IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 19, Issue 6 Ser. III (Nov. – Dec. 2022), PP 15-27
www.iosrjournals.org

Bored Pile Foundation Method in the Manado City Hospital Building Construction Project

Ir. JermiasTjakra, MT
Sheren Sara Punusingon
Faculty of Engineering, Department of Civil Engineering, University of Sam Ratulangi

Abstract
The construction of the Manado City Hospital Building is a public service facility by the government in Manado. The foundation is the lower part of the building structure that is directly related to the ground. which has the function of carrying the load of the building on it. Foundation development planning such as the construction of the Manado City Hospital building is very important. Considering that this building is a hospital building which is a very important infrastructure for the community.
In discussing this final assignment using the method of field studies, literature studies and consultations with various related parties. Where is the calculation of loading in analyzing the carrying capacity of the bored pile foundation soil seen from the SPT testing data. Based on the planning, the Pile Mac method was applied to bored pile foundation work with a total of 330 drill points with a depth of 11 m each point and a hole diameter of 40 cm. In order to be more efficient in controlling work time, the method for implementing bored pile foundations in Manado City Hospital building construction projects is as follows: Preparation of work sites, Field Surveys and determination of foundation points, then proceed with installation of stakes, machine settings, drilling process, reinforcement then proceed with the Casting process.
The intent and purpose of writing this final project is to explain the implementation of bore pile foundation work using the pile mac method in Manado City Hospital buildings, because foundation work is an important component in the structure of a lower part of the building.

Key words: *Construction implementation method, bored pile, Pile Mac (Rotary Circle Dumper).*

Date of Submission: 20-12-2022 Date of Acceptance: 31-12-2022

I. Introduction

Background

Manado City as the Capital of North Sulawesi Province is currently trying to increase and maximize regional development. Along with the increase in regional development,

development in various sectors to support the progress of the City of Manado has been carried out a lot. In this development many large buildings such as buildings, bridges, dams and other structures were erected. To hold the loadthe heavy weight of the building, of course, a solid foundation is needed.

A strong and sturdy foundation is a sub-building structure that is useful as a support for the construction on it. A building structure consists of a superstructure and a substructure. The foundation is the lower structure of the building that is directly connected to the ground, or the part of the building that is located below ground level which has the function of carrying the load of the part of the building above it.

Planning the construction of the foundation structure is important for a construction project.

Foundation development planning such as the construction of the Manado City Hospital building is very important. Considering that this building is a hospital building which is a public service facility by the government in Manado. Based on the type of soil, geographical conditions, location around the project, construction costs and ease of implementation in the field, the selection of the foundation for the Manado City Hospital building construction project is a deep foundation type, namely the Bored Pile foundation, this foundation will transmit the stresses that occur in the structural load into a layer of hard soil that can carry the load of the construction.

The hope of the bored pile foundation work is that it does not interfere with activities around the development project, including: vibration, noise, narrow location and other conditions that can interfere with or affect work activities around the hospital building construction project. For this reason, the writing of this final project is focused on the Bored Pile Foundation Implementation Method in the Manado City Hospital Building Development Project.

Formulation of the problem
Based on the background above, the formulation of the problem in this study was taken to be how the method of carrying out bored pile foundation work with the pile mac method in the construction of the Manado City Hospital building.

Scope of problem
Limitations of the problem taken, namely:
1. This research was conducted in the Manado City Hospital building.
2. Soil bearing capacity and foundation bearing capacity are not taken into account.
3. Not doing a cost analysis.
4. Implementation of bored pile foundation with the Pile Mac method.

Research purposes
The purpose of this study is to explain the method of carrying out bore pile foundation work with the Pile Mac method in the construction of the Manado City Hospital Building.

Benefits of research
The benefits of this research, namely:
1. Readers can understand and understand the method of carrying out bored pile foundation work using the pile mac method
2. Reference material for anyone who reads it, especially for students and practitioners who face the same problem.
3. Can add insight and also knowledge, especially in the field of civil engineering in the method of carrying out bored pile foundation work.

THEORETICAL BASIS
Soil As The Foundation
According to (Nakazawa, 1983)
Soil is the supporting foundation of a building, or the construction material of the building itself such as a levee or dam or sometimes as a source of external force on buildings, such as walls or retaining walls.
The bearing capacity of the soil is defined as the maximum strength of the soil to withstand pressure properly without causing failure. Whereas failure in the soil is excessive settlement or the inability of the soil to resist shear forces and to transmit the load to the soil. (Bowles J.E, 1993 in DiglibUnila, 11/2011).

Soil as the basis of the foundation, includes:
a. Soil Characteristics
According to (Frick, 2001) in planning the substructure, data is needed regarding the characteristics of the soil where the structure is located and the structural load acting on the planned substructure. The structural load that works depends on the type of material used, the number of levels of the building, the type of the type of load acting on the structure and others.
The results of soil investigations reported by the soil engineer include:
1. The condition of the subgrade which describes the type of soil layer at several depth layers.
2. Analysis of soil carrying capacity.
3.The value of the SPT (Standard Penetration Test) from several drill points.
4. The resistance of the cone tip and the amount of adhesive resistance from several sondir points.
5. The results of soil laboratory tests to determine the specific gravity of the soil and others.

Furthermore, recommendations from the soil engineer regarding the type of foundation that can be used based on the results of the soil investigation obtained.
b. Soil Investigation
To find out the location/depth of the compacted soil layer and the allowable bearing capacity of the soil and the bearing capacity of the foundation, it is necessary to carry out a soil investigation which includes investigations both in the field (location/new building plans) and research in the laboratory.
Standard Penetration Test is one method of soil investigation. Standard Penetration Tests are carried out in the borehole after taking soil samples at various depth intervals. The test method was carried out to obtain the parameters of the soil penetration resistance in the field. This parameter is obtained from the number of blows to the cone penetration which can be used to identify the soil layer.

This SPT results is presented in the form of a diagram on a boring log.

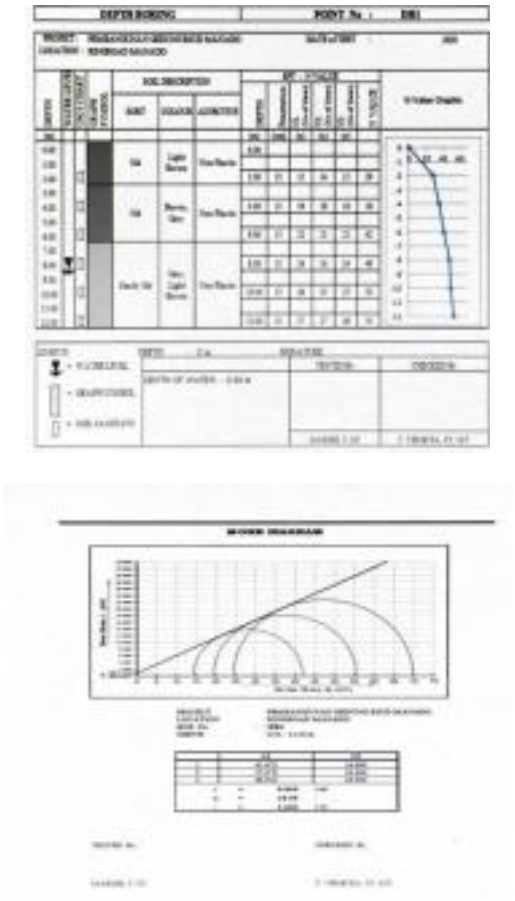


Figure 2.1 SPT data

Definition of Foundation

According to (Gunawan, 1983) the foundation is a part of building construction that functions to lay the building and transmit the load of the superstructure to the ground which is strong enough to support it.

(Frick, 2001) states that the foundation is the part of the building that connects the building to the ground which ensures the stability of the building against its own weight, live loads and forces - external forces on buildings such as wind pressure,earthquakes and others.

(Bowles, 1997) The foundation is part of an engineering system that transmits the load supported by the foundation and its own weight to and into the soil or rocks that lie beneath it.

The foundation function is:

1. As the foot of the building or the base of the building,
2. As a support for buildings and transmitting loads from above to the ground which is strong enough,
3. As a guard so that the position of the building remains stable (fixed).

1. **Shallow Foundation**

a. River Stone Foundation

River stone foundations are usually only used for construction that is not heavy, such as fences, simple dwellings that do not have a story.

Figure 2.2 River Stone Foundation

b. Palm Foundation

Palmfoundation is made of reinforced concrete, with a strong soil depth of up to 2.00 m below the ground surface.

Palm foundations can be divided into four types:

1. Single Palm Foundation
2. Continuous Palm Foundation
3. Combined Palm Foundation
4. Slab Foundation

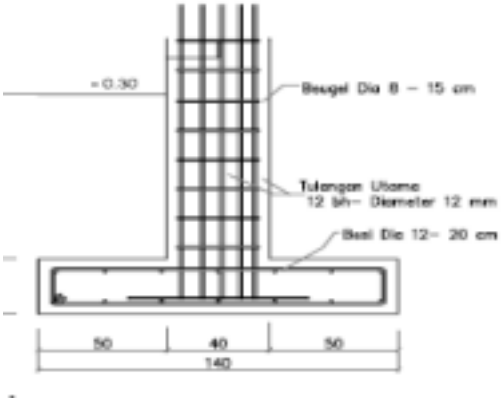


Figure 2.3 Palm Foundation

c. Chicken Claw Foundation

Chicken Claw Foundation Chicken claw foundation is used in swamp areas or to be precise on land with a carrying capacity of 1.5 – 3.5 tons / m2.

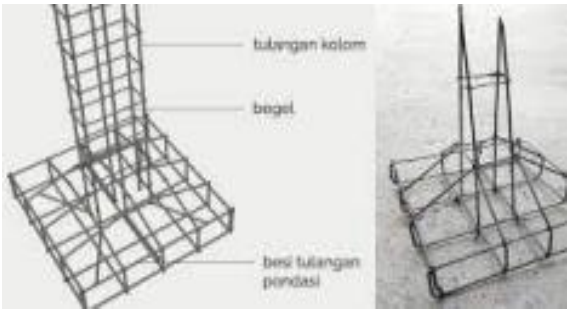


Figure 2.4 Chiken Claw Foundation

d. Cobweb Foundation

The cobweb foundation serves to carry the concentrated load / column from the superstructure such as three to five storey buildings, factories, hangars, high voltage transmission towers and water towers.

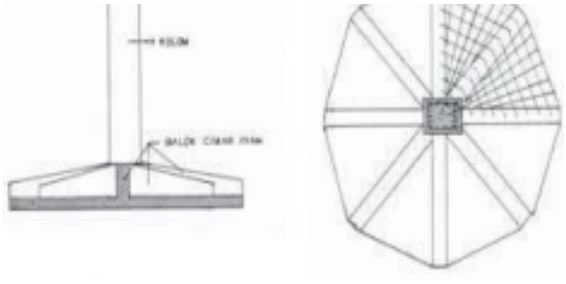


Figure 2.5 Cob Web Foundation

2. **Deep Foundation**

a. Pile Foundation

Pile foundation is a deep construction capable of withstanding orthogonal (perpendicular) forces to the pile axis by absorbing flexure.

Pile foundations are used for several purposes, among others

1. To transmit the load of a building located on water or soft soil, to a strong supporting soil.
2. To transmit the load to relatively soft soil to a certain depth so that the building is able to provide sufficient support to support the load.
3. To anchor a building which is affected by upward lift due to hydrostatic pressure or overturning moment.
4. To withstand horizontal forces and oblique directions.
5. To compact sandy soil, so that the carrying capacity of the soil increases.

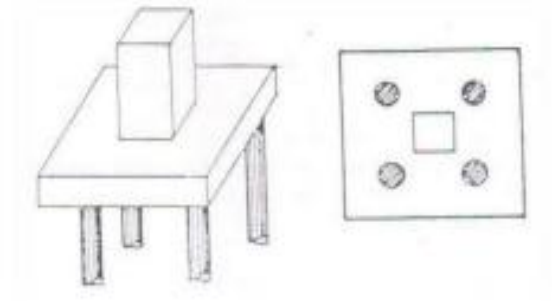


Figure 2.4 Pile Foundation

b. Well Foundation

Well foundation is a form of foundation that can be said to be a transition between shallow foundations and deep foundations (pile foundations). Well foundation is a type of deep foundation that is made on site using concrete components and split stones as fillers.

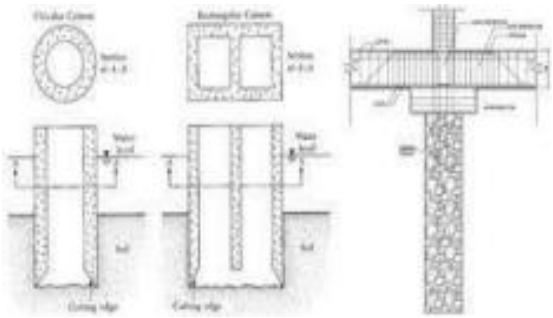


Figure 2.8 Well Foundation

c. Caisson Foundation

This foundation is used as the basic foundation of the building which is used if the open excavation method is not possible due to rising water or sediment at the base of the foundation. In addition, it is also used when the carrying capacity is insufficient by using a pile foundation or settlement and vibration play a role in its use.

Bored Pile Foundation

Bored Pile is a type of foundation with reinforced concrete elements inserted into the drilled hole. Bored pile foundations are used to maintain the stability of the slopes of retaining walls, including lightweight building foundations built on soft soil and structures that require large lateral forces.

There are various types of bored pile foundations, namely:

1. Bored pile straight forhard soil;
2. Bored pile endsenlarged bell-shaped;
3. Bored pile endsenlarged shapetrapezoid;
4. Bored pile straight forrocky ground.

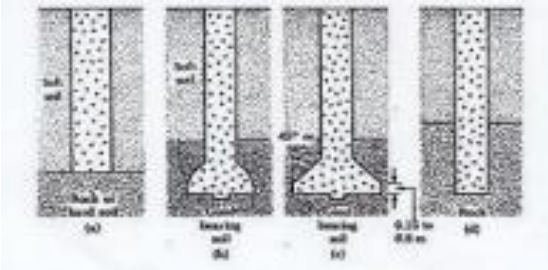


Figure 2.4 Types of Bored Pile

There are several types of tools and methods for working on bored piles, namely:

1. Bored pile mini cranes

With a bored pile machine toolthis can be carried out by drilling with a choice of diameters of 30 cm, 40 cm, 50 cm, 60 cm to 80 cm. The bored pile method uses a wet boring system, sufficient water is needed to support the smooth implementation of the work so that the water source must be considered when using this bored pile tool.

Figure 2.5 Bored Pile Mini Crane

1. Gawangan Bored Pile

This bored pile tool has the working system is similar to the bored pile mini crane, the only difference is in the design of the chassis and the pole where the gearbox is, then it also requires a mine on the right and left of the tool which is linked to another place in order to maintain the balance of the tool during drilling.

Figure 2.6 Bored Pile Gawangan

2. Bored Pile Manual / Strauss Pile

This Strauss pile toolusing manual labor to rotate the drill bit, using the dry bored pile method. Manual pile drill tools that are simple, concise and easy to operate and not noisy when working make this method widely used in various projects such as housing, factories, warehouses, fences etc. The drawback is the limited choice of diameters, namely only 20 cm, 25 cm, 30 cm and 40 cm. Of course this is because this is related to the driving force which is only human power. So this method is mostly used for buildings that are not so heavy.

Figure 2.7 Manual Bored Pile

1. Bored Pile Foundation Implementation Method

In terms of its implementation, bored pile foundations can be divided into 3 types of systems, namely:

1. Augering System

In this system, in addition to the auger itself, for field conditions on soils that easily slide, a casing or bentonite slurry is required as a landslide barrier.

2. Grabbing system

In using this system, a casing (continuous semirotary motion casing) is required as a slide barrier. The casing is inserted into the ground by pressing while rotating.

3. Wash Boring System

This system requires a casing as a slide barrier and also a water pump to circulate the water used for drilling. This system is suitable for loose sand soil conditions. For this type of bore pile, it is necessary to provide additional practical reinforcement to withstand the lateral forces that occur. Reinforcement minimum 2% of pile cross-sectional area. The basic method of drilling is divided into 2, namely:

a. Wet System Drilling

Drilling with the Wet System is used if it is known that the level of the groundwater spring is high enough so as to anticipate the release of water in the construction of the drill hole. Implementation of bored pile foundation with Wet System can be implemented with several drilling systems (methods), namely:

1. Wet System Drilling using Temporary Casing.

Casing is used if the type of soil in the field is at risk of collapse/landslide in the holethe results of the drill so that it will close the hole.

2. Wet System Drilling without Casing

For soil types that are strong and dense enough where the risk of landslides/collapses is negligible, casing is not required.

b. Dry System Drilling

1. Dry System Drilling using Temporary Casing

Casing is used if the type of soil in the field is at risk of collapse/slide in the drilled hole so that it will close the hole.

2. Drilling Dry System without Casing

For soil types that are strong and dense enough where the risk of landslides/collapses is negligible, casing is not needed.

In principle, the work on making drilled pile foundations is carried out in two stages, namely the drilling stage and the pile making stage, the implementation of which must be managed in an integrated manner so that optimal quality foundations can be produced.

The stages of bore pile foundation work are as follows:

a. Job site preparation.

Prior to commencement of the work, a site must be cleared of objects that could hinder the ongoing work, such as building debris or previous construction. Cleaning is carried out using excavators.

b. Determination of the foundation point.

The surveyor team measures and determines the position of the bored pile coordinates with the help of a theodolite or water pass.

c. Stake installation.

After conducting a field survey, the next step is to install signs or stakes based on the axle points of the foundation that have been surveyed.

d. Installation of Stand Pipe/casing.

Stand pipe or casing is installed provided that the center of the stand pipe must be at the foundation axis that has been surveyed.

e. Construction of drainage and water ponds.

Drainage and water ponds are made as clean water reservoirs for foundry work as well as water reservoirs mixed with drilling mud.

f. Machine Settings

After the stand pipe is installed, the drill bit according to the specified diameter is first inserted into the stand pipe, then several plates are installed to strengthen the subgrade for the machine mount, then the machine is positioned with the following provisions:

1. The drill bit is connected to the rotating handlebar, then the drill bit is checked whether it is really at the center/as stand pipe (foundation point)
2. The position of the machine must be perpendicular to the hole to be drilled (which has a standpipe installed), this can be checked with a water pass tool.

g. Drilling Process (Drilling Work).

After the location / position of the machine is completely perpendicular, the drilling process can begin with the following conditions:

1. Drilling is done by rotating the drill bit to the right, and occasionally rotating it to the left to ensure that the drilled hole is completely smooth, as well as to destroy the drilled soil so that it dissolves in water to make it easier to absorb.
2. The drilling process is carried out simultaneously with the drilling mud suction process, therefore the water stored in the water pool must be able to meet the water circulation required for drilling.
3. For every drilling depth of ± 3 meters, a drill rod is connected until the desired depth is reached.
4. If the desired depth is almost reached (another ± 1 meter), then the suction process is stopped, while the drilling process continues until the desired depth, then the drill rod is raised about 0.5-1 meter, then the suction process is continued until the water out of the exhaust hose looks cleaner (± 15 minutes).
5. The depth of drilling is measured with a depth meter, if the desired depth has not been reached, then the process in step 4 is repeated. If the desired depth has been reached, the drill handlebar may be lifted and opened.

h. iron matting

The reinforcement used is available before drilling is carried out, so that once the drilling process is complete, reinforcement is immediately installed, this is done to prevent the walls of the holes from sliding that have been drilled. The reinforcement installation process is carried out as follows:

1. The position of the crane must be paid close attention, so that the reinforcement inserted is completely perpendicular to the drilled hole, and also when casting does not block the entrance of the mixer truck.
2. Two slings are attached to the reinforcement, one at the upper end of the reinforcement and one at the longitudinal side of the reinforcement. In the part where the slings are tied, the spiral reinforcement bond with the main reinforcement is strengthened (welded if necessary), so that when the reinforcement is removed, the reinforcement is not damaged. Each connection should be welded, because during the casting process, when the tremi pipe is raised and lowered it is possible to hit the side of the reinforcement which can cause the reinforcement connection to come loose and the reinforcement to lift up.

3. Reinforcement is lifted using two crane hooks, one on the sling at the top end and one on the elongated side, lifting is done by pulling the hook alternately so that the reinforcement is completely straight, and after the reinforcement is lifted and is perpendicular to the drilled hole, then it is inserted slowly into the hole, the position of the reinforcement is kept so that it does not touch the borehole wall andthe position must be really in the middle / center of the drill hole.

4. If the desired level is below ground level, then an iron hanger is used.
5. After the reinforcement is inserted, then the tremi pipe is inserted. The tremi pipe is connected to facilitate the installation process and also to facilitate the installation process and also to facilitate cutting the tremi at the time of casting, the end of the tremi pipe is between 25 cm - 50 cm from the bottom of the foundation pit, if the distance is less than 25 cm then when casting the concrete is slow to come out of the tremi, whereas if the distance is more than 50 cm then the first time the concrete comes out of the tremi there will be dilution because it mixes with the foundation water, at the upper end of the tremi pipe it is connected to a casting funnel.

i. Casting Process

Casting process in the field is done with Ready Mix Concrete. Must be done immediately after the installation of reinforcement and tremi pipe is completed, in order to avoid the possibility of sliding on the borehole wall. Therefore, ordering ready mix concrete must be able to estimate the time with the time of casting. The casting process is carried out with the following conditions:

1. The tremi pipe is raised 25-50 cm above the bottom of the drilled hole. The water in the tremi pipe is allowed to stabilize first, then a rubber ball or rubber bowl is inserted which has the same diameter as the inside diameter of the tremi pipe.

which serves to suppress mixed water to the bottom of the hole when the concrete is poured for the first time, so that the concrete is not mixed with mud.

2. At the beginning of casting, the pouring is done more quickly, this is done so that the rubber ball or rubber bowl can really suppress the water mixed with mud in the tremi pipe, after that the pouring is stabilized so that the concrete does not spill from the funnel.
3. If the concrete in the funnel is full, the tremi pipe can be moved up and down provided that the tremi pipe is embedded in the concrete at least 1 meter when the tremi pipe is raised. If the tremi pipe embedded in the concrete is too long, this can slow down the casting process, so it is necessary to cut the tremi pipe taking into account the condition that the tremi pipe is still embedded in the concrete at least 1 meter.
4. The casting process is carried out by relying on the force of gravity, the position of the tremi pipe must be at the center of the borehole, so that it does not damage the reinforcement or does not cause the reinforcement to lift when the tremi pipe is moved up and down.
5. Casting is stopped 0.5-1 meter above the clean concrete boundary, so that the quality of the concrete at the clean concrete boundary is truly guaranteed (free of mud).
6. After the casting is complete, the tremi pipe is lifted and opened, and cleaned. Casting limits are measured with a depth meter

2. Advantages of Bored Pile Foundation

1. Single bored piles can be used on group piles or pile caps.
2. The depth of the pile can be varied.
3. Bored piles can be erected before the completion of the next stage.
4. When the driving process is carried out, ground vibrations will cause damage to nearby buildings, but with the use of bore pile foundations this can be prevented.
5. In pile foundations, the driving process in clay soil will make the ground undulate and cause the previous piles to move sideways. This does not occur in bored pile foundation construction.
6. During the implementation of the bored pile foundation there is no sound generated by the piling tool as happened during the implementation of the pile foundation.
7. Bored pile foundations can be enlarged, this provides greater resistance to upward forces.
8. Bored pile foundations have high resistance to lateral loads.

3. **Weaknesses of Bored Pile Foundations**

1. Bad weather conditions can complicate drilling and casting. This can be overcome by delaying drilling andcasting until weather conditions permit or pitching an awning as cover.
2. Drilling can cause density disturbance, if the soil is sand or gravel soil then use bentonite as a landslide barrier.
3. Casting concrete is difficult if it is influenced by ground water because the quality of the concrete cannot be controlled properly, it is overcome by means of a tremie pipe tip 25-50 cm from the bottom of the foundation pit
4. Water flowing into the borehole can cause soil disturbance, thus reducing the soil's bearing capacity against the pile, so the flowing water is directly sucked up and discharged.

5. Ground loss will occur if precautions are not taken, then casing is installed to prevent sliding.
6. Because the diameter of the pile is quite large and requires a lot of concrete and materials for small jobs, the cost is very high, the size of the drilled pile is adjusted to the required load.
7. Even though the penetration to the soil supporting the foundation is considered to have been fulfilled, sometimes it happens that the supporting piles are not perfect due to the presence of mudburied at the bottom, a paralon pipe is installed on the bored pile reinforcement for base grouting work.

Project management

Project management is a scientific discipline in terms of planning organizing management (executing and controlling) to be able to achieve project objectives. A project is a temporary activity that has a predetermined start and finish time (and usually always limited by time, and often also limited by funding sources), to achieve specific and unique goals and results and generally to produce a beneficial change or those with added value.

According to Wulfram I. Ervianto (2004), Construction Project Management is all planning, implementation, control and coordination of a project from the beginning (idea) to the completion of the project to ensure that the project is implemented on time, on cost, and on quality.

Project management is a scientifically and intensively developed management method since the mid-20th century to deal with specific activities in the form of projects. This is an effort so that the objectives of the activity can be achieved efficiently and effectively. Effective in this case is where the results of the use of resources and activities are in accordance with the target which includes quality, time costs and others. While efficient means the use of resources and the selection of sub-activities appropriately which includes the amount, type, when using other resources. The objectives of project management are:
1. Maximizing the potential of the team, this management becomes an individual driver so that they can play their roles optimally and be able to manage projects.
2. Manage risk. Implementation of a project that cannot be separated from trial and error, has risks and can be managed by carrying out project management.
3. Taking advantage of opportunities in this management will help manage opportunities to be utilized for the development of the company while still holding the values to be achieved.
4. Managing integration, making projects consistent and on track in integrity between business processes, systems and organizations.
5. Creating the right planning, this management will lead to the right planning from the beginning to the end of the process, as well as the maximum in capability and quality.

Project management stages:
1. Defining the project, defining the project objectives and the factors that must be considered so that the implemented project is successful with the desired quality.
2. Project initialization, initial planning of resources to be used before a project begins.
3. Project planning, clearly outlines how a project should be executed. In planning this project, it will be seen clearly the importance of the project management triangle, namely the time, cost and quality of a project.
4. Implementation of the project, carrying out the work so that the project in question is successful as desired
5. Project monitoring and control, taking the necessary steps so that the project operation runs smoothly
6. Closure of the project, accept the final results of the project and stop all use of resources

Construction Implementation Method

A method is a procedure or method taken to achieve a certain goal. Implementation is an action or implementation of a plan that has been prepared in detail, implementation is usually carried out after the plan is considered ready. Construction is the arrangement (model, layout) of a building (bridges, houses and so on).

The construction method is a series of construction implementation activities that follow procedures and have been designed in accordance with the knowledge and standards that have been tested. In every construction implementation, technological innovation is required, so that various development activities can run efficiently and effectively, and obtain higher quality construction products.

The construction method is also a series of activities and the sequence of building activities combined with contract requirements (specification drawings, completion schedules), availability of labor and selected environmental conditions (such as weather, soil conditions, etc.).

The Construction Implementation Method is a method that is made in a technical way that describes the mastery of systematic work completion from start to finish which includes the stages/sequences of the main work that can be technically accounted for, as well as how the stages in the method of carrying out the work with the schedule/timeframe for carrying out the work and technical analysis of work units. In preparing the implementation of work for a construction project, it should be in accordance with the requirements in the document where the method of carrying out the work made must meet the substantive requirements stipulated in

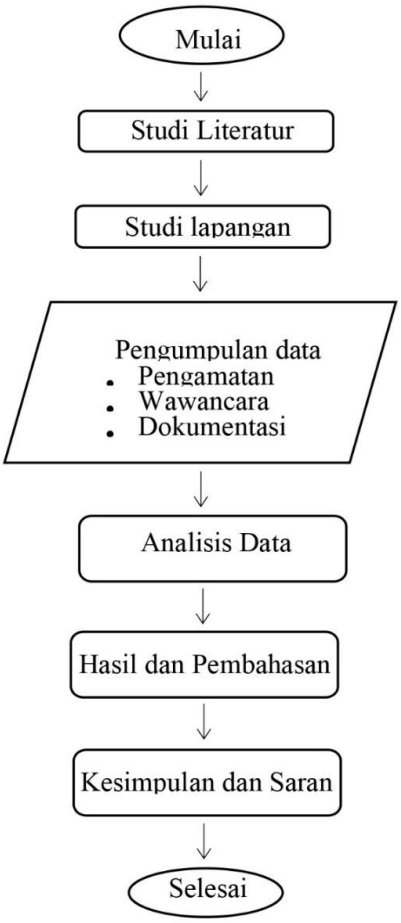
the selection document and describe the mastery in completing the work, including the stages/sequence of work from start to finish in an outline and how to work of each major type of work.

II. Research Methodology

Research sites

Project Name : Construction of the Manado City Hospital Building
Project Location :Tingkulu, Wanea District, Manado City
Project Owner : PT. MAM ENERGINDO

Research Flow Chart



III. Results

Construction of the Manado City Hospital Building.
Project Data
Name of Activity :Construction of the Manado City Hospital Building
Project Location :Tingkulu, Wanea District, Manado City
Contract Date : 16 December 2019
Fiscal Year : 2019-2020

Implementation Time: 365 Days
Service Provider : PT. MAM ENERGINDO
MK Consultant : PT. CIRIA EXPERTINDO CONSULTANT
Contract Value : Rp. 89,500,825,000,-
Source of Funds: PT.SARANA MULTI INFRASTRUKTUR (PERSERO) Regional Loan, budgeted for the 2019 & 2020 Manado City APBD.

Description of the Implementation of Bored Pile Foundation Work for the Construction of the Manado City Hospital Building

The current development of science and technology plays a very important role in a construction project, especially in the application of methods for carrying out construction work in the field. The use of the right method, practical, fast and safe, is very helpful in completing work on the project. So that the time, cost and quality targets as set can be achieved.

The implementation phase for the Construction of the Manado City Hospital Building began on December 16 2019, until now the construction of the 7th floor structure is underway.

For the foundation work for the construction of the Manado City Hospital Building, it began on March 19, 2020 with work on 330 drill points, the depth of each drill hole reaching 11 m and a diameter of 40 cm.

The stages of bored pile foundation work with the pile mac method are as follows:

a. Job site preparation.

Before the work begins, land clearing is carried out. Namely, land clearing, land leveling and topsoil disposal outside the project site. Cleaning the work location from existing disturbances such as buildings, plants or trees, electricity or telephone poles, cables and others. In general, this work is done mechanically, using excavators and dump trucks. The existence of human labor is to assist cleaning and loading manually.

b. Field survey and determination of foundation points

Study the lay-out of the foundation and determine the bore/stake out points according to the structural drawings and site layout that have been agreed upon by all parties (Contractor, MK, and PPTK). Then the surveyor team measured and determined the position of the bored pile coordinates with the help of a Total Station or Waterpass tool.

c. Stake installation

After carrying out a field survey and determining the point, the next step is to install signs or stakes based on the foundation axle points that have been surveyed.

d. Installation of Stand Pipe / casing

To avoid soil collapse, casing is prepared according to the diameter of the auger. The stand pipe/casing is installed provided that the center of the stand pipe must be at the axle point of the foundation that has been surveyed. The installation of the stand pipe is carried out with the help of an excavator (back hoe).

e. Reinforcing

Before drilling is carried out according to the point, the steel has been fabricated until it is ready to install. Drilling will begin when the iron fabrication is running at 25% of the total plan. Spiral steel is done using a bar bender.

f. Machine Settings

After the casing is installed, the drill bit according to the specified diameter is first inserted into the casing, then several plates are installed to strengthen the subgrade for the Pile Mac RCD (Rotary Circle Dumper) machine holder, then the RCD machine is positioned with the following provisions:

1. The drill bit is connected to the rotating handlebar, then the drill bit is checked whether it is really in the center/as stand pipe (foundation point).
2. The position of the pile mac must be perpendicular to the hole to be drilled.

g. Drilling Work

The work was carried out using a drill with an auger diameter of 40 cm to a design depth of 11 m. After the location/position of the machine is completely perpendicular, the drilling process can begin with the following conditions:

1. Drilling is done by rotating the drill bit to the right, done repeatedly to a predetermined depth
2. Drilling with an RCD machine after reaching the specified depth, finishing is carried out by changing the special drill bit to remove the mud in the hole.
3. After drilling, drilled soil is collected according to the evacuation route and prepared by excavators and dump trucks to transport it out
4. Try to complete the drilling sequence in one go, so that the use of the tool is more efficient.

h. Concrete reinforcement

The reinforcement used is available before the drilling is carried out, so that once the drilling process is complete, reinforcement is immediately installed, this is done to prevent the wall from sliding into the hole that has been drilled.

The reinforcement installation process is carried out as follows:
1. The position of the tower crane must be paid close attention, so that the reinforcement that is inserted is completely perpendicular to the borehole, and also that during casting it does not block the entrance of the mixer truck.
2. It is better to weld each spiral reinforcement bond with the main reinforcement, because during the casting process, when the tremi pipe is raised and lowered it is possible to hit the side of the reinforcement which can cause the reinforcement connection to come loose and the reinforcement to lift up
3. Reinforcement is lifted using a tower crane, lifting is done by pulling the hook carefully so that the reinforcement is completely straight, and after the reinforcement is lifted and is perpendicular to the drilled hole, then slowly inserted into the hole, the position of the reinforcement is maintained so that it doesn't touch the wall of the drill hole and its position must be really in the middle / center of the drill hole.
4. After the reinforcement is inserted, then the tremi pipe is inserted. The tremi pipe is connected to facilitate the process when casting, at the upper end of the tremi pipe is connected to the casting funnel.
i. Casting
Further work is in the form of planting iron assisted by a tower crane and casting K350 concrete assisted by a TM car and a concrete pump. Casting process in the field is done with Ready Mix Concrete. Therefore, ordering ready mix concrete must be able to estimate the time with the time of casting.
The order of casting, namely:
1. Installation of reinforcement and tremi pipes must be completed.
2. At the beginning of casting, the pouring is done more quickly, this is done so that it can really suppress the water mixed with the remaining mud to get out of the hole, after that the pouring is stabilized so that the concrete does not spill from the funnel.
3. If the concrete in the funnel is full, the tremi pipe can be moved up and down.
4. After the casting is complete, the tremi pipe is lifted and opened, and cleaned.

CLOSING

Conclusion

Based on the results of the study, it can be concluded that the construction of the Manado City Hospital Building in the stages of carrying out bored pile foundation work applies the Pile Mac method using an RCD (Rotary Circle Dumper) machine. As follows: preparation of work sites, field surveys and determination of foundation points, installation of stakes, installation of casing, steelwork, machine settings, drilling work, reinforcement and casting. The drilling work becomes easier, the method used is appropriate so that the project completion time is quite efficient and it is easier in terms of project management to go according to plan.

Suggestion

Based on the results of the analysis in this final project research, suggestions are given that are expected to be useful to implement, namely:
1. Must follow all stages of construction on project management. Because the success of a construction project in achieving project goals is very dependent on the management process that takes place within the project.
2. When using an RCD (Rotary Circle Dumper) machine, you must learn how to be more time and cost efficient.
3. Always prioritize work safety, because there are still workers and supervisors who do not use safety.

Bibliography

[1]. Halibu, E. Z. (2015). PERENCANAAN PONDASI BORED PILE DAN METODE PELAKSANAAN PADA PROYEK PEMBANGUNAN GEDUNG RSJ PROF DR. V.L. RATUMBUYSANG MANADO.
[2]. MANDAK, L. .. (2016). PERENCANAAN DAN METODE PELAKSANAAN PONDASI BORE PILE PROYEK PEMBANGUNAN BUTIK GUNUNG LANGIT MANADO.
[3]. SARI, N. M. (2015). METODE PELAKSANAAN PEMBANGUNAN PROYEK APARTEMEN ONE EAST SURABAYA DENGAN METODE TOP-DOWN. TUGAS AKHIR - RC14-1501.
[4]. DOKUMEN ADENDUM KONTRAK GEDUNG RSUD KOTA MANADO. (2019). Manado., 2019
[5]. Bowles, J.E. (1996) Foundation Analysis and Design, Tokyo, Japan.
[6]. CARANE, (2019). Metode PelaksanaanProyekKonstruksi. https://caranecom.blogspot.com/2019/04/pengertian-metode-pelaksanaanproyek.html.
[7]. ABRAR HUSEN, (2010). "ManajemenProyek". Penerbit ANDI, Yogyakarta.
[8]. (n.d.). https://www.adhyaksapersada.co.id/apa-itu- borepile/
[9]. (n.d.). Retrieved from https://www.linkedin.com/pulse/pengertian-proyek-harry-dharma-putra
[10]. (n.d.). Retrieved from
[11]. https://cpssoft.com/blog/manajemen/pengertian-dan-tahapan-manajemen-proyek/