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Superstructure Planning of 21 Floor Swasana Building Anami Tower B Klapa Village Project

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ABSTRACT

The structural planning of building construction is needed to get the most effective and efficient dimensions and configuration of the structure. Planning a building structure located in an earthquake-prone area must be planned according to standards, is strong, and is earthquake-safe. The Planning of the Superstructure of the Swasana Building 21 Floors Anami Tower B the Klapa Village Project refers to the Procedures for Planning for Concrete Structures and Buildings of SNI 2847-2019, and the Standards for Planning Earthquake Resistance for Building Structures of SNI 1726-2019. Planning of the Superstructure of the 21-Story Swasana Building Tower B of the Klapa Village project uses Etabs V.17 software which includes the planning of beams, columns, and floor slabs. Loads that are reviewed for the design of structural elements are dead load, live load, and earthquake load.

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1. INTRODUCTION

Anami Swasana Building Tower B Klapa Village Project is located on Jl. H. Naman, Pondok Kelapa Village, Kec. Duren Sawit, East Jakarta is a high-rise building consisting of 21 floors, built due to the increasingly limited available land. Therefore, to optimize the capacity of the limited land, the city government of Jakarta continues to work closely with entrepreneurs to think about building vertically [6][2]. One form of vertical settlement is the residence of the 21 Floor Swasana Apartment Tower B, the Klapa Village Project [7][11]. So that in planning the structure of this building, it is designed to be strong against the loads that occur including earthquake loads so that the building meets the requirements for strength and structural rigidity as required in SNI [8][12].

In designing the structure, it must be guided by the applicable regulations [9]. The design of the building structure refers to the Standard Procedures for Planning Concrete Structures for Buildings, SNI 2847-2019, Procedures for Planning for Earthquake Resistance for Buildings, SNI 1726-2019 [1].

2. METHOD

The data used to plan earthquake-resistant structure planning in the Swasana Building 21 Floor Anami Tower B Klapa Village Project, namely primary data and secondary data [5][10].

2.1 Primary Data

Primary data is data obtained from direct observations and research in the development area and around the construction site. These data include:
Project working drawing Project location point Building data.

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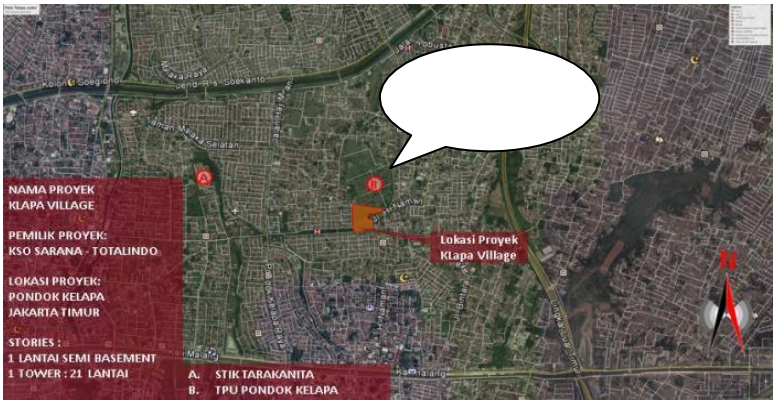


Figure 1. Project Location

2.2 Secondary Data

The data collection process required for building structural planning are:

Literature studies or reference materials used in the completion of this thesis include:

- SNI 2847:2019, Requirements for Structural Concrete for Buildings
- SNI 1727:2020 Minimum Load for Planning of Buildings and Other Structures
- SNI 03-1726-2019, Procedures for Planning Earthquake Resistance for Buildings
- SNI 2052-2017 Regarding Concrete Reinforcement

Steel Technical Data:

- Upper Structure
  Planning area: 1.4 ha
- Quality of Superstructure Concrete Column and Sherwal
  Basement – Lt. 6 : FC' 35
  Lt. 7 – Lt. 12 : FC' 35
  Lt. 13 – Lt. Roof : FC' 35
  Mast 400 x 400 : FC' 35
- Pilecap, Tie Beam, Plate, Beam
  Basement – Lt. 6 : FC' 35
  Lt. 7 – Lt. Roof : FC' 30
  Ladder and Parapet : FC' 30
  Lintol and Practical Column : FC' 20
  Working Floor : FC' 15
- Steel and Reinforcement Quality
  10 mm, U24 (Plain) D≥ 10 mm,
  U40 (Deform) M≥ 4 mm,
  U50 (Wiremesh)

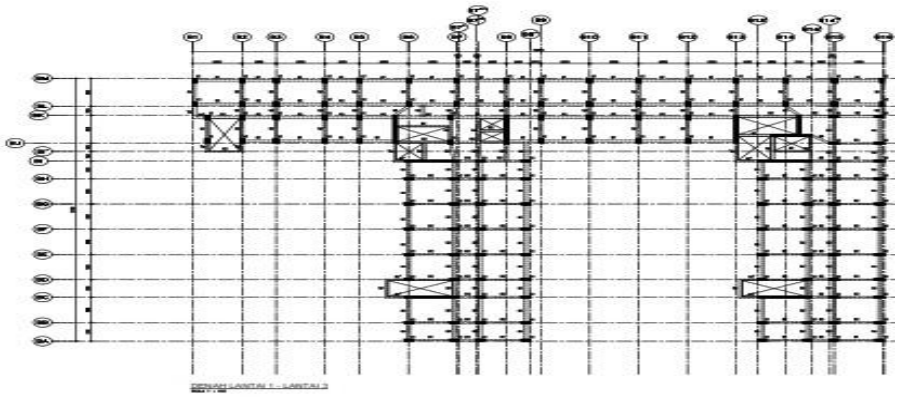
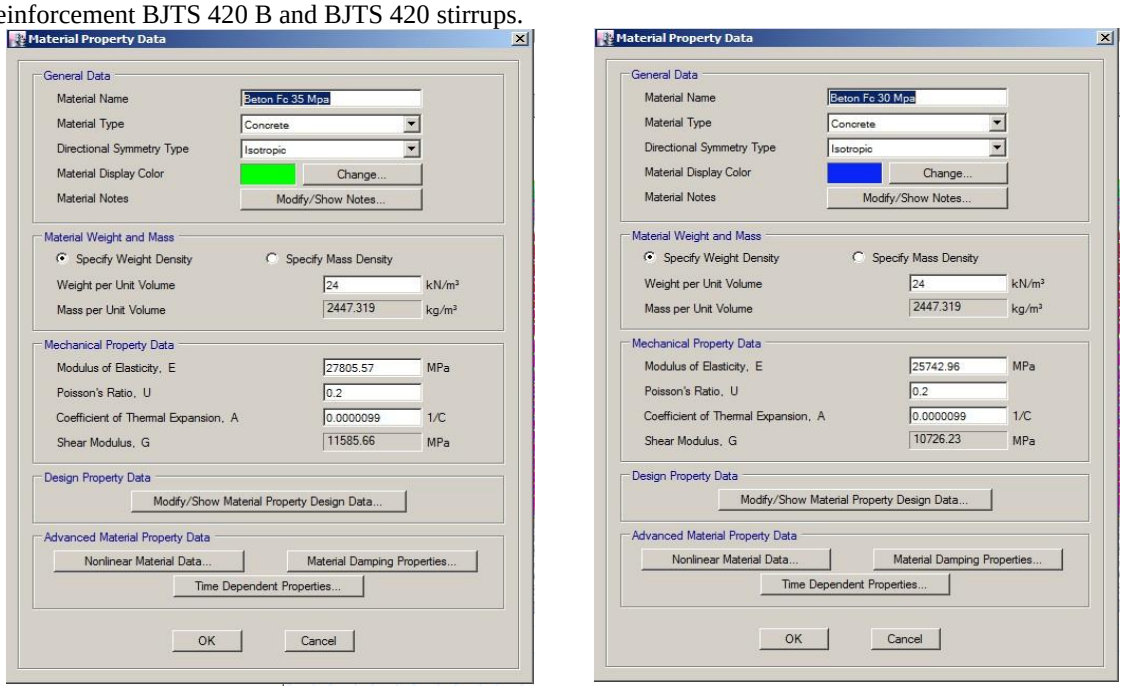


Figure 2. Floor plan 1 to 21

3. RESULTS AND DISCUSSION

3.1. Structure Modeling

Input material data based on the planned concrete quality, namely fc' 30 and 35 MPa, and for steel reinforcement BJTS 420 B and BJTS 420 stirrups.



(a) (b)

Figure 3. Input concrete quality data (a) Fc 35 MPa(b)Fc 30 Mpa

3.2. Burden

3.2.1 Dead Load

- Building Materials
  - a. Reinforced concrete : 2400 kg/m3
  - b. Ordinary concrete : 2200 kg/m3
- Building Components
  - a. Wall brick : 250 kg/m3
  - b. Ceiling and Hangers : 28 kg/m3
  - c. Tile (24 kg/m2) + Specs (21 kg/m2) : 45 kg/m2
  - d. Partition : 72 kg/m2
  - e. Plumbing : 10 kg/m2
  - f. Sanitation : 20 kg/m2

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3.2.2. Live Load

According to SNI 1727:2020 Minimum design load and related criteria for buildings and other structures.

Table 1 Overall load per floor

Floor	Dead Load	Live Load	Own Weight	Total Weight
Floor 1	1686765.62	33477.28	1720242.89	3440485.8
Floor 2	1655195.99	21625.12	1676821.1	3353642.21
Floor 3	1655195.99	21625.12	1676821.1	3353642.21
Floor 4	1655195.99	21625.12	1676821.1	3353642.21
Floor 5	1655195.99	21625.12	1676821.1	3353642.21
Floor 6	1655195.99	21625.12	1676821.1	3353642.21
Floor 7	1655195.99	21625.12	1676821.1	3353642.21
Floor 8	1655195.99	21625.12	1676821.1	3353642.21
Floor 9	1655195.99	21625.12	1676821.1	3353642.21
Floor 10	1655195.99	21625.12	1676821.1	3353642.21
Floor 11	1655195.99	21625.12	1676821.1	3353642.21
Floor 12	1655195.99	21625.12	1676821.1	3353642.21
Floor 13	1655195.99	21625.12	1676821.1	3353642.21
Floor 14	1655195.99	21625.12	1676821.1	3353642.21
Floor 15	1655195.99	21625.12	1676821.1	3353642.21
Floor 16	1655195.99	21625.12	1676821.1	3353642.21
Floor 17	1655195.99	21625.12	1676821.1	3353642.21
Floor 18	1655195.99	21625.12	1676821.1	3353642.21
Floor 19	1655195.99	21625.12	1676821.1	3353642.21
Floor 20	1655195.99	21625.12	1676821.1	3353642.21
Floor 21	1391074.44	9495.6	1400570.03	2801140.07
Total Weight (W)				**69960827.86**

3.2.3. Response Spectrum

In determining KDS, what we need to know is the value of the short spectrum response acceleration (Ss) and the 1 second spectrum response acceleration value (S1). The values of Ss and S1 can be seen on the spectrum response map of SNI 1726:2019. However, to get more accurate Ss and S1 scores, the author uses the Spectra Indonesia Design aid program which can be accessed on the website http://rsa.ciptakarya.pu.go.id/2021/.

The results obtained are:

Latitude = -2.8827
Longitude = 108.2387
Ss = 0.074522
S1 = 0.08656

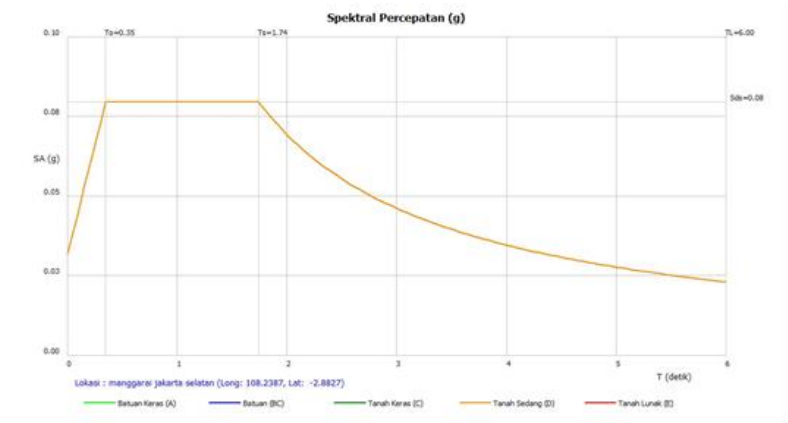

Figure 4. Graph of Medium Soil Spectrum Response

3.3. Structural Analysis

Structural analysis is carried out after entering all dead loads, live loads, earthquake loads and load combinations based on SNI 1726:2019, so the structural analysis is obtained as follows:

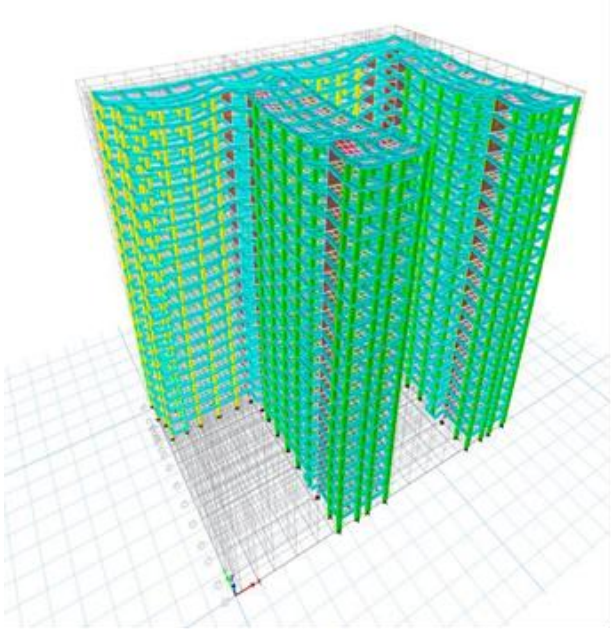

Figure 5. Modeling after Run Analysis

3.3.1. Moments and Forces on Beams 300 x 600

Moments and forces acting on each beam, namely there is a positive design moment due to factored load (Mu+), negative design moment due to factored load (Mu-), and design shear force due to factored load (Vu).

Table 2. Recap of moments and forces on the beam 300 x 600

Block Plan Shear Moments and Forces 300 x 600		
Mu+	78.5912	kN-m
Mu-	-133.417	kN-m
Vu	94.149	kN

Support Reinforcement:

Reinforcement Ratio Required	= 0.0047
Minimum reinforcement ratio	= 0.0035
Reinforced area required	= 764 mm2
Required amount of reinforcement	= 50D25

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Field Reinforcement:
Reinforcement ratio required = 0.0028
Minimum reinforcement ratio = 0.0035
Reinforcement ratio required = 0.0028
Area of reinforcement used = 982 mm2
Required amount of reinforcement = 50D25

3.3.1. Moments and Forces on Beams 300 x 900

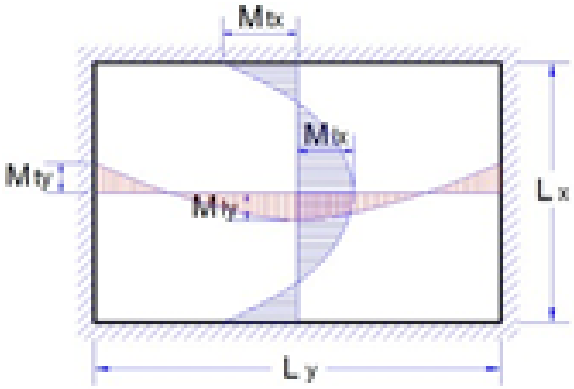
Table 3. Recap of moments and forces on the beam 300 x 900

Block Plan Shear Moments and Forces 300 x 900		
Pu	608.1993	kN
Mu	156.2888	kN-m
Vu	110.5051	kN

3.3.3. Preliminary Design Floor Plate 400 x 500

a. Structure Material Data
   Concrete compressive strength fc = 35 MPa
   Yield stress of steel for flexural reinforcement fy = 420 MPa
b. Floor Plate Data
   Length of directional plate span x Lx = 400 cm
   Length of span of y Ly direction plate = 500 cm
   Floor plate thickness h = 200 mm

Floor plate moment coefficient:
Ly / Lx (500 / 400) = 1.25 (Coefficient of Plate Moment)



Bidirectional Because Ly/Lx < 2
Field x Clx = 69
Field y Cly = 31
Support x Cty = 19
Support y Cty = 57

With 4 pinched sides
Diameter of reinforcement used = 25 mm
Net thickness of concrete blanket ts = 20 mm

4. CONCLUSION (10 PT)

Based on the results of the Superstructure Planning of the Swasana Building 21 Floor Anami Tower B, the Klapa Village Project, based on SNI 1726: 2019, SNI 1727: 2020 and SNI 2847: 2019 using the Etabs V-17 program and structural components designed on beams, columns and plates, then concluded as follows:

a. On beam 1 with dimensions of 300 x 600

Positive design moment due to factored load Mu+	= 78.5912 kNm
Negative design moment due to factored load Mu-	= 133,417 kNm
Design shear force due to factored load Vu	= 94.149 Kn
Support Reinforcement:	
Reinforcement Ratio Required	= 0.0047
Minimum reinforcement ratio	= 0.0035
Reinforced area required	= 764 mm2
Required amount of reinforcement	= 50D25
Field Reinforcement:	
Reinforcement ratio required	= 0.0028
Minimum reinforcement ratio	= 0.0035
Reinforcement ratio required	= 0.0028
Area of reinforcement used	= 982 mm2
Required amount of reinforcement	= 50D25

b. In Columns with dimensions of 400 x 900 with the amount of reinforcement 125D25

Axial force due to factored load Pu	= 608,199 kN
Ultimate moment due to factored load Mu	= 117.9836 kN/m
Design shear force due to factual load Vu	= 169.7724 kN
Center distance of flexural reinforcement to the concrete side	= 63 Kn
Reinforcement area used	= 7.331

c. Floor Plate with dimensions of 400 x 500

Field moment in the x direction	= 13,205 kN/m
Y-direction field moment	= 5.932 kN/m
Moment of support in the x direction	= 3.636 kN/m
Moment of support in the y direction	= 10,908 kN/m
Design moment (maximum) plate	= 13,204 kN/m

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