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The Implementation Method of Bored Pile Foundation in the ARC 100 Construction Project, Gubeng, Surabaya

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Abstract

The substructure of bored pile foundations is one type of deep foundation commonly used in high-rise building construction, particularly in areas with low soil bearing capacity, such as the ARC 100 Gubeng Construction Project in Surabaya. Both primary and secondary data were collected through interviews with contractors and project service providers involved in the foundation work. Based on the observations conducted, the bored pile foundation work utilized the wet boring method using Zoomlion heavy equipment, beginning with the preparation stage, determination of foundation bore points, and site cleaning. This was followed by the installation of temporary casing, foundation hole drilling, reinforcement fabrication, reinforcement placement, and welding of reinforcement joints. Next, a slump test was performed on the concrete mix, followed by the installation of the tremie pipe, concrete casting, removal of the temporary casing, and final site cleaning. The bored pile foundation work for the ARC 100 Gubeng project in Surabaya was carried out in accordance with standard construction procedures. Any factors that could potentially hinder the work were promptly addressed. Furthermore, both the contractor and consultant agreed that workplace safety must always remain a top priority throughout the entire construction process.

Keywords: Bored Pile Foundation, High-Rise Building, Temporary Casing

INTRODUCTION

The city of Surabaya, as the capital of East Java Province, continues to strive to enhance and maximize regional development. Along with the city's rapid growth, various sectors are also being improved to support Surabaya's progress. These developments include housing, apartments, hospitals, office buildings, entertainment facilities, bridges, highways, and other infrastructure. According to Kerlima Hutagaol (2024), Surabaya should emphasize a balanced and wise approach to development management.

A building generally consists of two main parts: the superstructure and the substructure. The building structure requires a strong and stable foundation to support the load above it. In construction projects, the first stage of structural work carried out on-site is typically the substructure, which includes foundation construction.

The ARC 100 Building in Gubeng, Surabaya, is an important infrastructure project that requires careful planning of its substructure (foundation) to ensure safety and stability. Considering soil conditions, project location, cost, and the heavy building load, the bored pile foundation was selected as the most suitable solution. This type of foundation can transfer building loads to hard soil layers located approximately 20 to 60 meters deep, making it ideal for high-rise structures.

The purpose of this study is to describe, step by step, the implementation method of the bored pile foundation in the ARC Building construction project in Gubeng, Surabaya, as well as to identify the factors that influence the smooth execution of the bored pile foundation work.
The bored pile foundation method is carried out by drilling the soil first, then inserting the reinforcement cage, and finally casting concrete into the borehole. This method is suitable for deep and unstable soil conditions.

According to Leonardo Mandak (2016), the implementation process of bored pile foundations consists of two main stages: soil drilling and bored pile construction.

- Soil Drilling
  - Wet Method
    a. Using Temporary Casing: suitable for soil that is prone to collapse or landslides.
    b. Without Casing: applied only to dense and stable soil with a low risk of collapse.
  - Dry Method
    a. Using Temporary Casing: used when the soil is easily collapsible.
    b. Without Casing: applied to strong and stable soil where the risk of collapse can be ignored.

The drilling method is selected based on soil conditions and groundwater levels to ensure a safe and efficient construction process.

RESEARCH METHOD

In this study, data analysis was conducted using a qualitative approach. The data sources were obtained through direct observation, interviews with field workers, and project documentation. The primary data collected included information related to the implementation method of the bored pile foundation, the factors influencing the construction process, and the soil bearing capacity based on the results of the boring test.
In addition, this research also utilized supporting data, such as bored pile foundation design drawings and other technical documents provided by the contractor and construction planning service providers. Through this approach, the study is expected to provide a comprehensive overview of the bored pile foundation implementation process in the studied project.

Research Location

Figure 2.1 Research Location (Google Earth, 2025)
The research project site, ARC 100, is located at Jln. Raya Gubeng 102–106, Surabaya, Indonesia.
Research Flowchart

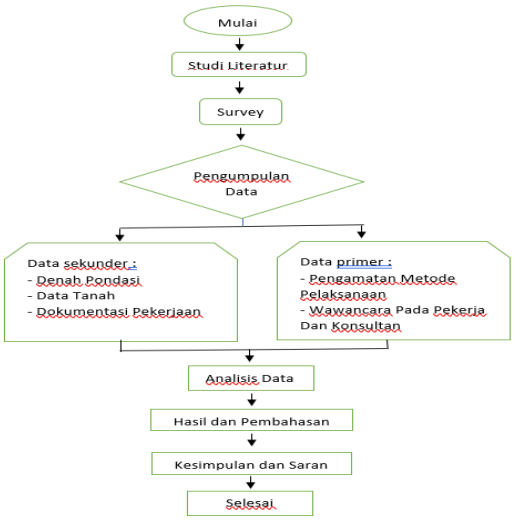

Figure 2.2 Flowchart

RESULTS AND DISCUSSION

Project Data

In this study, the project analyzed is "Construction of ARC 100 Gubeng Surabaya" with the following project profile:

Project Information	Details
Project Name	Construction of ARC 100 Gubeng Surabaya
Project Planner	PT. Robecco Indonesia
Project Contractor	PT. Indonesia Pondasi Raya
Maintenance Period	240 calendar days
Budget	IDR 65,000,000,000
Funding Source	PT. Robecco Indonesia
Contract Number	B2/BPK-RJS/Contract/Construction/X/2014
Location	Jln. Raya Gubeng No. 102–106, Surabaya, Indonesia
Land Area	2,800 m²
Scope of Work	Bored Pile Foundation

The figure below shows the bored pile foundation design drawing used in the construction of the ARC 100 Gubeng building in Surabaya.

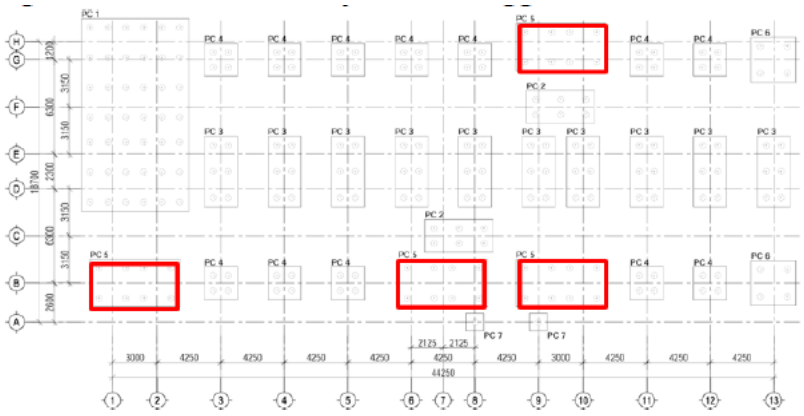

Figure 3.1 Bored Pile Foundation Layout

Bored Pile Details In the ARC 100 Gubeng Construction Project in Surabaya, the bored pile foundation used has a depth of 48 meters. The following figure shows the design of the bored pile foundation.

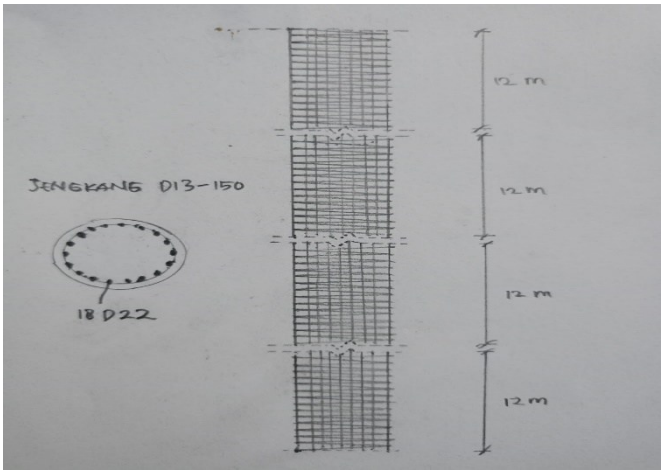

Figure 3.2 Bored Pile Details

In the ARC 100 Gubeng Construction Project in Surabaya, the wet boring method was used, employing Zoomlion heavy equipment with the use of temporary casing. This method was selected because the soil type at the project site has a potential risk of collapse in the borehole, thus requiring additional protection during the drilling process. The following figure illustrates the flow of stages in the bored pile foundation
implementation process:

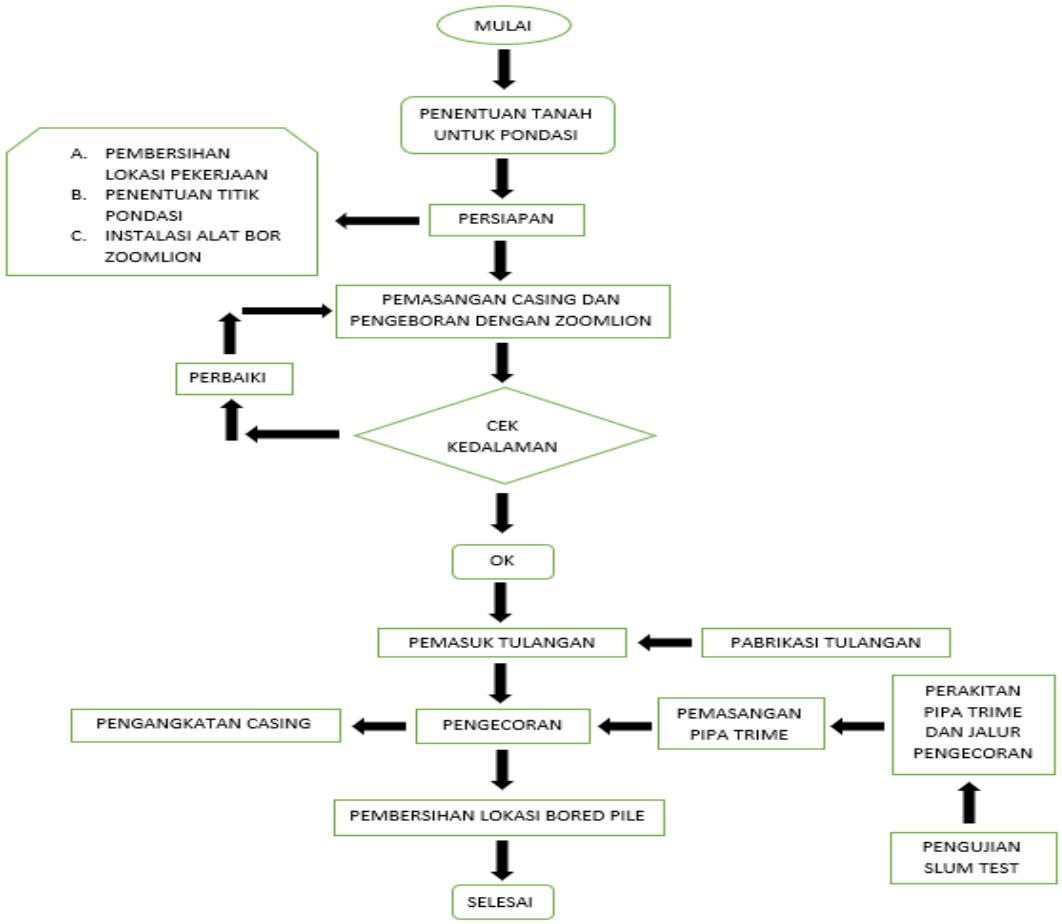

Figure 3.3 Flow of Bored Pile Foundation Construction Stages

In bored pile foundation work, there are several important stages that must be carried out starting from determining soil conditions, preparation stages, installation of steel reinforcement, up to the concrete casting process. In this section, the author systematically describes each stage so that the implementation process can be understood in greater detail.

Soil Determination for Foundation

- Standard Penetration Test (SPT) Before beginning foundation construction, the soil conditions at the project site must first be tested. This test is conducted using the Standard Penetration Test (SPT) method with the assistance of a Jacko mini drilling machine to determine the depth of the hard soil layer that will serve as the foundation base. The results of this test become the reference for determining the ideal boring depth of the bored pile. The bored pile method was chosen because it matches the soil characteristics at the ARC 100 Gubeng construction site in Surabaya, which requires a strong foundation to support the structural load above it.
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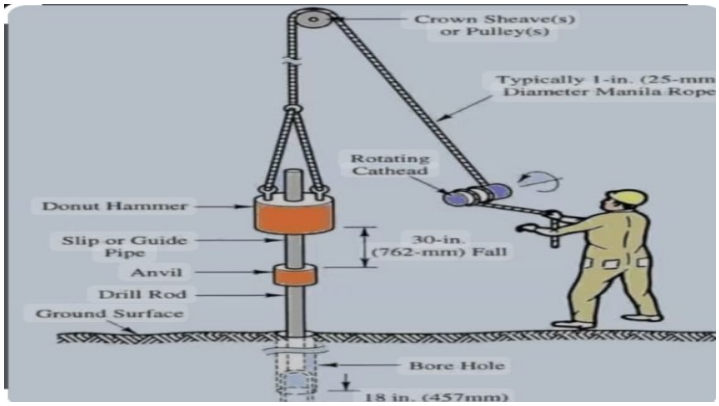

Figure 3.4 Standard Penetration Test (Boring)

Preparation of Bored Pile Foundation

- Site Cleaning At the initial stage of the ARC 100 Gubeng construction project in Surabaya, a site cleaning activity was carried out. After the project area was cleared, heavy equipment such as excavators, Zoomlion drilling machines, and dump trucks could easily enter the site to begin the next stage of the bored pile foundation work.

Figure 3.5 Project Site Preparation

- Field Measurements and Foundation Point Determination The survey team measured and determined the coordinates of the bored pile foundation points using a theodolite. Once these points were determined, they were marked directly in the field as a reference for drilling. This project involved 146 bored pile points in the construction of ARC 100 Gubeng in Surabaya.

Figure 3.6 Determination of Bored Pile Foundation Points

Bored Pile Drilling Process

- Drilling Using the Wash Boring Method
  The construction of the bored pile foundation for the ARC 100 Gubeng Project in Surabaya was carried out using the wet boring system. This method utilizes water to maintain the stability of the borehole walls and prevent collapse during the drilling process. The drilling equipment used was a Zoomlion heavy-duty drill, which functions to bore the soil to a predetermined depth according to the foundation design plan. Water and slurry produced during the drilling process are circulated through pumps to ensure that the borehole remains stable throughout the operation.

Figure 3.7 Drilling with Zoomlion Wet Boring Type

- Factors Affecting the Drilling Process
  1. Weather
     Unfavorable weather conditions, such as heavy rain, can cause water accumulation and mud in the work area. This situation may hinder drilling activities and reduce work efficiency and implementation time.
  2. Fuel (Diesel)
     The availability of fuel is also an important factor in ensuring the smooth operation of the drilling equipment. A shortage of fuel can cause a temporary halt in drilling activities. Therefore, regular monitoring and supply of fuel are necessary to ensure that the bored pile drilling process proceeds according to schedule.
- Installation of Temporary Casing
  The installation of temporary casing is carried out as an initial step to maintain the stability of the borehole and prevent soil collapse around the drilling area. In this project, the casing was installed at a depth of approximately 6 meters. Once the casing was properly placed, the drilling process continued until it reached the predetermined depth.

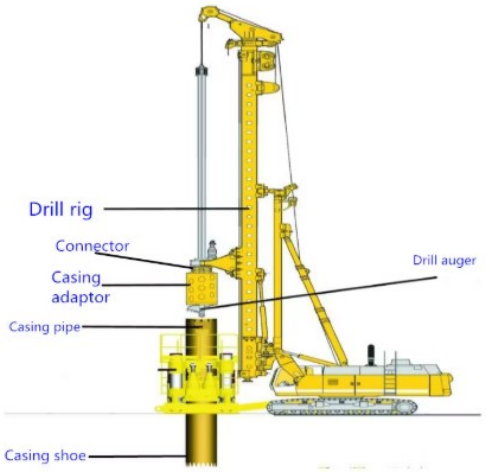

Figure 3.8 Installation of Bored Pile Casing Pipe

- Reinforcement Fabrication Work
  The steel reinforcement materials used in the bored pile foundation project are as follows:
  - Deformed bar D22 for the main reinforcement
  - Deformed bar D13 for the stirrups or spiral reinforcement

a. Steel Cutting
   At this stage, the steel bars are cut using specialized cutting tools and measuring instruments such as tape measures to adjust the length of the reinforcement according to on-site requirements.
b. Spiral Reinforcement Fabrication
   After the cutting process is completed, the next step is the fabrication of spiral reinforcement made from D13 deformed bars. The spiral is formed using a manual roller operated by trained workers to produce neat and precise spiral shapes that meet the bored pile design specifications.
c. Reinforcement Assembly
   The next stage is the assembly of the main reinforcement (D22 deformed bars) with the spiral reinforcement (D13 deformed bars). This process is carried out by tying the two types of steel together using binding wire. The wire ties at the beginning and end of the reinforcement are adjusted according to the spacing between the stirrups as specified in the bored pile design.
d. Reinforcement Splicing
   After the spiral reinforcement is attached to the main bars, the process continues by connecting the main reinforcement sections of 12 meters each until the total depth reaches 48 meters. The splicing is performed by welding according to the design drawings. All fabrication and splicing processes are carried out simultaneously to ensure that reinforcement installation proceeds efficiently and reduces on-site working time.

Installation of Reinforcement in the Bored Pile Hole After the fabrication process is completed, the reinforcement cage is lowered into the borehole with the help of heavy equipment and ropes following the wash boring process performed by the Zoomlion machine. At this stage, the position of the reinforcement must be ensured to be centered within the borehole. To prevent

displacement during concrete casting, supports and ties are used at specific points to keep the reinforcement cage stable throughout the casting process.

Figure 3.10 Insertion of Steel Reinforcement

After the reinforcement has been installed, the borehole depth is re-measured. If there is a difference in depth due to the cleaning process, the hole must be cleaned again before proceeding with the concrete casting. Bored Pile Foundation Concrete Casting In the casting process, ready-mix concrete with a compressive strength of K-300 supplied by PT. SCG Readymix Indonesia is used. The concrete casting is carried out through several stages as follows:

- Slump Test
  Before the casting begins, a slump test is conducted to ensure that the concrete's slump value is within the specified range of 8–12 cm. The slump value must not be too low or too high, as this would affect the quality and strength of the concrete once it hardens.

Figure 3.11 Slump Test

- Installation of Tremie Pipe
  Before the concrete casting begins, the tremie pipe is installed. The purpose of the tremie pipe is to ensure that the fresh concrete does not mix with the mud or soil at the bottom of the borehole, as such mixing could reduce the concrete's quality. The tremie pipe is assembled by connecting several pipe sections until it reaches the required length according to the borehole depth. The funnel at the pipe's end is adjusted to ensure that the concrete flows precisely into the casting channel.
- Concrete Casting Using Truck Mixer
  Prior to casting, the work area is cleaned and leveled using heavy equipment to allow the ready-mix truck to reach the casting point safely. After final inspections are completed, the

casting process begins by pouring the concrete through the tremie pipe until the borehole is completely filled according to the planned volume.

Figure 3.12 Bored Pile Foundation Casting

Factors Affecting the Casting Process

One of the key factors influencing the concrete casting process is work area accessibility. During foundation work, it is necessary to regulate the movement of workers, equipment, and materials to ensure efficient field operations. A narrow or limited work area can restrict movement and slow down progress. For example, the route used by the truck mixer must be properly planned; if it is too narrow or difficult to access, the concrete casting process may be delayed due to late delivery of concrete to the casting point.

- Removal of Temporary Casing
  After the casting process is completed, the next stage is to remove and lift the temporary casing, which previously functioned as the borehole wall support. This process is carried out using heavy equipment. During the removal, additional lifting tools are used to pull the casing out of the bored pile hole to ensure no part is left inside the ground, preventing any obstruction to subsequent construction work.
- Cleaning of Bored Pile Area
  After all casting and casing removal work is completed, the final stage is site cleaning. This process involves clearing excavated soil and leftover materials around the foundation area. Cleaning is usually done using an excavator and manual tools such as shovels and hoes to tidy up the site, ensuring the foundation area is clean and ready for the next phase of construction.

CONCLUSION

Based on the results of the study on the bored pile foundation work at the ARC 100 Gubeng Construction Project in Surabaya, it can be concluded that the implementation method applied by PT. Indonesia Pondasi Raya (Indopora) has been carried out in accordance with field

construction stages. The workflow includes preparation, site cleaning, field surveying and foundation point determination, drilling equipment installation, drilling using Zoomlion machinery, casing installation, reinforcement fabrication, reinforcement placement, slump test, tremie pipe installation, concrete casting, casing removal, and site cleaning.

Several factors influencing the smooth execution of the bored pile foundation work include weather conditions, fuel availability, manpower, equipment, and worksite accessibility. With proper management by the contractor and supervision by the consultant, the foundation work can be completed according to the required standards, technical procedures, and project plan.

SUGGESTIONS

In implementing bored pile foundation work, a well-planned work method is required to ensure that every stage of construction runs effectively and efficiently. Understanding field conditions and selecting the most appropriate construction method are crucial to minimizing potential obstacles during the process. The use of proper equipment, effective access management, and optimal time and labor management will enhance work quality while reducing the risk of delays. Thus, the project objectives in terms of cost, quality, and time can be achieved as expected.

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