

## **CHAPTER IV**

### **METHODOLOGY**

#### **4.1 Project Location for Internship**

The internship was done at Hotel Santika, which is located at Jalan Engku Putri No. 9, Batam Centre, Batam, Riau Island Province, with PT. Multi Daya Investama as the owner, PT. Prambanan Dwipaka as the contractor. The decision of choosing Hotel Santika for internship is based on the regulations from Universitas Internasional Batam follows:

1. Construction project of a building with four floors or more.
2. Construction project that is worth more than Rp. 500.000.000,- (five hundred million rupiah)

#### **4.2 Period of Time for Internship**

The internship was done in a period of time of three months. With the regulations from Universitas Internasional Batam, the internship starts from February and ends at April 2019. The work day of the internship is on Saturday, in which the work time starts from 08.00 a.m. until 05.00 p.m.

#### **4.3 Method of Internship**

In order to fulfill the criteria of writing an internship report, data collection and analysis is done beforehand.

### 4.3.1 Data Collection

Data are being collected in form of actual data on site and drawings. These data are used for analyzing the strength of the retaining wall, which is going to be discussed by the writer on the next chapter. The procedures of collecting data at Hotel Santika follows:

1. Observational Study

Observational study is a way of collecting data in which it is gathered directly on site. The observation of structural construction is being done during the internship period. The structural construction of the retaining wall is being observed intensively due to the topic of the internship report. The procedurals of building the retaining wall at Hotel Santika are observed from the start until the end of the construction.

2. Literature Study

Literature study is a way of collecting data in which it is gathered from sources like journals and books in which discusses about retaining wall and its properties. Literature review is used as theoretical basis for calculating the strength of the retaining wall at Hotel Santika.

3. Interview

Interviewing related parties in the construction project of Hotel Santika is a method of acquiring data in which it is not written or displayed in the data acquired from the method before. Interviewing

people in the project such as the contractor, the supervisor from the management consultant, foreman of the workers and the workers themselves are essential for identifying the problems that exist in the construction site.

#### **4.3.2 Data Analysis**

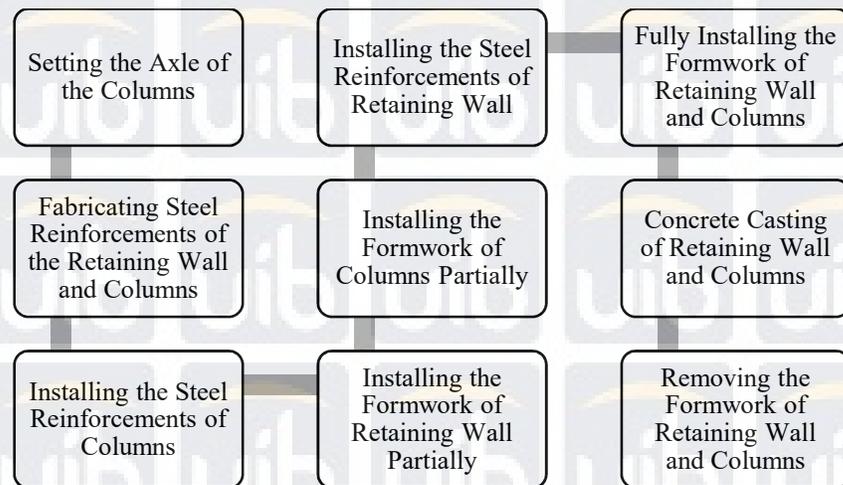
Data analysis is done after data is being collected. With the context of the title for this internship report, the writer intends to summarize the usage and the capability of the retaining wall designed and built in the construction project of Hotel Santika.

#### **4.4 Construction Method**

The construction of Hotel Santika starts from foundation. The foundation used is bored pile with the combination of piling. After setting the foundation, pile cap is constructed to join nearby piles. After casting the pile caps, ground beams are casted in order to fixate the position of the columns and also the columns are casted in order to have a lateral support. Not to forget that the ground slab is casted as well since it is needed to be fused with ground beam. The construction of the floors afterwards follows the sequence of casting the columns, beam and slab. In this construction, a retaining wall is used. Hence, the wall is being constructed after the ground slab of the basement level. The retaining wall has a various of length and height. In this report, the scope of the report is about the longest span. The method of constructing the retaining wall of Hotel Santika as follows:

#### 4.4.1 Structural Work

The structural work for constructing the retaining wall starts from structural work for columns, since the retaining wall will be casted with the column. The following diagram explains the sequence of constructing the retaining wall.



**Figure 4.1** The sequence of constructing the retaining wall

##### 1. Setting the Axle of the Columns

The axle of the columns is usually predetermined before casting the ground beam. The method of determining the axle is by using theodolite, an instrument that is usually used for surveying. In this case, theodolite is being used to determine the axle of the columns. After determining the axle, marking is being done in order to fix the position of the axle. The marking can be by having an inked thread or other tools for marking such as paint or markers. The axle of columns may vary due

to the shifting of casted concrete as well as human error. Ergo, it is important to control and check the axle of every column on site.

## 2. Fabricating Steel Reinforcements of Retaining Wall and Columns

Steel rebars are being fabricated in order to be installed and casted. These are the steps of fabricating the steel rebars:

- 1) The rebars are fabricated with the sized determined from the shop drawing in which given consent by the management consultant. Hence, the rebars are ordered by the logistic team of the project as per request of the demand for work. The length of the rebar from the supplier is 12 meters.



*Figure 4.2* Reinforcements Bars

- 2) In order to cut and bend the steel bars into sizes that is needed on site, a bar cutter is needed to cut the steel bars and a bar bender is needed to bend the steel bars.



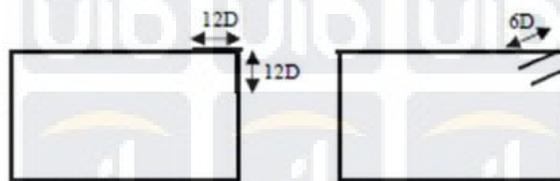
**Figure 4.3** Bar Cutter



**Figure 4.4** Bar Bender

To fabricate the stirrups for columns and beams, both bar cutter and bar bender. The bar cutter cuts steel bars into sizes that will be bent. The bar bender is used for bending the steel to form a ring bracing of the column. The length needed for

making the stirrups of the column is the perimeter of the main reinforcement bars plus the hook of the stirrups which the length is six times of the diameter of the steel bar with the condition the stirrup is bended to  $135^\circ$ . While for the stirrup that is bended to  $90^\circ$ , the length needed for the hook is twelve times of the diameter of the steel bar.



**Figure 4.5** The minimum length required for stirrups

- 3) The longitudinal bars of columns are being cut according to the height of the designed column plus a length of 50 times diameter of the rebar for the joint of the next column above. The longitudinal bars below with the length of 50 times diameter of the rebar is being narrowed down for the sake of joining between two columns.



**Figure 4.6** Stirrups



**Figure 4.7** Reinforcement bars of column

4) The longitudinal bars of the column and the stirrups are tied together with a rebar tie wire.

As for the reinforcement bars for the retaining wall, the rebars are usually being cut according to the shop drawing. The bar bender is used for bending one edge of the rebar.

### 3. Installing the steel reinforcements of columns

The erection of steel reinforcements of columns is being directed by a tower crane due to the weight of the bound rebars. The spared length of 50 times diameter of steel length is prepared beforehand in order to install the upcoming column bars. The installation of the steel bars is being done by tying the stirrups of the columns into place with the planted bars and the new column bars by using a rebar tie wire. It is given a concrete deck blocks with the reason to have the steel reinforcements bar in the middle of the concrete column.



(a)



(b)

**Figure 4.8** (a) Tower crane and (b) concrete deck blocks

### 4. Installing the formwork of retaining wall and columns partially

In order to determine if the placement of the columns and the retaining wall is on place, it is needed to install the formwork partially.

Usually, it is being installed on the outer part of the wall in order to have

easier installation of the reinforcement bars for the retaining wall. The installment of the formwork is being helped with a tower crane. The formwork must be clean and lubricated with oil for easier removal of formwork.

#### 5. Installing the steel reinforcements of the retaining wall

With the formwork on place, the next step will be erecting the reinforcement bars of the retaining wall. Before starting the procedures, the ground beam must be ready with spared steel bars for binding the reinforcement bars of the retaining wall with the spared bars from the ground beam. The vertical reinforcement bars are assembled first, then the horizontal reinforcement bars act as the steel bars' stiffeners. The horizontal reinforcement bars are installed from the axle of the columns of both sides. The steel bars are being bound by rebar tie wire.



*Figure 4.9* The installment of steel reinforcement bars of the retaining wall

#### 6. Fully installing the formwork of retaining wall and columns

In order to continue to casting concrete, the formwork must be finished. The formwork is installed when the reinforcement bars of both retaining wall and columns are already in place.



**Figure 4.10** The installation of formwork

#### 7. Concrete casting of the retaining wall and columns

When the formwork is installed, concrete casting takes place.

The concrete must be in good condition in which the slump levels are in ideal number and vibration of the casting process is being executed. Casting is being done with the help of the tower crane due to the inaccessibility of concrete pump to the location. The tower crane carries a huge bucket that contains concrete, and the concrete flows down from the bucket through an elastic rubber pipe. The grade of concrete was designed K-400 with the slump of  $12 \pm 2$  cm.



**Figure 4.11** Concrete casting of columns and retaining wall

8. Removing the formwork of retaining wall and columns

After the concrete settled down for 24 hours, the dismantling of the formwork is being done with the help of the tower crane. The process starts from dismantling the tie beams of the formwork, and then disassemble the plywood of the formwork. It must be done cautiously in order to prevent damage against the newly-casted concrete.