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# Method Implementation Testing Foundation Pile Using (PDA Test) in the Residential Block Development Project of Class IIa Corrective Institution, Binjai

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**Abstract:** One of the most important things in a building construction is the foundation, to prove the strength of the pile foundation that has been worked on at the project site, then further testing will be carried out. In the Class IIa Binjai Penitentiary Residential Block Development Project, a Pile Driving Analyzer (PDA Test) test will be carried out. This test is a dynamic test used to see or measure how much the bearing capacity of the pile is, the ultimate axial pressure resistance of a pile and others. This study aims to compare and ensure whether the Pile Driving Analyzer (PDA Test) test implementation method carried out on the Class IIa Binjai Penitentiary Residential Block Development Project is in accordance with the regulations referring to SNI 8459: 2017 and the guideline that has been published by the Regulation concerning foundation testing on building structures in accordance with the Indonesian National Standard (SNI) 03-2847-2013. This study uses a qualitative method, data obtained from observations and interviews with the implementing team in the field and the data can be used as primary data and from the test data, various secondary data specifications. With these two regulations, it will be compared according to the conditions of field work according to the standards referring to the Foundation Test in building structures with the rules of the Indonesian National Standard (SNI) 03-2847-2013 and referring to the Indonesian National Standard (SNI) 8459: 2017 concerning the Foundation Test Method in High-Strain Dynamic Pile (HSDP) and PDA test testing including HSDP testing. This discussion will focus on testing the pile foundation after the foundation of the Class IIA Binjai Penitentiary Residential Block Construction is carried out in the field.

**Keywords**: Pile Foundation, Qualitative, Pile Driving Analyzer (PDA Test)

## I. Introduction

Pile foundation is a foundation that is usually used on soft soils, swampy soils with small soil bearing capacity conditions. So the pile foundation is a foundation construction that is able to withstand orthogonal forces to the pile axis by absorbing bending. Pile foundations are used when the soil conditions are relatively stable and the depth of the hard soil is not far below the ground surface. Piles are construction parts made of wood, concrete, and/or steel, which are used to transmit surface loads to lower surface levels in the soil mass. The function and use of the pile foundation is to move or transfer the load from the construction above it (superstructure) to the hard soil layer which is very deep (Hutami, 2013) [7]

In a construction project, the most important element in a building is the foundation. According to Hardiyatmo (2002: 79) the foundation is the lowest element in civil engineering construction that functions as a building support and distributes the structural load to the soil layer below. [6] The foundation acts as a lower structure that is tasked with distributing the building load to the soil layer that supports it. In building construction with light loads and good soil layers, shallow foundations are usually used. Conversely, if the building load is considered heavy and the soil layer conditions are inadequate, deep foundations such as piles are the choice. The bearing capacity of piles is determined through the results of soil investigations, such as sondir tests.

The sondir test is a method for assessing the subsurface soil layer, which is used to select the type of foundation to be applied. The piling stage at the project site is carried out with *the Hydraulic Jacking System* , which works by creating a load in the form of pressure on the pile. The main advantage of this system is that it can record pressure at each depth penetration and its operation does not cause noise. Meanwhile, *the Pile Driving Analyzer Test* is a method that is often used to check dynamic material testing and monitor the piling process after the work is completed. The *Pile Driving Analyzer Test* method is able to evaluate the capacity of several piles in one day. In addition, this method is also used to check the condition of the pile and can analyze the stress and energy of a hammer during the work process. The hammer tool during piling is used when conducting this test by giving a heavy impact on the foundation. The PDA program calculates the results of the speed and force signals measured through *the accelerometer* and *strain transducer* installed on the test pile. The sensors used can be *Smart Sensors* (sending data via *Wireless Transmitter* ) or *Traditional Sensors* (sending data using cables).

The analysis of the data from the PDA using the CAPWAP program is very important in the west/dynamic load testing. This program provides soil distribution to the foundation resistance and simulates static load tests. The relationship between the results of CAPWAP data and static load testing has certainly proven the reliability of this method in determining the capacity of the pile.

In this study, the author focuses on the method of implementing pile foundation testing on the Class IIa Binjai Penitentiary Residential Block Development project . Field testing is compared with standards referring to SNI 03 - 2847 - 2013 concerning

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

foundation testing for building structures and SNI 8459: 2017 concerning deep foundation testing methods with *High-Strain Dynamic Pile* (HSDP), where PDA testing is included in the HSDP category. [5]

This discussion focuses on dynamic testing carried out after the foundation is completed, using the *Pile Driving Analyzer Test* (PDA Test) method, namely testing by dropping a load on the foundation to evaluate its performance and capacity.

## II. Literature Review

### Foundation

It is the lowest element in a civil building construction that functions as a building support and distributes a structural load to the hard ground below (Hardiyatmo (2002: 79). The foundation is a part of the structure below the building or construction that is in contact with the ground and functions to withstand and distribute the load force from above. The foundation is designed as a solid building base unit below the ground surface and is the lowest part of a construction.

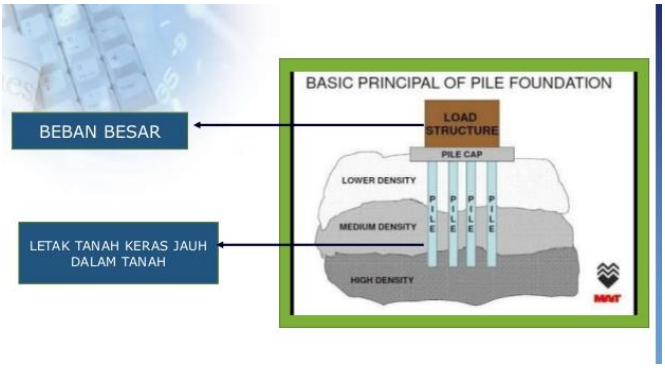



Figure 1. Basic Principles of Pile Foundations

(Source: Document of PT. Razasa Karya Contractor)

The foundation is the initial stage in building a building. The foundation comes from the word foundation, in everyday language Indonesian people generally use the word foundation or more often called foundation. According to the Big Indonesian Dictionary (2008:414) which states that the foundation is a strong building base and is usually located below the ground surface where the building is built [8]. According to Hardiyatmo, HC (2002:79), the foundation is the lowest structural component of a building that transfers the building load to the soil or rock below it. [9]

There are various types of foundations that can be selected in planning, depending on the function of the upper structure, the size and weight of the load to be borne, the condition of the land where the building stands, and the available construction costs. Foundations are generally divided into two categories.

### Foundation Pile

Pile foundation is one type of deep foundation that functions to channel the structural load to the soil layer that has a high bearing capacity at a certain depth. The purpose of this study is to calculate the bearing capacity of piles from the results of Sondir and Standard Penetration Test (SPT), compare the results of the pile bearing capacity and calculate the settlement that occurs in the pile. The calculation of the pile bearing capacity is carried out using the Meyerhoff method. (1976) [10]

In choosing the type of foundation, there are several important things to consider, such as the load that must be borne by the foundation, the condition of the soil in the surrounding environment, and the budget for making the foundation compared to the planned budget for the structure above it. Piles have two main types, namely *Mini Pile* and *Spun Pile* , with various sizes. In this project, the type of *Spun Pile* used has a size of 30 cm in diameter, 6 meters long, and uses concrete with a quality of K500. [5]


Figure 1. Illustration of Piling

(Source: Document of PT. Razasa Karya Contractor)

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025


Figure 1. *Spun Pile* diameter 30 cm, length 6 meters,

(Source: Document of PT. Razasa Karya Contractor)

The process of installing piles into the ground is carried out using a piling system that uses *a Hydraulic Static Pile Driver* (HSPD). This method presses the pile into the ground with a hydraulic jack that is given an additional load in the form of *a counterweight* . One of the advantages of the HSPD method is that it does not cause vibrations during the piling process, and the hydraulic pressure can be obtained directly read through the manometer of the tool, so that the pressure on the pile at each certain depth can be known.

The description of the equipment used in the Class IIa Binjai Penitentiary project is a Hydraulic Static Pile Driver as shown in Figure 1 below:

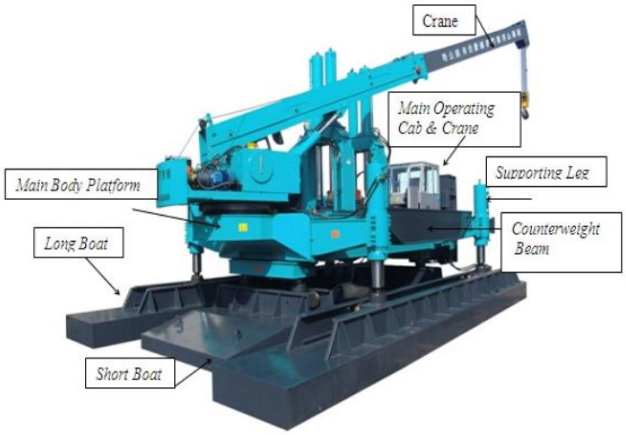



Figure 1. Hydraulic Static Pile Driver Capacity 120 Ton

(Source: Document of PT. Razasa Karya Contractor)

HSPD has several varying equipment capacities, such as 120 tons, 320 tons, and 450 tons. The selection of the type of equipment is adjusted to the planned load of the piles on the project. For the Porter and Hall Construction project, the 120 ton type is used. The use of pile foundations has several advantages compared to Bore Pile, namely:

1. The bearing capacity of pile foundation piles is greater than the bearing capacity of bored piles.
2. Capable of supporting soft or watery soil, pile foundations can transfer the load to harder soil layers at a certain depth.

Spun Pile type pile foundation , namely:

1. Special Equipment Requirements: *Mini pile installation* requires heavy equipment such as *a hydraulic hammer* or *mini crane,* which may not always be available at the project site, especially in remote areas.
2. High Costs for Certain Locations. In locations with limited access, transporting heavy equipment and materials can increase costs significantly.

**Pile Driving Analyzer (PDA Test)**

PDA Test (Case Method) is one type of dynamic testing using the wave analysis method and is often referred to as a re-strike test according to the nature of the test which performs a re-strike or re-strike of the pile foundation being tested. The implementation

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

of the PDA Test refers to ASTM D-4945 (Standard Test Method for High-Strain Dynamic Testing of Deep Foundations): *"This test method is used to provide data on strain or force and acceleration, velocity or displacement of a pile under impact force. The data are used to estimate the bearing capacity and integrity of the pile, as well as hammer performance, pile stresses, and soil dynamic characteristics, such as soil damping coefficients and quake values. This test method is not intended to replace Test Method D 1143."*

PDA Test is a dynamic testing method used to determine the ultimate axial capacity of a pile, assess the integrity of a pile foundation structure, and can measure the energy generated by the impact of a hammer on deep foundations such as piles and bored pile foundations. The hammer is dropped from a certain height freely or suddenly onto the pile head, with the recording of the blows being done repeatedly using variations in the height of the hammer fall.

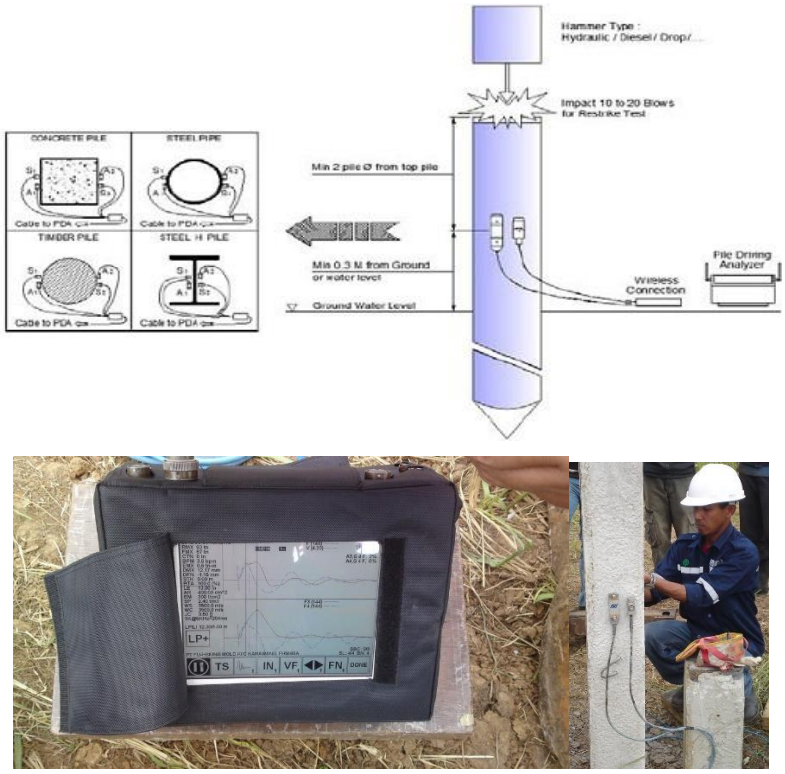





Figure 1. PDA (Case Method) and CAPWAP testing

(Source: Document of PT. Razasa Karya Contractor)

According to the ASTM D – 4945 – 1996 method applied in SNI 8459:2017, this PDA test is useful for determining the axial bearing capacity of the pile. The hammering is stopped when the hammer efficiency reaches more than 50% or the measured compressive stress (CSX) approaches the limit of its compressive stress capacity.

Several variables that can be measured through the PDA test include ultimate bearing pressure, pile integration, and maximum load on the test pile. The Case Method is used as the main procedure in PDA data analysis, which includes force measurements, velocity, and re-strike which are calculated dynamically and in real-time to obtain an overview of the bearing capacity of a single pile foundation [3].

Through PDA Test using "Case Method", we can find out:

a. Bearing Capacity of Pole

b. Pole Integrity Value

c. Displacement

d. Efficiency of hammer impact energy transfer to the pile

Testing using the PDA method is usually carried out after the pile has sufficient strength to withstand hammer impacts, or after the pile has reached 28 days of age. [4].

**III. Methodology**

The research method used in this study is a qualitative method. In data collection, researchers observed the testing of the bearing capacity of the piles using the *PDA test method* on the P Project for the Construction of Class IIA Binjai Penitentiary Housing Blocks . The *PDA test* observed was carried out on a project carried out by the Implementing Contractor PT. Razasa Karya, with

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

the package name " Construction of Class IIA Binjai Penitentiary Housing Blocks ". The data obtained by the researcher are primary data obtained directly from the field, namely DED (Detail Engineering Design), bore pile specifications, soil sondir test results obtained from CV. Mentan Cipta Utama, and *PDA test results* obtained from PT. Matra Bangun Technoconsul, which is a subcontractor of PT. Razasa Karya as the Project Implementer.

In addition, this study refers to the guidelines issued regarding foundation tests on building structures, namely the Indonesian National Standard (SNI) 03-2847 - 2013 [4], and SNI 8459:2017 concerning foundation test methods using *High-Strain Dynamic Pile* (HSDP), where the *PDA test* is included in the HSDP test category .

**Research Data**

Research data is data taken from the Development of Housing Blocks for Class IIA Penitentiary in Binjai, North Sumatra

a. Project Owner: Class IIA Binjai Penitentiary

b. Project Name: Construction of Class IIA Binjai Penitentiary Residential Block

c. Project Location: Gaotot Subroto Street, Binjai, Class IIA Prison, Binjai

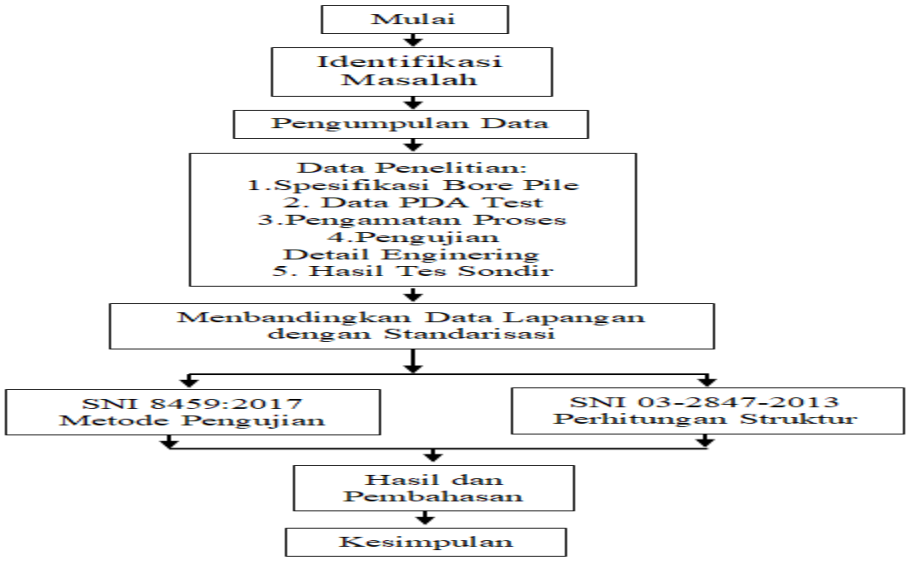
d. Planning Consultant: CV. Citra Pratama Consultant

e. Construction Management Consultant: CV. NINTA

f. Implementing Contractor: PT. Razasa Karya Contractor

The equipment used in this study includes:

1. Excavator Heavy Equipment
2. Well drilling machine (Borehole Drilling Machine)
3. Computer for *PDA test*
4. Transducer sensor or force sensor
5. Accelerometer sensor or speed sensor
6. Conversion cable
7. Connecting cable




**Research Flowchart**

**IV. Results and Discussion**

Comparison of Standard and Field Implementation Methods. The purpose of this comparison is to assess whether the *PDA test implementation method* carried out in the field is in accordance with applicable standards. The test refers to SNI 03-2847-2013 concerning foundation testing on building structures and SNI 8459:2017 which regulates the foundation test method using *High-Strain Dynamic Pile* (HSDP), where the *PDA test* is included in the HSDP test. Therefore, the author will describe and compare it in a table form that can be seen in the table.

Table 1. Comparison with Method Implementation

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

| **Implementation Method Based on Applicable Standards and Guidelines** | **Implementation Method Based on Testing Field** |
|---|---|
| A. Regulations on foundation testing of building structures SNI 03-2847-2013 | |
| 1. For 2-storey buildings, you must test the strength of each pile foundation point and get the results of how many tons the load can support.<br>2. Concrete must be 28 days old to reach optimum strength.<br>*Mini Pile* 25x25 with K500 Concrete (fc=40 Mpa) | 1. In the building test building on the pile foundation, the structure calculation is carried out for each 1 point of the pile foundation. In this project, 1 Pile Cap point consists of 4 pile points. This project consists of 48 Pile Caps and 192 pile points. Samples were taken at 3 points for the PDA Test, namely at AS A8, B8 and C8. |
| B. Based on SNI 8459:2017 | |
| 1. Before dynamic testing is carried out, some preparatory work for *the PDA* has been done. Some things to note and note are:<br>Number of Press Pile to be tested, Location map of points to be tested, Hammer weight, Hammer drop height, Soil Data Results (Soil Testing on Site) and Test Date.<br>2. According to ASTM D 4945-08, the installation of *Strain Transducer instrument* must be done in the right way. The pole measuring Spun Pile 30 cm is placed at a position of about 50 cm from the pole head.<br>3. The test result measurements were recorded using a *PDA computer* from HPT SAMYON INSTRUMENTS in the field, then analyzed using *RCAPWAP* based on one-dimensional wave theory.<br>4. *Strain Transducer* and *Accelerometer* are installed at the top of the pole with a distance of more than 1.5D - 2D from the top of the pole, where D is the diameter of the pole cross-section, to ensure accurate recording results. | The tested Compression Pile Number is A8 no.71 B8 no.76 and C8 no.81. According to the location plan of the point to be tested, Hammer weight, Hammer drop height, Soil Data Results (Soil Testing on Site) and Test Date have been made. A thick steel plate is placed on the multiplex to distribute the impact force. |

(Source: PT. Razasa Karya Contractor Document 2024)

The following is a picture of the Pile Foundation Plan and foundation details for the of Class IIA Binjai Penitentiary Housing Blocks Penitentiary Project.

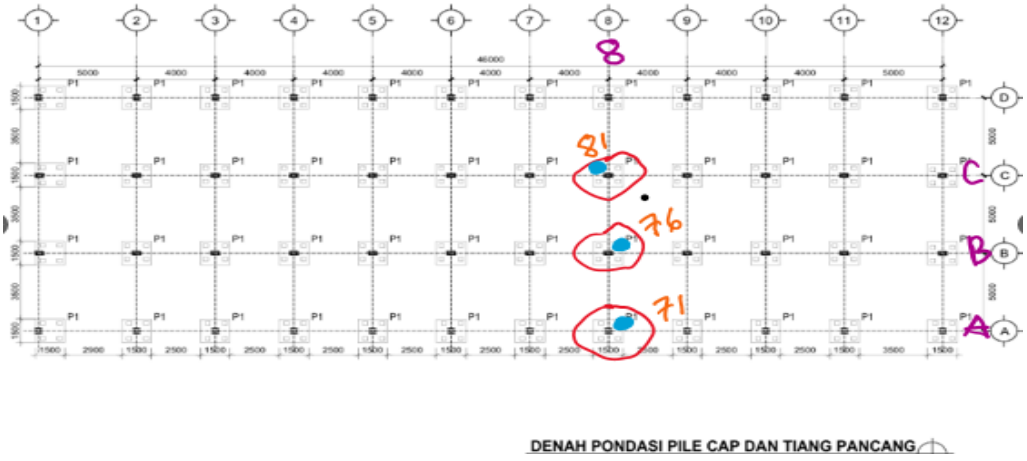



Figure 2. Pile Foundation Plan

(Source: Document of PT. Razasa Karya Contractor)

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

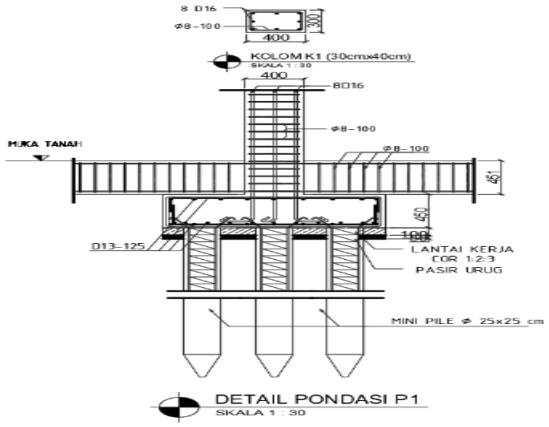



Figure 3. Pile Foundation Details

(Source: Document of PT. Razasa Karya Contractor)

**Results testing PDA *test***

Data Results Test on Pole AS A8 no.71 , AS B8 no.76 and AS C8 no.81, Results The bearing capacity of the pole is as follows:

**Pile Test Result Data on AS A8 Pile no.71**

**PAD Test Results on A8 As number 71** Figure 4 shows the results of the PDA test.

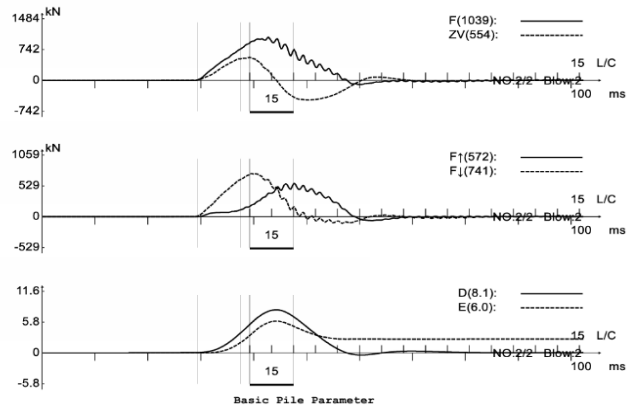



Figure 4. PDA results on Pile Cap as A8 no.71

(Source: Document from PT. Matra Bangun Colsultan)

**Results CAPWAP on As A8 number 71.** Figure 7 shows the results of CAPWAP

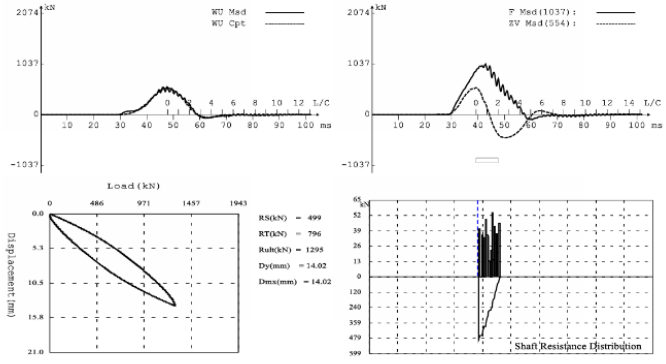



Figure 7. CAPWAP results on Pile Cap as A8 no.71

(Source: Document from PT. Matra Bangun Colsultan

**PDA Test Recap Results as A8 number 71** Table 2 is a summary of the results of the PDA Test.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

Table 2. PDA Test Results as A8 number 71

**CASE RESULTS**

| JC | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RSP | 1285 | 1268 | 1251 | 1235 | 1218 | 1201 | 1185 | 1168 | 1151 | 1135 | 1118 |
| RSU | 1650 | 1670 | 1690 | 1710 | 1729 | 1749 | 1769 | 1789 | 1809 | 1829 | 1849 |
| RMX | 1304 | 1287 | 1270 | 1254 | 1238 | 1222 | 1206 | 1190 | 1174 | 1158 | 1142 |
| RCAPWAP = 1295.00 kN Jc(RSP) = 0.00 Jc(RSU) = 0.00 Jc(RMX) =0.05 | | | | | | | | | | | |
| VMX (m/s) | TVP (ms) | VT1*Z (kN) | FT1 (kN) | FMX (kN) | DMX (mm) | DFN (mm) | SET (mm) | EMX (KJ) | | | |
| 0.95 | 39.2 | 554 | 897 | 1037 | 8.1 | 0.0 | 0.10 | 6 | | | |

**PILE MODEL**

| Segment (NO.) | Length (m) | Area (cm²) | Modulus (kPa) | Spec.Weight (kN/m³) | Perimeter (m) | Impedance (kN.s/m) | Z-Change (%) |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 625 | 33722 | 25.50 | 1.0000 | 585 | 100 |
| 19 | 15.00 | 625 | 33722 | 25.50 | 1.0000 | 585 | 100 |
| Toe | 15.00 | 625.00 | | | | | |
| Wave Speed : 3600m/s Overall : 3600m/s Pile Damping : 2.00% Time Increment : 0.278ms | | | | | | | |

(Source: Document from PT. Matra Bangun Colsultan)

**Pile Test Result Data on AS B8 no.76**

Based on the results of the *PDA test* (Pile Driving Analyzer) processed using the *CAPWAP* (Case Pile Wave Analysis Program) program on the AS B8 NO.76 foundation, the following results were obtained for the pile bearing capacity:

**PAD Test Results on As B8 number 76** Figure 6 shows the results of the PDA test.

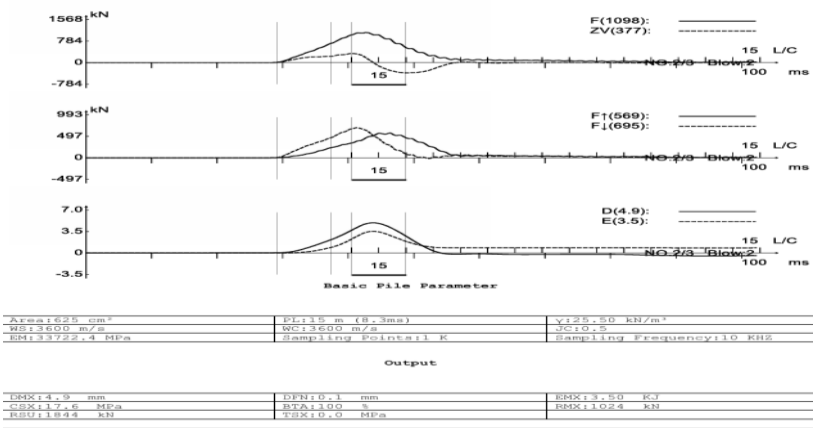



Figure 6. PDA results on Pile Cap as B8 no.76

(Source: Document from PT. Matra Bangun Colsultan)

**Results CAPWAP on As B8 number 76** Figure 7 shows the results of CAPWAP

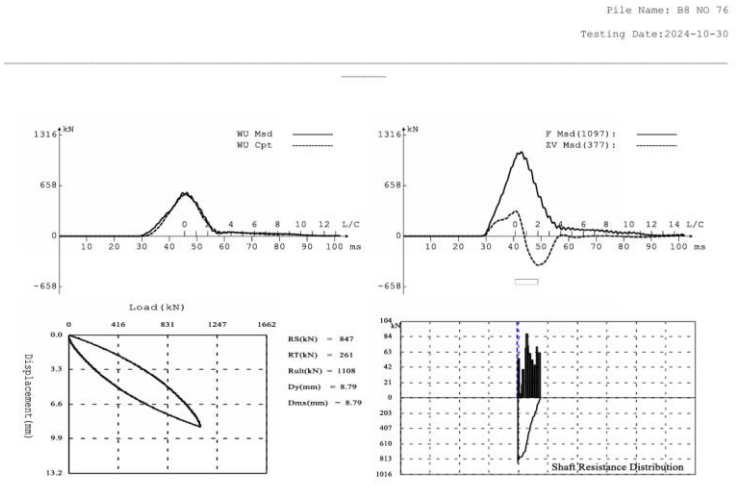



Figure 7. CAPWAP results on Pile Cap as B8 no.76

(Source: Document from PT. Matra Bangun Colsultan

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

**PDA Test Recap Results as B8 number 76** Table 2 is a summary of the results of the PDA Test.

Table 2. PDA Test Results as B8 number 76

Pile Name: B8 NO 76

Testing Date:2024-10-30

**CASE RESULTS**

| JC | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RSP | 1128 | 1107 | 1086 | 1065 | 1044 | 1023 | 1002 | 981 | 960 | 939 | 918 |
| RSU | 1674 | 1708 | 1741 | 1775 | 1809 | 1843 | 1876 | 1910 | 1944 | 1977 | 2011 |
| RMX | 1138 | 1112 | 1087 | 1065 | 1044 | 1023 | 1002 | 981 | 960 | 939 | 918 |
| RCAPWAP = 1108.00 kN Jc(RSP) = 0.09 Jc(RSU) = 0.00 Jc(RMX) =0.12 | | | | | | | | | | | |
| VMX (m/s) | TVP (ms) | VT1*Z (kN) | FT1 (kN) | FMX (kN) | DMX (mm) | DFN (mm) | SET (mm) | EMX (KJ) | | | |
| 0.64 | 40.5 | 329 | 1008 | 1097 | 4.9 | -0.4 | 0.10 | 4 | | | |

**PILE MODEL**

| Segment (NO.) | Length (m) | Area ($cm^2$) | Modulus (kPa) | Spec.Weight ($kN/m^3$) | Perimeter (m) | Impedance (kN.s/m) | Z-Change (%) |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 625 | 33722 | 25.50 | 1.0000 | 585 | 100 |
| 19 | 15.00 | 625 | 33722 | 25.50 | 1.0000 | 585 | 100 |
| Toe | 15.00 | 625.00 | | | | | |
| Wave Speed : 3600m/s Overall : 3600m/s Pile Damping : 2.00% Time Increment : 0.278ms | | | | | | | |

(Source: Document from PT. Matra Bangun Colsultan)

**Data Results Test Pile on AS C8 Piling no.81**

Based on the results of the *PDA test* (Pile Driving Analyzer) processed using the *CAPWAP* (Case Pile Wave Analysis Program) program on the AS C8 NO.81 foundation, the following results were obtained for the pile bearing capacity:

**PAD Test Results on As C8 number 81** Figure 8 shows the results of the PDA test.

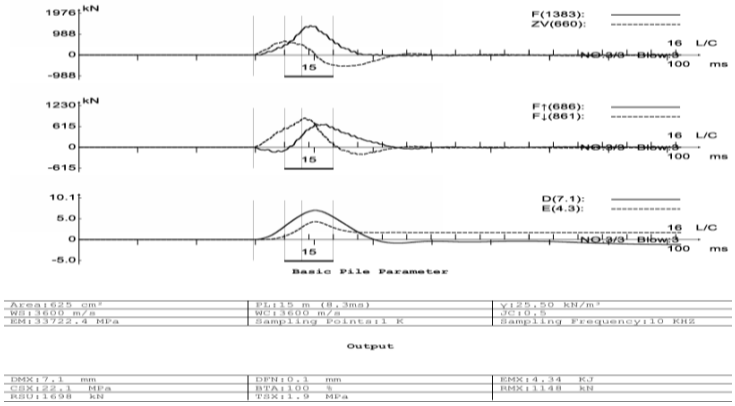



Figure 8. PDA results on Pile Cap as C8 no.81

(Source: Document from PT. Matra Bangun Colsultan)

**Results CAPWAP on As C8 number 81** Figure 8 shows the results of CAPWAP

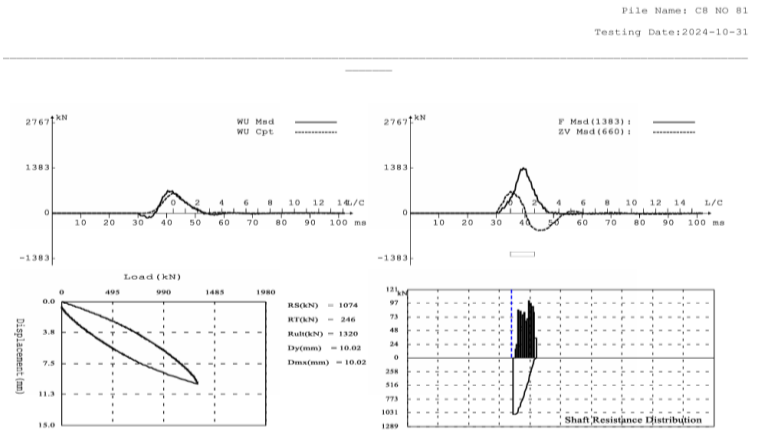



Figure 8. CAPWAP results on Pile Cap as C8 no.81

(Source: Document from PT. Matra Bangun Colsultan

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XIV, Issue I, January 2025

**PDA Test Recap Results as C8 number 81** Table 3 is a summary of the results of the PDA Test.

Table 3. PDA Test Results as B8 number 76

**RCAPWAP RESULTS**

| Soil Segment No. | Depth Below Gages (m) | Depth Below Grade (m) | Activated Resistance R (kN) | Sum Down of R (kN) | Sum UP of R (kN) | Unit Resistance (Depth) (kN/m) | Unit Resistance (Area) (kPa) |
|---|---|---|---|---|---|---|---|
| 1 | 0.79 | 0.79 | 0 | 0 | 1320 | 0 | 0 |
| 2 | 1.58 | 1.58 | 0 | 0 | 1320 | 0 | 0 |
| 3 | 2.37 | 2.37 | 15 | 15 | 1320 | 19 | 19 |
| 4 | 3.16 | 3.16 | 23 | 38 | 1305 | 29 | 29 |
| 5 | 3.95 | 3.95 | 84 | 122 | 1282 | 106 | 106 |
| 6 | 4.74 | 4.74 | 20 | 142 | 1198 | 25 | 25 |
| 7 | 5.53 | 5.53 | 82 | 224 | 1178 | 104 | 104 |
| 8 | 6.32 | 6.32 | 54 | 278 | 1096 | 68 | 68 |
| 9 | 7.11 | 7.11 | 76 | 354 | 1042 | 96 | 96 |
| 10 | 7.89 | 7.89 | 80 | 434 | 966 | 103 | 103 |
| 11 | 8.68 | 8.68 | 63 | 497 | 886 | 80 | 80 |
| 12 | 9.47 | 9.47 | 64 | 561 | 823 | 81 | 81 |
| 13 | 10.26 | 10.26 | 69 | 630 | 759 | 87 | 87 |
| 14 | 11.05 | 11.05 | 101 | 731 | 690 | 128 | 128 |
| 15 | 11.84 | 11.84 | 95 | 826 | 589 | 120 | 120 |
| 16 | 12.63 | 12.63 | 43 | 869 | 494 | 54 | 54 |
| 17 | 13.42 | 13.42 | 90 | 959 | 451 | 114 | 114 |
| 18 | 14.21 | 14.21 | 80 | 1039 | 361 | 101 | 101 |
| 19 | 15.00 | 15.00 | 35 | 1074 | 281 | 44 | 44 |
| Toe | 15.00 | 15.00 | 246 | 1320 | 246 | - | 3936 |
| Total RCAPWAP Capacity : 1320kN Skin Friction : 1074kN Pile Base : 246kN | | | | | | | |
| Pile Displacement Measurement : 0.10mm Blow Count = 10000b/m | | | | | | | |
| Pile Displacement Match : 0.01mm Blow Count = 100000b/m | | | | | | | |
| Match Quality : 5.23% | | | | | | | |

| Soil Model Parameters (basic parameters) | Symbol | Shaft | Toe |
|---|---|---|---|
| Case Damping Factor | JS/JT | 0.37 | 0.64 |
| Smith Damping Factor(s/m) | SS/ST | 0.20 | 1.51 |
| Quake(mm) | QS/QT | 1.67 | 0.13 |
| Unloading Quake(% of loading quake) | CS/CT | 0.10 | 0.70 |
| Unloading Level(% of Ru) | UN | 0.00 | - |
| Soil mass(kg) | PL | - | 0.00 |

(Source: Document from PT. Matra Bangun Colsultan)

From the results of the dynamic testing *of the SAMYON INSTRUMENTS HPT* in the field, then the analysis of the bearing capacity with the *RCAPWAP computer program* on the 3 tested piles, the ultimate bearing capacity of the piles was obtained as in Table 4.

Table 4. Summary of *PDA test* and *RCAPWAP results* as follows:

| No. | No. Tiang | Dimensi Tiang | | Daya Dukung (ton) | | | |
|---|---|---|---|---|---|---|---|
| | | | | PDA HPT SAMYON (ton) | RCAPWAP (ton) | | |
| | | Penampang | Panjang Tiang (m) | Total | Friksi | Ujung | Total |
| 1 | A8 NO 71 | □ 25 x 25 cm | 15.00 meter | 122.4 | 49.9 | 79.6 | 129.5 |
| 2 | B8 NO 76 | □ 25 x 25 cm | 15.00 meter | 102.4 | 84.7 | 26.1 | 110.8 |
| 3 | C8 NO 81 | □ 25 x 25 cm | 15.00 meter | 114.8 | 107.4 | 24.6 | 132.0 |

***Pile Driving Analysis (PDA) Test*** Report PT. Matra Bangun Technoconsult

(Source: Document from PT. Matra Bangun Colsultan)

The results of the PDA test showed that the bearing capacity of the A8 No.71 foundation was 122.4 tons, while the results of the analysis using the CAPWAP program showed that the bearing capacity of the foundation was 129.5 tons, with a difference of 7.1 tons. On the B8 No.76 foundation, the results of the PDA test showed a bearing capacity of 102.4 tons, while the results of the CAPWAP analysis showed 110.8 tons, with a difference of 8.4 tons. While on the C8 No.81 foundation, the results of the PDA test showed a bearing capacity of 114.8 tons, and the results of the CAPWAP analysis showed 132.0 tons, with a difference of 17.2 tons.

From the test results, the ultimate bearing capacity of the pile foundation is appropriate and has even exceeded the planned strength. Based on soil sounding data with a depth of 15 meters, it is able to withstand the permitted bearing capacity of 55 tons of piles. It can be concluded that the strength of the pile foundation that is worked on in the field is 2 times the strength of the foundation from the plan so it is very good.

## V. Conclusion and Suggestions

After conducting direct observations in the field, the results of the observations discussed previously can be concluded as follows:

a) PDA test method for pile foundation test on the Construction of Hall and Porter of Class I Medan Tanjung Gusta Prison, the test requirement procedure based on the guidelines on the Regulations governing foundation tests on building structures is SNI 03-2847-2013 concerning the procedure for calculating concrete structures for building structures, including foundations. The provisions have been met because they have been used. In building construction, testing on pile foundations is carried out

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by calculating the structure for each 1 point of pile foundation. In this project, 1 Pile Cap point consists of 4 to 5 pile points. This project consists of 48 Pile Caps and 222 pile points. Samples were taken at 3 points with an average depth of 15 m with an average bearing capacity of 113.2 tons in the PDA Test, namely in AS A8, B8 and C8.

b) The foundation tested using the PDA test method is a pile foundation with a bearing capacity code on the A8 No.71 foundation of 122.4 tons, a bearing capacity on the B8 No.76 foundation of 102.4 tons, that the bearing capacity on the C8 No.81 foundation is 114.8 tons. If the test results are compared with the planned bearing capacity of 55 tons, then the ultimate bearing capacity of the pile foundation has met the criteria, because the recorded bearing capacity is much greater than the planned bearing capacity.

Some suggestions from the author to improve the quality of this report are as follows:

a) It is recommended to make the number of long points in a Pile Cap consist of 4 points, so that the number is consistent in each Pile Cap.

b) To obtain optimal results, the concrete should be 28 days old before testing, especially if the concrete has not reached the planned compressive strength.

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