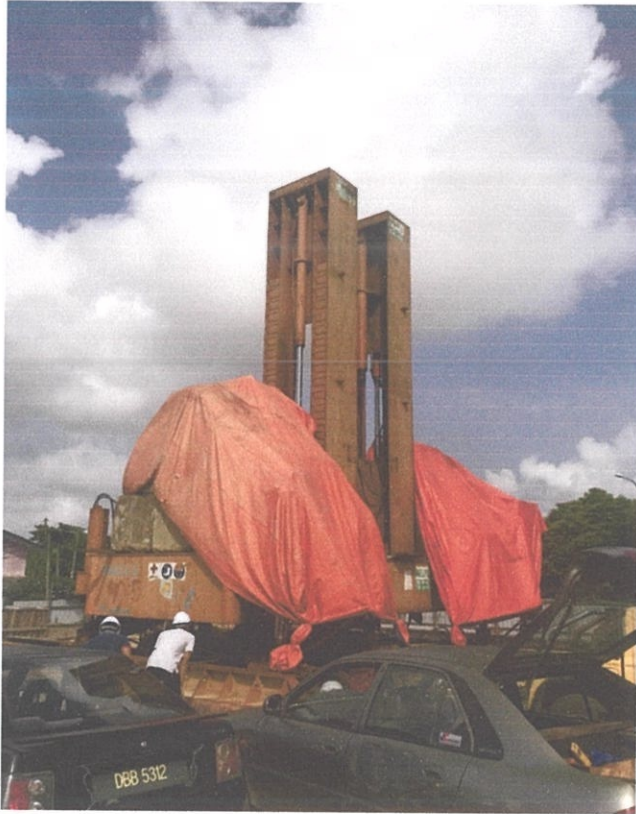


Photo 3.1 The Machineries used for Static Load Test

3.2 Background of Project

Based on the case studies, the project was carried out during the industrial training is about 'KlinikJenis 3, Penampang, Kota Bharu, Kelantan DarulNaim'. The contractor selected to do this project is D' Intan Trade (class G7 contractor) with the cost project of RM 21,000,000.00 and the contract period is about 107 weeks.

The project was given on September 2017 and would be plan to finish on December 2021. The points of piles needed in this project is about 500 and the first piling point started on 13 September 2017. Length of is 12m with a diameter of 250mm. The project uses a spun pile type. The test that was tested towards piling is Static Load Test which is Maintained Load Test and Pile Driven Test.

The Static Load Test was conducted on pile one (1) point of precast reinforced concrete pile at 'Klinik Kesihatan Jenis 3 Penampang, Kota Bharu' as required by Main Contractor named D'Intan Trade Sdn. Bhd. and carried out by Kelpile Sdn. Bhd. from 25th September 2018 until 27th September 2018.

Those pile are selected by Main-Contractor as shown at table below :-

Item	Location	Pile Point	Pile Size	Date Tested	Test Load
1.	TNB SUBSTATION	35	350mm DIAMETER SPUN PILE	25/09/2018 – 27/09/2018	75 TONNE

Table 3.1 Details of pile that were test



Figure 3.1 Plan of the site construction

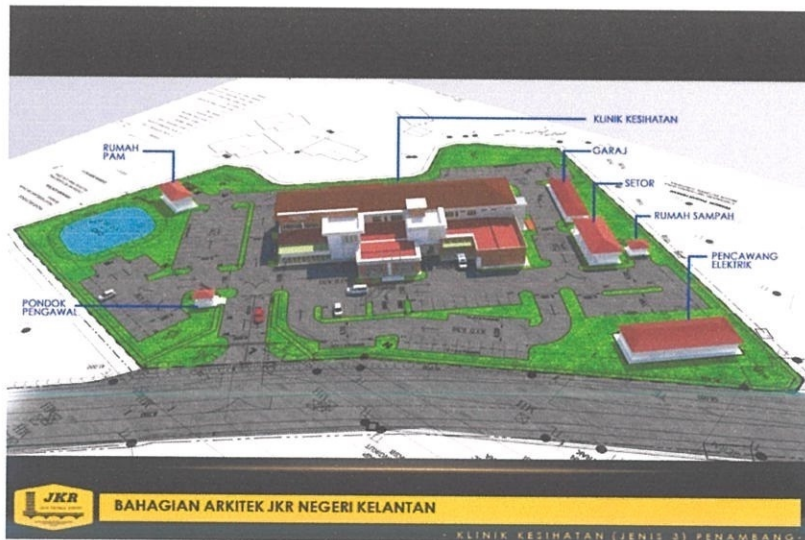


Figure 3.2 The illustration of the building

3.3 Components for Maintain Load Test

i. Dial gauge

A gauge consisting of a circular graduated dial and a pointer actuated by a member that contacts with the part being calibrated. Any of various instruments, it is used to accurately measure small distances and angles, and amplify them to make them more obvious. For the static load test, the number of dial gauges that used is four.

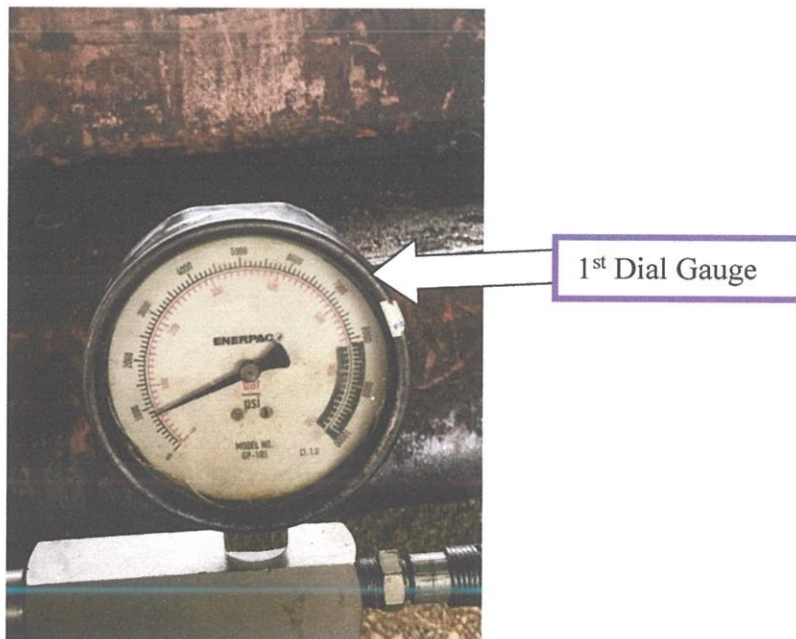


Photo 3.2 First dial gauge at Static Load Test

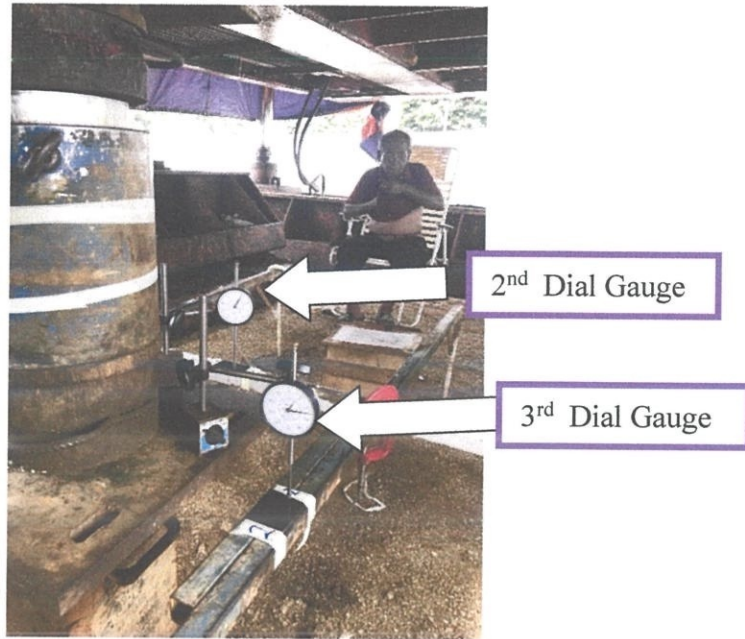


Photo 3.3 Second and third dial gauge at Static Load Test

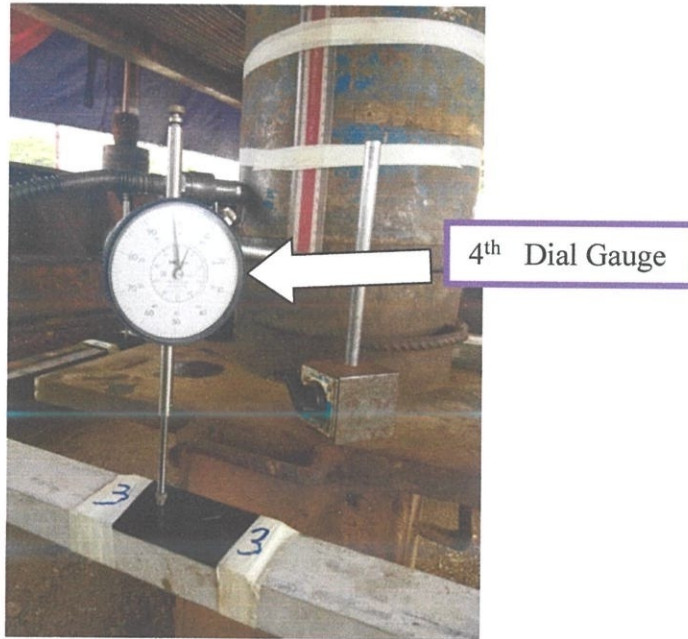


Photo 3.4 Fourth dial gauge at Static Load Test

ii. Connector (Dolly)

The function of connector in static load test is to make the pile cap and the machine, which is hydraulic jack in pile attached each other. This is because the pile cap cannot reach the hydraulic machine to push and give the strength to the spun pile piling to check the strength of the pile can be resist based on the specification from JKR Kota Bharu.

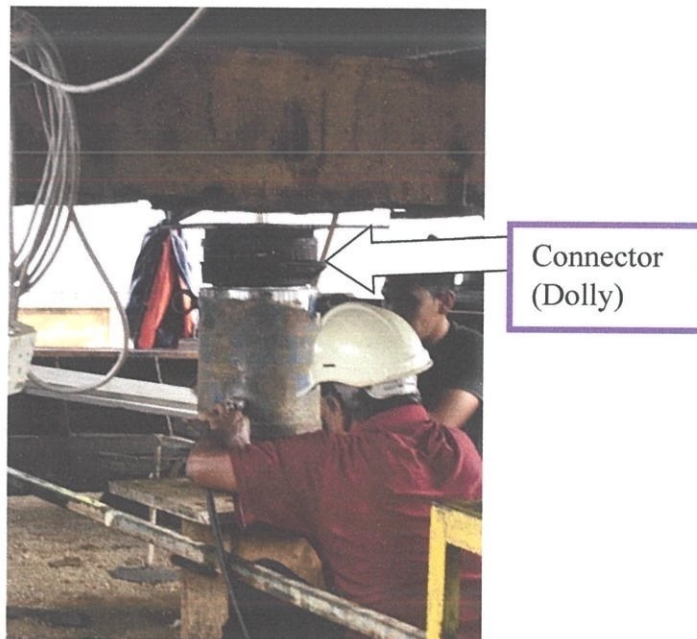


Photo 3.5 Connector (dolly) under the Hydraulic Jack In Pile

iii. Pile Driver (Hydraulic Jack In Pile)

Specialty equipment which installs piles using hydraulic rams to press piles into the ground. This system is preferred where vibration is a concern. There are press attachments that can adapt to conventional pile driving rigs to press 2 pairs of sheet piles simultaneously. Other types of press equipment sit atop existing sheet piles and grip previously driven piles. This system allows for greater press-in and extraction force to be used since more reaction force is developed.

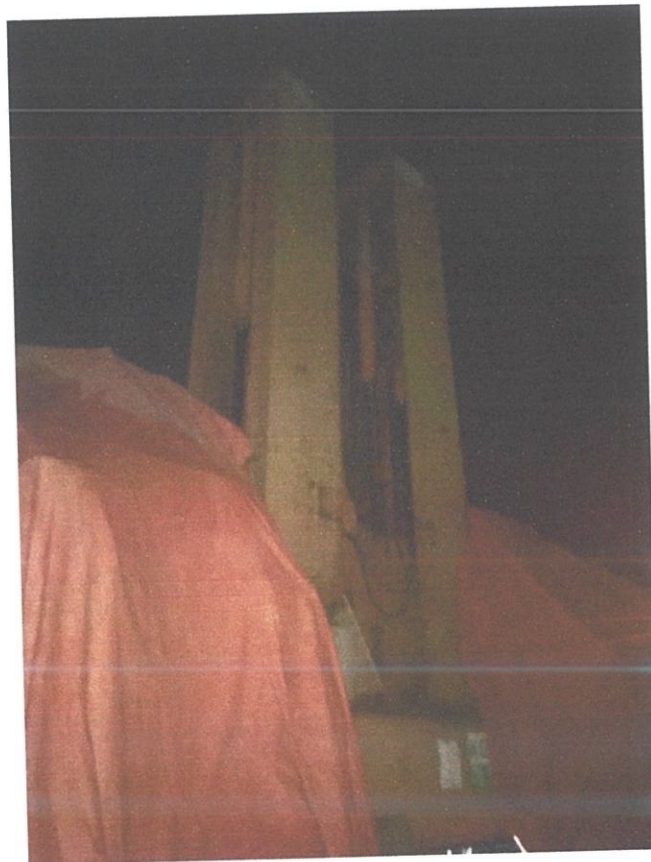


Photo 3.6 Hydraulic Jack In Pile Machine

iv. Hydraulic Pump Machine

A hydraulic pump is a mechanical source of power that converts mechanical power into hydraulic energy. It generates flow with enough power to overcome pressure induced by the load at the pump outlet.



Photo 3.7 Enerpac Hydraulic Pump

3.4 Procedures for Static Load Test

3.4.1 Settlement Measurement

Dial gauges and levering survey instrument scales are used to measure the pile top settlement. Four dial gauges will be equally spaced around the pile head and firmly held by magnetic base. Magnetic bases are attached to the hydraulic jack.

A vertical scale will also be installed to the pile head/hydraulic jack at one side. A temporary bench mark (TBM) will be established on the well-founded structures. Hence, the TBM and the vertical scale will serve as a second check for the pile top settlement. Two scales will be installed to the reference beam as a checking to ensure the accuracy of the dial gauges readings is high.

3.4.2 Test Piles Details

- | | | |
|-------|-------------------------------------|----------------------------------|
| i. | 1. Pile Location | : TNB Substation - 35 |
| ii. | 2. Pile Size | : 350mm Diameter Pile |
| iii. | 3. Depth (m) | : 24.00 m |
| iv. | 4. Working Load | : 30 tonne |
| v. | 5. Test Load | : 75 tonne |
| vi. | 6. Settlement of Working Load | : 3.62 mm |
| vii. | 7. Settlement of Twice Working Load | : 14.55 mm |
| viii. | 8. Residual Settlement | : 4.63 mm |
| ix. | 9. Date Driven | : 18/ 09 / 2018 |
| x. | 10. Date Of Test | : 25 / 09 / 2018 – 27 / 09 /2018 |

3.4.3 Maintained Load Test Procedure

The load shall be applied in increment of 25% of the working load up to 2.5 times working load. The load increment and time interval for load is as follows :-

- i. Load to 25% and maintain for two (2) hours
- ii. Load to 50% and maintain for two (2) hours
- iii. Load to 75% and maintain for two (2) hours
- iv. Load to 100% and maintain for twelve (12) hours
- v. Load to 137.5% and maintain for two (2) hours
- vi. Load to 175% and maintain for two (2) hours
- vii. Load to 215.5% and maintain for two (2) hours
- viii. Load to 250% and maintain for twenty-four (24) hours
- ix. Unload to 175% and maintain for two (2) hours
- x. Unload to 100% and maintain for two (2) hours
- xi. Unload to 50% and maintain for two (2) hours
- xii. Unload to 0% and maintain for two (2) hours

3.4.4 Jack In Record

Jacked In record sheet is needed at every piling works as it is the records that holds the overall information of site. It contains from the location of work is done, pile size and length, ground level, cut-off level, pile serial no. and etc.

The image shows a 'Jacked In Record' sheet with the following structure:

- Project:** BARRA MEDICAL CENTER/PAKISTAN AIR FORCE HOSPITAL RELAYAN, S. C. 11-11
- Contractor:** DEVI CHAKH PVT. LTD.
- Machine Type:** 125
- Pile Location:** 125
- Foundation:** 125
- DATE:** 12/12/2011
- FILE NO.:** 125
- NO. OF PILES:** 125
- TOTAL DRIVE:** 125

The main table has columns for:

- Pile No.
- Pile Size
- Pile Length
- Cut-off Level
- Ground Level
- Pile Serial No.
- Remarks

At the bottom, there are fields for 'INSPECTOR OF WORKS' and 'PILE REPRESENTATIVE'.

Photo 3.8 Jack In record

3.4.5 Load Settlement Curve Graph

The Load-settlement curve describes the variation of vertical load Q as a function of the pile settlement.

By default the program offers the construction of this curve for the maximal value of settlement equal to 25 mm. This magnitude, however, can be adjusted up to the value of 100 mm before running the calculation. An example showing a typical shape of the load-settlement curve appears in the figure

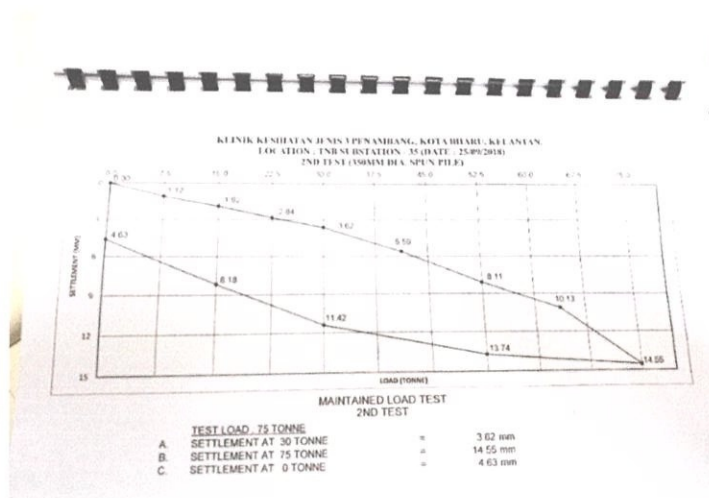


Photo 3.9 Load-Settlement Curve Graph of Static Load Test

3.5 Advantages and Disadvantages of Maintained Load Test

3.5.1 Advantages of Static Testing:

- i. A static load test allows a more rational design. Confirmation of pile-soil capacity through static load testing is considerably more reliable than capacity estimates from static capacity analyses and dynamic formulas
- ii. An improved knowledge of pile-soil behaviour is obtained that may allow a reduction in pile length or an increase in the pile design load, either of which may result in potential savings in foundation costs.
- iii. The ultimate pile capacity determined from load testing allows confirmation that the design load may be adequately supported at the planned pile penetration depth.

3.5.2 Disadvantages of Static Testing:

- i. Demand great amount of time when done manually. This is because the static load test need a large amount of energy either in machineries and labours. The machineries that were used is Hydraulic Jack In Pile
- ii. A long time consuming to be taken for this test. This test need a few days to be taken for the test which is two days in 48 hours including day and night.
- iii. Different procedures. Static load testing is an in situ type of load testing used in geotechnical investigation to determine the bearing capacity of deep foundations prior to the construction of a building. It differs from the static load test and dynamic load testing in that the pressure applied to the pile is slower

4.0 CONCLUSION

This type of test is one of the proper and the best type of test that are mostly contractors used for the piling that were construct the huge and high building structure. This type of test is not a new type of test that were using in the construction industry. Static Load test can also detect the various problem that can make the piling cause problem in the future of the building structure. Static load test is also to determine the strengthen of the piling and to determine the number of load that can the piling can resist either it is in a huge amount of load or beside of the result. Based on the report, static load test have a very clear of result and it takes an expensive amount of cost and need a specialist or sub-contractor to take this test and this take a long time consuming which is around 48 hours including day and night without miss seeing the dial gauge.

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Puan Nur Shuhada – (2018, 29 October), Supervisor/Engineer of Klinik Kesihatan Jenis 3, Penampang, Kelantan

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