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REINFORCEMENT NEEDS FOR THE FOUNDATION OF A MULTI-STOREY BUILDING Y – NORTH JAKARTA

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Abstract: The North Jakarta XYZ Building Construction Project consists of two stages of construction. The first phase of construction began on August 17, 2020 and was completed on August 17, 2021, while the second phase is currently under construction. The building structure consists of two towers with a total of 107 residential units for households. Construction work on this project includes preparatory work such as marking work, foundation work, substructure work such as pile drive, and superstructure work such as pillar work and curtain installation. The method of calculating rebar reinforcement using the Bar Bending Schedule (BBS) includes several steps to calculate the working volume, calculate reinforcement needs, calculate waste and calculate rebar weight. Based on the results of the analysis, it can be obtained that the main rebar requirement for D19 is 676.7 kg or 36.8% of the rebar requirement. End Spiral + Joint Reinforcement, D13 is 908.54 Kg or 48.98% of the rebar requirement. Middle Spiral Rebar + Joint, D10 amounted to 269.51 Kg or 14.53% of rebar requirements. Rebar waste, namely D19 Main Reinforcement, contains 178.08 kg of waste or 26.31% of rebar needs. Rebar waste, namely Spiral End Reinforcement + Joint, D13 contains 27.46 kg of waste or 12.63% of rebar needs. Rebar waste, namely Spiral End Reinforcement + Joint, D13, contains 11.85 kg of waste or 5.44% of rebar needs. The amount of cost needed for strengthening needs is Rp. 30,603,434.

Keywords: Reinforcement, structural elements, multi-storey buildings

INTRODUCTION

The calculation of the reinforcement needs of the building structure is an important part of the building structure design process. The background of this calculation involves several factors that must be considered, including the load applied. The type of material used for the structure (e.g., reinforced concrete, steel, wood) will affect the needs of the reinforcement. Structural analysis is performed to determine the forces in the structural elements. This information is necessary to calculate the reinforcement requirements required to withstand those forces. The calculation must also consider the safety factors necessary to ensure that the structure has sufficient capacity to withstand the load exerted on it.

The geometry and dimensions of the structure also affect the needs of reinforcement. Structures with different shapes and dimensions will require different reinforcement distributions. Structural analysis is performed to determine the forces in the structural elements. This information is necessary to calculate the reinforcement requirements required to withstand those forces. The calculation must also consider the safety factors necessary to ensure that the structure has sufficient capacity to withstand the load exerted on it. The envrebarment in which the structure is located also needs to be considered. For example, if the structure is located in an earthquake-prone area, the reinforcement calculation must take into account the earthquake forces that are expected to occur.

All of the above factors, along with other factors, will affect the calculation of the reinforcement needs of the building structure. Keep in mind that these calculations must be performed by trained and experienced structural engineers, and must comply with all applicable regulations and standards.

In this study, it is explained how to determine the calculation of needs for the type of pile foundation. The purpose of this study is to analyze the need for reinforcement on the inner foundation, namely piles. The benefit of this research is to know the need for reinforcement on the inner foundation, namely the piles.

The structure in the foundation, beams, foundations and slabs are made of rebar and concrete, both of which are a combination of tensile and compressive resistant materials. Rebar is a tensile resistant material, while concrete is a compressive material. The combination of these two materials in the concrete structure allows the construction of the structural parts to withstand the compressive and tensile forces of the building. The structural must be designed to withstand the axial force of the factored load on all parts of the structure and the maximum moment of the factored load on a reviewed construction.

In the planning of foundations, beams, foundations and slabs, the theoretical bases used are the application of construction planning, but there is an additional new factor (in addition to the bending moment) namely the normal compressive forces that are included in the calculation. Therefore, there needs to be an adjustment in compiling the equilibrium equation by reviewing the combination of bending moment and normal compressive force.

In construction bending, the planning of the installed reinforcement can be planned to behave in a daktail and usually the normal compressive force is dominant so that collapse of compressive and tensile nature is difficult to avoid.

According to SNI 2847:2013, a foundation is part of a substructure system that holds its own weight and the entire force load then passes it to the soil and rock layers located underneath.

Based on SNI 2052:2017, carbon steel or alloy steel in the form of a round-cross-sectional rod with a plain surface or fins/threads and is used for concrete repeating. This steel is produced from billet raw materials by hot rolling.

RESEARCH METHODOLOGY

1. Literature Review

   Literature Studies is one of the basic techniques in reviewing research sources that have been carried out by previous researchers to expand their horizons and solve problems related to the object to be studied. References related to the problems to be studied are:

   a) Object of research
   b) The results of the research that have been carried out by previous researchers can be compared with the results of the research to be studied.

2. Flowchart

The stages of research that will be carried out include, preparation work, sample taking, preparation of tools and materials, kneading of original soil samples, testing of soil samples of mixed variations, and the last is the analysis of test results. The research process will be described in the form of a flowchart in figure 1.

The research methods carried out are contained in the following flow chart.

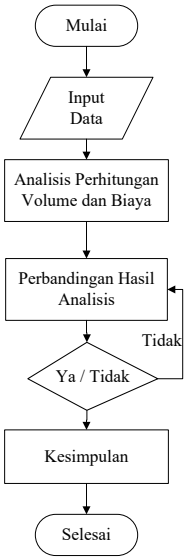

Figure 1. Image of the Research Flow
Source : Researcher

The place where the research was carried out was at the Dian Nusantara University Campus, Jl. Tanjung Duren Barat, Grogol Petamburan, West Jakarta. The research process was carried out from March 13, 2023 to August 12, 2023.

RESULTS AND DISCUSSION

1. Literature

1. The Housing Authority Act 1983.
2. Concrete Reinforcement Steel. SNI 07-2052-2002
3. Table of Rebaring Data in the field
4. Formula for Calculating the Need for Rebar Rebar Per 12 m
5. (Rebar Length x Number of Rods) / 12 m (length of one rebar)
6. Formula for Calculating Weight Requirement (kg) of Reinforcement Rebar
7. (Rebar Length x Number of Rods) x D x Rebar Coefficient (Kg)

2. U.S. Pile Foundation Data Type. B/As. 2

1. Pile dimension 350/350 mm, h = 1800 mm = 4 Pile Pieces
2. Number of main reinforcing rebar 4D19 L = 19 m
3. Spiral end + connection D13-75 L = 1.3 m
4. Spiral tengah D10-150 L = 1,3 m

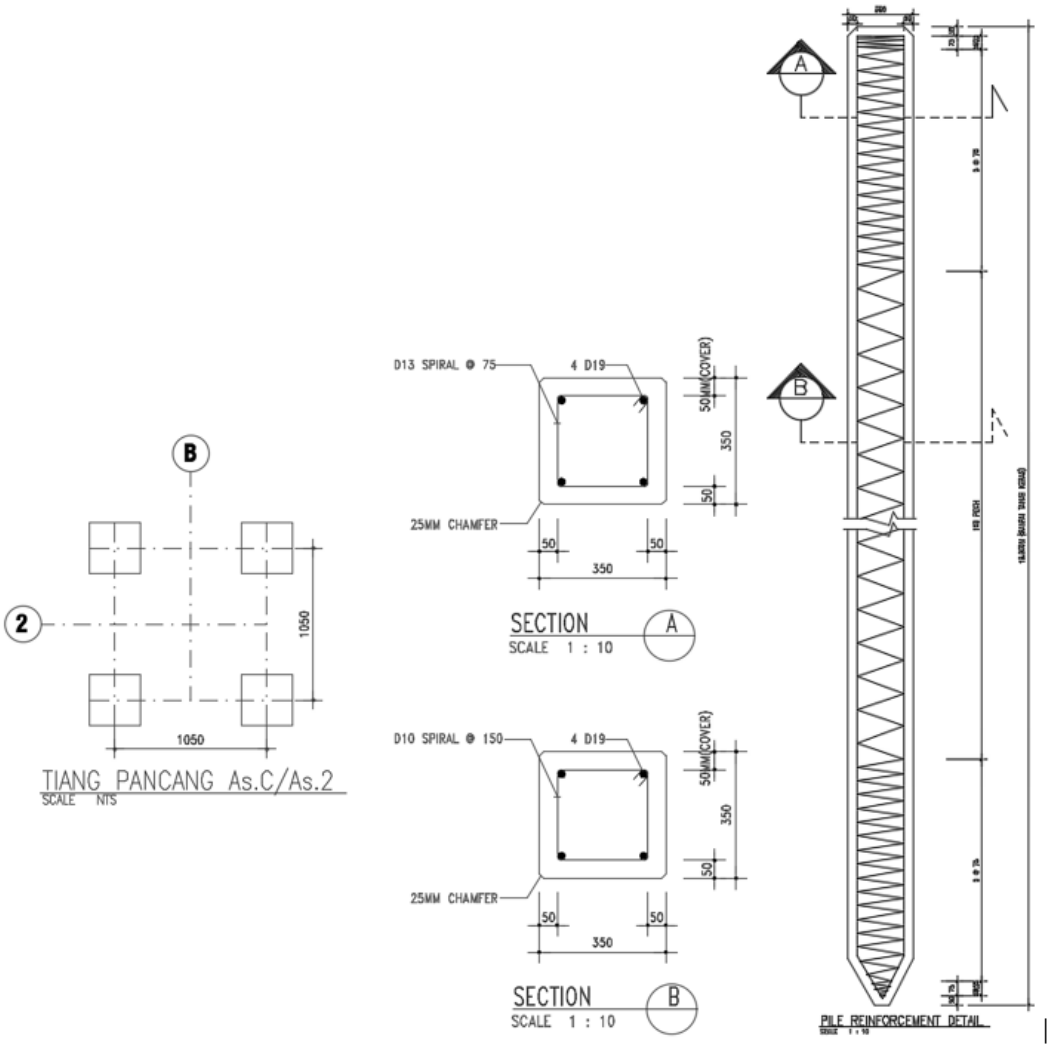

Figure 2. Kind Data
Source : Author

3. Rebar Calculation Analysis

Calculation of Type Foundation (350x350)
Main Reinforcement: 4D19

1. Number of Foundations : 4 Foundations
2. Length of Cuts : 19 m
3. Number of Cuts : 4
4. Number of Cuts Needed : Number of Foundations x Number of Cuts
   4 x 4 = 16
5. Length of Rebar/Bar : 12 m
6. Rebar/Bar Requirement : 1 piece
7. Cut (pieces) : Length of Rebar/Bar
   : Length Cuts
   12 m: 12 m = 1 piece
   Cuts
   12 : 7 m = 1.71 pieces ~ 1 piece
   (rounded down)
8. Waste/Bar (m) : (Length of Rebar/Bar x Rebar/Bar Requirement) – (Length of Cuts x Cut)
   (12 x 1) – (12 x 1) = 0 m
   (12 x 1) – (7 x 1) = 5 m
9. Number of Reinforcement Pieces (Btg) : Number of Cuts Needed: Cut
   16: 1 = 16
10. Length Needed (m) : Length of Cuts x Number of Cuts Needed
    19 m x 16 = 304 m
11. Length of Reinforcement (m) : Length of Rebar/Bar x Number of Cuts of Reinforcement
    12 m x 32 = 384 m
12. Length of Waste (m) : Length of Reinforcement – Length of Requirement
    192 m – 192 m = 0 m
    192 m – 112 m = 80 m
13. Weight of Rebar (Kg/m) : 2.23 Kg/m
14. Requirement of Rebar (Kg) : Length Needed x Weight of Rebar
    192 m x 2.23 Kg/m = 427.39 Kg
    112 m x 2.23 Kg/m = 249.31 Kg
15. Waste Rebar (Kg) : Waste Length x Rebar Weight
    0 m x 2.23 Kg/m = 0 Kg
    80 m x 2.23 Kg/m = 178.08 Kg

Table 1 Recapitulation of Calculations (1)

Tidak
1

No	Foundation Type	Rebar	Sum Foundation	Panjang Cut (m)	Sum Piece	Sum Cutting Needs	Panjang Besi/Btg (m)	Needs Besi/Btg (bh)	Cut (bh)
			1	2	3	4 = 1x3	5	6	7 = 5:2
1	Foundation	Main reinforcement 4D19	4	12	4	16	12	1	1
				7	4	16	12	1	1
	(350/350)	Spiral Reinforcement End + Joint, D13-75		1,3	168	672	12	1	9
		Middle Spiral Reinforcement Rebar, D10-150		1,3	84	336	12	1	9

Tipe Pondasi	Besi	Total Pondasi	length Potongan (m)	Total Potongan	Total Kebutuhan Potong	Total Besi/Btg (m)	Needs Besi/Btg (bh)	Cut (bh)
		1	2	3	4 = 1x3	5	6	7 = 5:2
Pondasi	Tulangan Utama 4D19	4	12	4	16	12	1	1
			7	4	16	12	1	1
(350/350)	Tulangan Spiral Ujung + Joint, D13-75		1,3	168	672	12	1	9

Table 2 Recapitulation of Calculations (2)

Waste/Btg (m)	Total Cut the reinforcement (Btg)	length Necessity (m)	length Tulangan (m)	length Waste (m)	Weight Rebar Kg/m	Kebutuhan Rebar (Kg)	Sampah Rebar (Kg)
8 = (5x6)-(2x7)	9 = 4:7	10 = 2x4	11 = 5x9	12 = 11-10	13	14 = 10x13	15 = 12x13
0	16	192,00	192	0,00	2,23	427,39	0,00
5	16	112,00	192	80,00	2,23	249,31	178,08
0,3	75	873,60	900	26,40	1,04	908,54	27,46
0,3	38	436,80	456	19,20	0,62	269,51	11,85

Based on the calculation analysis, the main reinforcement rebar D19 was obtained of 676.7 kg or 36.8% of the rebar needs and rebar waste, namely the main reinforcement D19 there was waste of 178.08 kg or 81.92% of the rebar requirement. Spiral Reinforcement Tip + Joint, D13 amounted to 908.54 Kg or 48.98% of rebar needs and rebar waste, namely Spiral Reinforcement Tip + Joint, D13 contained waste of 27.46 Kg or 12.63% of rebar needs. Middle Spiral Reinforcement + Joint, D10 amounted to 269.51 Kg or 14.53% of rebar and rebar waste, namely Spiral Reinforcement Tip + Joint, D13 had waste of 11.85 Kg or 5.44% of rebar needs.

Cost Calculation Analysis

The unit price of rebar per Kg obtained from the market price of rebar in 2024 in the city of DKI Jakarta is Rp. 16,500 per Kg. So that the cost comparison can be seen in Table 4.6 Comparison of Rebar Material Costs.

Tabel 3 Biaya Material Besi

Rebar	Researcher Analysis
Main reinforcement D19 (Kg)	676,70
End Spiral Reinforcement D13 (Kg)	908,54
End Spiral Reinforcement D10 (Kg)	269,51
Total (Kg)	**1854,75**
Cost (Rp)	**30.603.434**

Based on Table 3 of the cost of rebar materials, the results of the Researcher's calculation are Rp. 30,603,434.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that:

1. The main reinforcement rebar requirement of D19 is 676.7 kg or 36.8% of the rebar requirement. Spiral Reinforcement End + Joint, D13 is 908.54 Kg or 48.98% of the rebar requirement. Middle Spiral Rebar + Joint, D10 amounted to 269.51 Kg or 14.53% of the rebar requirement.
2. Rebar waste, namely Main Reinforcement D19, has waste of 178.08 Kg or 26.31% of rebar needs. Rebar waste is Spiral Tip + Joint Reinforcement, D13 has waste of 27.46 Kg or 12.63% of rebar needs. Rebar waste is Spiral Tip + Joint Reinforcement, D13 has waste of 11.85 Kg or 5.44% of rebar needs.
3. The amount of cost needed for reinforcement needs is Rp. 30.603.434.

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