Al-Bahjah is a formal and non-formal educational institution that combines general education with Al-Quran which is located on Pangeran Cakrabuana Street, Sumber, Cirebon District. The construction of Building Office and Administration Al-Bahjah is indispensable as a center for management and administration.

The planning of the Building Office and Administrative Al-Bahjah has a floor size of 30 m x 14 m with 5 floors of structure and building height of 19.60 m. The building structure is designed with reference to SNI 1727-2013, PPIUG 1987, SNI 2847-2013 and SNI 1726-2012. The static equivalent analysis method is used in analyzing earthquakes. The structure lies in the class of medium land sites (SD) and is included in the type D Seismic Design Category, so the earthquake force on the structure is planned using a configuration of the structure of the Special Moment Resisting Frame (SMRF). ETABS v9.6 structure analysis program is used to help structure modeling and calculate internal forces acting on the structure, with the material used is concrete f'c 25 Mpa, reinforcement fy 400 Mpa and fy 240 Mpa.

**Keyword:** SNI 1727-2013, PPIUG 1987, SNI 2847-2013, SNI 1726-2013, Seismic Design Category D, Lateral Equivalent Analysis, SMRF, ETABS v9.6.0
I. PRELIMINARY

A. BACKGROUND

Al-Bahjah is a formal and non-formal educational institution that combines general education with Al-Quran which is located on Pangeran Cakrabuana Street, Sumber, Cirebon District. With an area of campus about 2.5 hectares (Muh. Abdus Syakur /Hidayatullah.com), inside must be used efficiently for various infrastructure facilities to support campus activities, given the growing LPD Al-Bahjah will attract many enthusiasts either students or entrants will be studying. The development of “Building Offices and Administrative Al Bahjah” is one of the buildings planned for efficiency use of available land in order to be optimal, as the center of management and administrative. Therefore, building design must meet the safety and service excellence for it to be no convincing design in accordance with the regulations of the Indonesian National Standard.

B. FOCUS PROBLEM

In this research focused on Designing and Analyzing of Building Offices and Administrative Al-Bahjah - Cirebon with reinforced concrete structures, which include beam, column, slab, foundation and seismic force that react to the structure of building which refers to regulations SNI 2847-2013 about structural concrete requirements for buildings, PPIURG 1987 and SNI 1727 – 2013 about the minimum load for the planning of buildings and SNI 1726-2012 about seismic force.

C. PROBLEM FORMULATION

1) How to design and analyze structure Offices and Administrative Building of Al-Bahjah - Cirebon using a reinforced concrete structure according the regulations of SNI?
2) How to design and analyze dimension of the slab, beams, columns, and foundations?
3) How seismic force that occur in the structure Offices and Administrative Building of Al-Bahjah – Cirebon?
4) How to calculate the budget structure Offices and Administrative Building of Al-Bahjah – Cirebon?

D. BOUNDARIES OF PROBLEM

In order to avoid widening of problem discussion, the limitation in forming this thesis given as follows:

a) Just design and analyze the main structure:
   - Tie Beam / Sloop
   - Beam
   - Column
   - Slab
   - Pile Cap & Bored Pile Foundation
b) For earthquake analysis procedure, just calculating the static lateral equivalent.
c) Does not design and analyze the support structure:
   - Shear Wall
   - Stairs
   - Mechanical Electrical, Plumbing
d) Visualizing through 2D and 3D drawing.
e) Analysis structure with ETABS
f) Calculating the budget of the structure only.

E. RESEARCH OBJECTIVES

a) Can design and analyze Offices and Administrative Building of Al-Bahjah - Cirebon based on regulations SNI 2847-2013, SNI 1727-2013, PPIURG 1987 and SNI 1726-2012.
b) Can analyze and design of slab, beam, column, and foundation.
c) Can analyze the seismic forces that occur in the building structure.
d) Can estimating the Budget Plan (RAB) Building Structure.

F. USEFULNESS OF RESEARCH

1. The theoretical usefulness
2. The practical usefulness
II. REVIEW OF THE LITERATURE AND 
THE THEORETICAL BASIS

A. RESEARCH THAT HAS BEEN DONE 
BEFORE

1. First, research conducted by Yusuf (2015) with the title Analisis Perencanaan Gedung Aula dan Rektorat Universitas Swadaya Gunung Jati Cirebon dengan Struktur Beton.


3. Third, research conducted by Arrozaq (2018) with the title Perencanaan Pembangunan Puskesmas Pabuaran Kabupaten Cirebon.

B. THEORRETICAL BASIS

1. Definition of Building
   Building is a physical form of the result a construction work that integrates with its domicile, part or all of it is above and / or in the land and / or water, which functions as a place for humans to carry out our their activities, whether for residence , religious activities, business activities, social activities, cultural and special activities. (Undang-Undang Republik Indonesia No. 28 tahun 2002 Pasal 1 Ayat 1 tentang Bangunan Gedung).

2. Definition of Reinforced Concrete
   Reinforced concrete is reinforced concrete with an area and the amount of reinforcement that is not less than the minimum required value with or without prestressing, and planned based on the assumption that the two materials work are together in carrying forces. Reinforced concrete is made from a combination of concrete and steel reinforcement. Therefore, it has the same properties as the constituent materials are very strong against compressive load and tensile load. (SNI 03-2847-2002 Pasal 3)

3. Planning Basic
   a. Service Ability /Kemampuan Layan
      Structure and components must be designed to have strength of design in all sections of at least the required strength calculated for loads and factored forces in such a combination as specified in the standard. (SNI 2847-2013)
   b. Kuat Perlu (U)
      Kekuatan perlu (U) must be at least equal to the effect of deep factored load (combination load used). The combination load there are:

      1) Combo 1 = (1,4SW + 1,4DL)
      2) Combo 2 = (1,2SW + 1,2DL) + 1,6LL
      3) Combo 3 = (1,2SW + 1,2DL) + 1,0Eqx + 1,0LL
      4) Combo 4 = (1,2SW + 1,2DL) + 1,0Eqy + 1,0LL
      5) Combo 5 = (1,2SW + 1,2DL) + 1,0Wx + 1,0LL
      6) Combo 6 = (1,2SW + 1,2DL) + 1,0Wy + 1,0LL
      7) Combo 7 = (0,9SW + 0,9DL) + 1,0Eqx
      8) Combo 8 = (0,9SW + 0,9DL) + 1,0Eqy
      9) Combo 9 = (0,9SW + 0,9DL) + 1,0Wx
      10) Combo 10 = (0,9SW + 0,9DL) + 1,0Wy
   c. Strength of Design /Kuat Desain
      Stength of design provided by a structural component, connection with other structural components, and its cross section, with bending, normal force, and torsi must be taken in the amount of nominal strength calculated according to the requirements and assumptions of SNI 2847-2013.

      1) Penampang terkendali tarik \( \phi = 0,90 \)
      2) Penampang terkendali tekan
         (a) Dengan tulangan spiral \( \phi = 0,75 \)
         (b) Komponen struktur lain \( \phi = 0,65 \)
      3) Geser dan Torsi \( \phi = 0,75 \)
      4) Tumpuan pada beton \( \phi = 0,65 \)

4. Loading
   Expenses It is the force or other action derived from the weight of all building materials, occupants, items in the building, environmental effects, displacement differences, and restraints due to dimensional changes. (SNI 1727-2013).
Analysis and Design Structure of Building Office and Administrative Al-Bahjah Cirebon

a. Vertical Load

1) Dead Load

The dead load is the weight of all building construction materials installed, including walls, floors, roofs, ceilings, stairs, partition walls remain, finishing, buildings cladding and other structural and architectural components as well as other connected equipment including heavy serviceability tap. (SNI 1727:2013 pasal 3.1.1)

Table 2.1 Building materials PPIUG 1987

<table>
<thead>
<tr>
<th>Group</th>
<th>Additional Dead Load (kN)</th>
<th>Reduction 25 % Live load (kN)</th>
<th>Self weight</th>
<th>Seismic Weight (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Floor</td>
<td>1764.4</td>
<td>252</td>
<td>2921.24</td>
<td>4937.64</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>1444.4</td>
<td>377.475</td>
<td>2894.735</td>
<td>4716.61</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>1575.2</td>
<td>262.5</td>
<td>2947.745</td>
<td>4785.445</td>
</tr>
<tr>
<td>4th Floor</td>
<td>1765.2</td>
<td>262.5</td>
<td>2925.045</td>
<td>4952.745</td>
</tr>
<tr>
<td>Roof</td>
<td>399</td>
<td>100.8</td>
<td>2588.131</td>
<td>3087.931</td>
</tr>
</tbody>
</table>

b. Horizontal Load

1) Earthquake Load

Earthquake load is the load arising from the movement of the ground where the structure is standing. Because the building structure has mass, the mass inertia from the top of the building provides resistance to movements. Therefore the earthquake load is very dependents on the mass of a building, and the movement of the earthquake to reach the surface of the land is affected by local soil conditions.

Figure 2.1 Peta gerak tanah seismik dan koefisien resiko

- Site class = Categories SD (medium)
- Earthquake acceleration parameter (Ss, S1) for the location of Al-Bahjah Sendang, Sumber - Cirebon with latitude -6,755881204105325 and longitude 108,5034334695764 is Ss = 0,733 g and S1 = 0,296 g
- Earthquake acceleration response parameter SMS = 0,889 and SM1 = 0,535
- Seismic design category SDS = 0,593 ≥ 0,50 (Category D, high seismic risk level)
- Structure system, the type of building structure that was reviewed used Special Moment Resisting Frame (SMRF)
- Earthquake analysis procedure used lateral equivalent analysis.

Table 2.3 Seismic effective weight the structure

<table>
<thead>
<tr>
<th>Group</th>
<th>Additional Dead Load (kN)</th>
<th>Reduction 25 % Live load (kN)</th>
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<tr>
<td>Roof</td>
<td>399</td>
<td>100.8</td>
<td>2588.131</td>
<td>3087.931</td>
</tr>
</tbody>
</table>

2) Wind Load

Wind load acting on a building depends on the average speed of the wind at the location of the building. The wind load input using reference ASCE 07 (Pasal 6. SNI 1727-2013)

- Wind velocity (mph)
  Average wind velocity in the area building at Sendang – Sumber, Cirebon. V = 8,6992 mph (meteo.bmkg.co.id)
- Wind direction factor
  Kd= 0,85 (pasal 26.6 SNI 1727-2013)
- Exposure type = Category B
5. Basic Calculations

a. Slab

Slab are horizontal elements structure that support dead loads and live loads and distribute them to the vertical frame in a structural system. Slab designed are two way system. Slab calculation uses the following formula:

- Dimension (thickness) of slab
  \[ h = \frac{\ln(0.8 + \frac{f_y}{1400})}{56 + 56\epsilon} \times (0.2 < \frac{f_{ym}}{f_{yc}} < 2.0) \]

- Moment of slab (PBI 1971)
  \[ M_{lx} = 0.001 \times Q \times l^2 \times C_lx \]
  \[ M_{ly} = 0.001 \times Q \times l^2 \times C_ly \]
  \[ M_{tx} = -0.001 \times Q \times l^2 \times C_{tx} \]
  \[ M_{ty} = -0.001 \times Q \times l^2 \times C_{ty} \]

- Requirements
  \[ \Omega M_n \geq M_u, \text{ with } \Omega = 0.85 \]

b. Beam

Beams are structural members that support the vertical and horizontal loads. (Kenneth-Belanger, 1981). The elements acting on the beam are usually a flexural load, a shear load, and a torsion load, so that reinforcing steel is required to withstand the load. Beam calculation uses the following formula:

- Dimension
  \[ h_{\min} = \frac{l}{16} \times (0.4 + \frac{f_y}{700}) \]
  \[ b_{\min} = \frac{h}{2} \times s/d \times \frac{5}{2} h \]

- Load Ultimate
  \[ Q_u = 1.2 \times DL + 1.6 \times LL \]

- Moment Ultimate
  \[ M_u = 1.2 \times M_{DL} + 1.6 \times M_{LL} \]

- Eccentricity value (e)
  \[ e = \frac{M_u}{P_u} \]

- Longitudinal rebar
  \[ P_u \times \frac{A_{Gr}}{h_x} \times \frac{et}{h} \]
  \[ \rho = \beta \times \frac{f_c'}{A_{Gr}} \times b \times d' \]
  \[ \Omega P_n \geq P_u, \text{ with } \Omega = 0.65 \]

- Requirements
  \[ P_{n_{(max)}} = 0.85\phi \left[ 0.85f_c'(A_{gr} - A_{st}) + f_y A_{st} \right] \]
  \[ \Omega P_n \geq P_u, \text{ with } \Omega = 0.65 \]

- Column Interaction


c. Column

Column is the vertical rod of the frame structure that carries the load from the roof, beam, and its own weight which is forwarded to the foundation. Column calculation uses the following formula:

- Load Ultimate
  \[ P_u = 1.2 \times DL + 1.6 \times LL \]

- Moment Ultimate
  \[ M_u = 1.2 \times M_{DL} + 1.6 \times M_{LL} \]

- Eccentricity value (e)
  \[ e = \frac{M_u}{P_u} \]

- Longitudinal rebar
  \[ P_u \times \frac{A_{Gr}}{h_x} \times \frac{et}{h} \]
  \[ \rho = \beta \times \frac{f_c'}{A_{Gr}} \times b \times d' \]
  \[ \Omega P_n \geq P_u, \text{ with } \Omega = 0.65 \]

- Requirements
  \[ P_{n_{(max)}} = 0.85\phi \left[ 0.85f_c'(A_{gr} - A_{st}) + f_y A_{st} \right] \]
  \[ \Omega P_n \geq P_u, \text{ with } \Omega = 0.65 \]

- Column Interaction
2) Column
- Longitudinal reinforcement. Pasal 21.6.3.1
- Shear reinforcement. Pasal 21.6.4.3
- Convienement reinforcement. Pasal 21.6.4.4

e. Foundation (Bored Pile)
Bored pile foundation is a tube-shaped deep foundation, which functions to continue the load on the building structure above it from the ground surface to the hard soil layer below it.
- Daya Dukung Pondasi
  \[ Q_u = Q_d + Q_g - W \]
  \[ Q_{jin} = Q_u / SF \]
- Daya dukung ujung tiang
  \[ Q_d = 750 \times Ap \text{ (untuk N-SPT} > 50) \]
- Daya dukung geseakan tiang
  \[ Q_g = O \times (Ni/2 \times Li) \text{ (untuk N-SPT} > 50) \]
- Effisiensi tiang group
  Rumus Converse Labarre
  \[ \eta = 1 - \frac{\theta}{90} \times \left[ \frac{(n-1)m+(m-1)n}{mn} \right] \]
- Requirements
  \[ Pu < P_{effisiensi} \]

III. METHOD AND OBJECT OF RESEARCH
A. METHOD OF RESEARCH
1. The Research Methods Used
The research method used is a method of quantitative and qualitative methods, understanding as below:
   a) Quantitative method is a method performed by learning the references and study literature for the preparation of the thesis.
   
   There are the research method used:
   - SNI – 2847 – 2013 (Persyaratan beton struktural untuk bangunan gedung)
   - SNI – 1726 – 2012 (Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan Non-gedung)
   - SNI – 1727 – 2013 (Beban minimum untuk perancangan bangunan gedung dan struktur lain)
   - PPPURG 1987 (Pedoman Perencanaan Pembebanan Untuk Rumah dan Gedung)

b) Qualitative method is a method performed by collecting field data that will be used as the data in the project. There are:
   - SPT data
   - Building Area
   - Function of building

2. The Types and Sources of Data
The data source is something that can provide information about the data. By type, data can be divided into two, namely primary data and secondary data.
   a) Primary data is data created by researchers for the special purpose to resolve problems that are being addressed.
   b) Secondary data is data that has been collected for purpose other than resolve the problems being faced.

3. Technique of Data Collection
In the preparation of this thesis, the collection of data obtained by the authors carried out in a manner as follows:
   a) Observation or direct observation to the field to observe directly the object of the research.
   b) Interviews with contractors and consultants in the project.
   c) Explore and examine theories or methods in the library.

4. Metode Analisis Data
Stage of analysis using ETABS v9 and analysis manually as a comparison. The stages of analysis used in this paper are as follows:
   a) Structure modeling
   b) Design element structure
   c) Calculate the loads
   d) Calculate the dimensions and strength of the structure
   e) Calculate the earthquake force
B. LOCATION OF RESEARCH
The location of the research reviewed by the authors in this thesis is located at Pangeran Cakrabuana Street No. 179, Sendang Village, Sumber Sub-distric, Distric of Cirebon.
C. FLOW OF RESEARCH

Figure 3.1 Flowchart of research methodology

D. DESIGN OF BUILDING

The design of the building used software AutoCAD and Sketchup Rendering 3D.

Figure 3.2 Base Elv. ± 0.00 m

Figure 3.3 1st Floor Elv. + 4.00 m

Figure 3.4 2nd Floor. + 8.00 m

Figure 3.5 3rd Floor Elv. + 12.00 m

Figure 3.6 4th Floor Elv. + 15.80 m

Figure 3.7 4th Floor Elv. + 19.60 m
IV. DESIGN AND ANALYSIS

A. DATA DESIGN STRUCTURE

1. Building Specification
   a) Name of Project: Development Project Building Office and Administrative of Al-Bahjah Cirebon
   b) The building consist of five levels with reinforced concrete structure
   c) Total building area : 2520 m²
      - Base : 420 m²
      - 1st Floor : 420 m²
      - 2nd Floor : 420 m²
      - 3rd Floor : 420 m²
      - 4th Floor : 420 m²
      - Rooftop : 420 m²
   d) Building length : 30,00 m
   e) Building width : 14,00 m
   f) Building height : 19,60 m

2. Material Specification
   a) Concrete : fc' 25 Mpa, K 301,20 kg/cm²
      For all structure elements, there are slab, beam, column, and bored pile
   b) Rebar
      Longitudinal rebar : BJTD 40 (fy 400 Mpa)
      Transversal rebar : BJTP 40 (fy 240 Mpa)

Table 4.1 Building configuration

<table>
<thead>
<tr>
<th>No.</th>
<th>Lantai</th>
<th>Elevasi (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Base Floor</td>
<td>± 0,00 m</td>
</tr>
<tr>
<td>2.</td>
<td>1st Floor</td>
<td>+ 4,00 m</td>
</tr>
<tr>
<td>3.</td>
<td>2nd Floor</td>
<td>+ 8,00 m</td>
</tr>
<tr>
<td>4.</td>
<td>3rd Floor</td>
<td>+ 12,00 m</td>
</tr>
<tr>
<td>5.</td>
<td>4th Floor</td>
<td>+ 15,80 m</td>
</tr>
<tr>
<td>6.</td>
<td>Roof floor</td>
<td>+ 19,60 m</td>
</tr>
</tbody>
</table>

Table 4.2 Structure materials

<table>
<thead>
<tr>
<th>No.</th>
<th>Type Structure</th>
<th>Rebar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Longitudinal</td>
</tr>
<tr>
<td>1.</td>
<td>Slab</td>
<td>Ø 12</td>
</tr>
<tr>
<td>2.</td>
<td>Beam</td>
<td>D 16</td>
</tr>
<tr>
<td>3.</td>
<td>Column</td>
<td>D 22</td>
</tr>
<tr>
<td>4.</td>
<td>Pile Cap</td>
<td>D 22</td>
</tr>
</tbody>
</table>

3. Data Frame of Structure

Table 4.3 Structure dimensions

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type / Code</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab</td>
<td>Slab Rooftop</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Slab 1st - 4th</td>
<td>130</td>
</tr>
<tr>
<td>Beam</td>
<td>Sa</td>
<td>250/400</td>
</tr>
<tr>
<td></td>
<td>S1</td>
<td>300/500</td>
</tr>
<tr>
<td></td>
<td>Ba</td>
<td>250/450</td>
</tr>
<tr>
<td></td>
<td>B1</td>
<td>300/550</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>300/550</td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td>300/550</td>
</tr>
<tr>
<td></td>
<td>B4</td>
<td>300/550</td>
</tr>
<tr>
<td></td>
<td>B5</td>
<td>300/500</td>
</tr>
<tr>
<td></td>
<td>B6</td>
<td>300/500</td>
</tr>
<tr>
<td>Column</td>
<td>K1</td>
<td>500 x 500</td>
</tr>
<tr>
<td></td>
<td>K2</td>
<td>550 x 550</td>
</tr>
<tr>
<td>Pile Cap</td>
<td>P1</td>
<td>2750 x 2750 x 750</td>
</tr>
<tr>
<td>Bored Pile</td>
<td>BP1</td>
<td>Ø500</td>
</tr>
</tbody>
</table>

B. STRUCTURE MODELING

In the analysis of this building structure using software ETABS v.9.6.0. In generally the analysis and design in ETABS was consist of modeling structure, defining material properties and frame section then determination of loading and analysis model of structure.

Figure 4.1 Model Structure on ETABS v.9.6.0

C. RESULT DESIGN & ANALYSIS STRUCTURE

1. Structure Reinforcement

In calculating structure reinforcement (there are Beam, Column, Slab, Pile Cap, Bored Pile) used output ETABS analysis and manual analysis as comparison.

| Table 4.4 Comparison force of beam in ETABS analysis with Manual analysis |
|---|---|---|---|---|---|---|---|
| Code | Label (Story) | ETABS Analysis | Manual Analysis | Validasi (%) | Code | Label (Story) | ETABS Analysis | Manual Analysis | Validasi (%) |
| B1 | B01 (Lt. 2) | 33,33 | 83,78 | 0,38 | 83,325 | 87,267 | 67,684 | 93,61 | 87,27 | 13,52 |
| B2 | B02 (Lt. 2) | 141,15 | -106,81 | 1,19 | 106,98 | 128,82 | 138,95 | 92,18 | 92,02 | 0,50 |
| B3 | B03 (Lt. 3) | 141,15 | -106,81 | 1,14 | 106,98 | 128,82 | 138,95 | 92,18 | 92,02 | 0,50 |
| B4 | B04 (Lt. 3) | 141,15 | -106,81 | 1,22 | 106,98 | 128,82 | 138,95 | 92,18 | 92,02 | 0,50 |

**Table 4.5 Recapitulation of Beam reinforcement**

<table>
<thead>
<tr>
<th>Code</th>
<th>Label (Story)</th>
<th>ETABS Analysis</th>
<th>Manual Analysis</th>
<th>Applied reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B01 (Lt. 2)</td>
<td>33,33</td>
<td>83,78</td>
<td>0,38</td>
</tr>
<tr>
<td>B2</td>
<td>B02 (Lt. 2)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,19</td>
</tr>
<tr>
<td>B3</td>
<td>B03 (Lt. 3)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,14</td>
</tr>
<tr>
<td>B4</td>
<td>B04 (Lt. 3)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,22</td>
</tr>
</tbody>
</table>

**Table 4.6 Maximum value of Axial force (Pu) and Momen (Mu) Column**

<table>
<thead>
<tr>
<th>Code</th>
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<th>Manual Analysis</th>
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</tr>
<tr>
<td>B2</td>
<td>B02 (Lt. 2)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,19</td>
</tr>
<tr>
<td>B3</td>
<td>B03 (Lt. 3)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,14</td>
</tr>
<tr>
<td>B4</td>
<td>B04 (Lt. 3)</td>
<td>141,15</td>
<td>-106,81</td>
<td>1,22</td>
</tr>
</tbody>
</table>
Table 4.7 Recapitulation of Column reinforcement

<table>
<thead>
<tr>
<th>Column Type</th>
<th>Name Label</th>
<th>Column Type</th>
<th>Length</th>
<th>Longitudinal rebar (mm)</th>
<th>A_{col}</th>
<th>A_{col}</th>
<th>A_{col}</th>
<th>Shear rebar (mm)</th>
<th>A_{col}</th>
<th>Validasi (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>C19</td>
<td>KOMBO2-1</td>
<td>(2,5 x 1,25m)</td>
<td>2500</td>
<td>8</td>
<td>22</td>
<td>3041</td>
<td>Aman</td>
<td>0,49</td>
<td>10</td>
</tr>
<tr>
<td>K2</td>
<td>C18</td>
<td>KOMBO2-1</td>
<td>(2,5 x 2m)</td>
<td>3025</td>
<td>8</td>
<td>22</td>
<td>3041</td>
<td>Aman</td>
<td>0,64</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 4.8 Recapitulation of Slab reinforcement

<table>
<thead>
<tr>
<th>Type Pelat</th>
<th>Function</th>
<th>Reinforcement</th>
<th>X - direction (mm)</th>
<th>Y - direction (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1-1</td>
<td>Office</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S1-2</td>
<td>(4 x 2,5m)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S1-3</td>
<td>(2,5 x 2m)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S2-1</td>
<td>Meeting room</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S2-2</td>
<td>(4 x 2,5m)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S3-1</td>
<td>Guest House</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S3-2</td>
<td>(4 x 2,5)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S3-3</td>
<td>(3,75 x 2,5m)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S3-4</td>
<td>(2,5 x 1,25m)</td>
<td>Ø 12 - 150</td>
<td>Ø 12 - 150</td>
<td></td>
</tr>
<tr>
<td>S4-1</td>
<td>Roof</td>
<td>Ø 10 - 175</td>
<td>Ø 10 - 175</td>
<td></td>
</tr>
<tr>
<td>S4-2</td>
<td>(4 x 2,5m)</td>
<td>Ø 10 - 175</td>
<td>Ø 10 - 175</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.9 Comparison of load point (output ETABS Analysis and Manual analysis)

Table 4.10 Bearing capacity bored pile with various diameters

Table 4.11 Group pile efficiency

*Note:*
The value of group pile efficiency at poer 1 was tried with the number of pile as much as 4, shown V_{total} < V_{efisiensi,1 Tiang} (213,7 < 245,18) means comply the requirements (YES)

Table 4.12 Cost plan of structure building
Design structure of slab is used:

1. Type of column K1 with dimension 500 mm x 500 mm (Pu = 1704,72)  
2. Type of column K2 with dimension 550 mm x 550 mm (Pu = 1829,57)  

5. Design structure of slab is used:

a) The thickness of Slab floor used 130 mm  
b) The thickness of Slab Roof top used 100 mm  

6. Design structure of foundation is used:

a) Using a bored pile with a diameter of 50 cm, and has a carrying capacity of 77,10 Ton  
b) Group pile consist of 4 units, capable of holding a point load of 245,18 Ton  
c) Pile cap dimension is 2,75 m x 2,75 m x 0,75 m  

7. Cost plan of building structure obtained Rp. 7.313.963.000,00
and column should be used that are almost similar in size to facilitate of work in the field.

4. In planning the foundation should be use data from the actual location, so that the planning results can be in accordance with the conditions of the soil structure.

5. In inputting data on the ETABS program, it should be done carefully in accordance with the assumption or regulation that have been set previously so that a structural analysis can be produced that approaches the actual situation.

6. The used of structural analysis application accompanied by manual analysis as a comparison, to avoid input or modeling in application, due to lack of thoroughness of the user.

REFERENCES


