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ANALYSIS PLANNING AND DESIGN STRUCTURE OF BUILDING FLATS RENT FOR FACTORY WORKERS IN INDUSTRIAL AREA CIREBON REGENCY

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ABSTRACT

The industrial area in Cirebon Regency which has absorbed a number of industrial workers need to be supported by the infrastructure that facilitates the existence of industrial workers from inside and outside of Cirebon Regency, namely is residence that becomes one of the primary needs / basic human and they should find a place to live that suits the needs and financial capabilities. According to the Constitution 1945, Law No. 4 1992 Housing and Settlement and the Law No. 39 of 1999 on Human Rights, the house is the people's basic rights and guaranteed by law and supported by the Presidential Decree 22/2006 issued a national program "Flats 1000 Tower" which was targeted to build flats are middle to lower class.

In order to create a structure that is safe and meets serviceability limit, so in the process of design the building structure must be according to SNI 2847-2013 of reinforced concrete. Beside planning, the loading structure must be according to SNI 1727-2013, then for calculation of earthquake engineering refers to SNI 1726-2012. Analysis structure using ETABS, for the material of structures is used concrete including frame section (column, sloof, beam, and slab).

From the planning and design of the flats that were done in this thesis obtained 2 types of columns with a size 50/50 using reinforcement 12-D19 and shear reinforcement Ø10-100 and 35/35 using reinforcement 8-D19 and shear reinforcement Ø10-100, then obtained 2 types of main beams with a size 35/50 using reinforcement 12-D16 with shear reinforcement Ø10-100 and size 25/30 using reinforcement 5-D16 with shear reinforcement Ø10-120, then for floor and roof slab obtained a thickness 13cm using reinforcement D12-150. RAB structure obtained in this plan is Rp.15,920,000,000,- so that the price per meter is Rp.3,686,000,-.

Keywords : Analysis and Planning structure, ETABS, Thesis Result.

I. PRELIMINARY

A. BACKGROUND

The industrial sector is one of the driving force of the West Java economy, which contributed quite dominant in supporting economic growth through employment. The industrial sector is also part of the development of economic growth in West Java. The government of Cirebon Regency has set a sub-district area Pangenan and sub-district Plumbon as an industrial area. Cirebon selected as the industrial area because of the access of Cipali Toll road (Cikopo-Palimanan) which is a continuation of the Palikanci Toll road (Palimanan-Kanci) are already interconnected and this makes the distance between Cirebon and Jakarta closer.

The industrial area in Cirebon Regency which has absorbed a number of industrial workers need to be supported by the infrastructure that facilitates the existence of industrial workers from inside and outside of Cirebon Regency, namely is residence that becomes one of the primary needs / basic human and they should find a place to live that suits the needs and financial capabilities. According to the Constitution 1945, Law No. 4 1992 Housing and Settlement and the Law No. 39 of 1999 on Human Rights, the house is the people's basic rights and guaranteed by law and supported by the Presidential Decree 22/2006 issued a national program "Flats 1000 Tower" which was targeted to build flats are middle to lower class.

The workers with lower middle economic conditions that work in industrial areas have a tendency residing away from the work environment or rent a place to stay that is close to the working environment. Both cause problems, for those who live far away from the work environment, will require large transportation costs, increased travel time, increased risk on the road, traffic congestion and lead to reduced hours of rest which may affect the health and performance of labour that could affect the production results both qualitatively and quantitatively. Based on the description as outlined above, the author is interested to lift it into the thesis, which is by taking the title "Analysis Planning and Design Structure of Building Flats Rent for Factory Workers in Industrial Area Cirebon Regency".

B. FOCUS PROBLEM

Based on the observations, the authors focus on Analysis Planning and Design Structure of Building Flats Rent for Factory Workers in Industrial Area Cirebon Regency.

C. FORMULATION PROBLEM AND IDENTIFICATION PROBLEM

1) Formulation Problem

In a thesis titled "Analysis Planning and Design Structure of Building Flats Rent for Factory Workers in Industrial Area Cirebon Regency" will explain the problems that exist in the study area, so look for solutions to the problem. Therefore, it is necessary to limit the writing that aims for the preparation of Thesis, the restriction of the issue in the lift as follows:

a. Just plan and design the construction of Flats in accordance with SNI-2847-2013 Reinforced Concrete, PPPURG 1987 and SNI-1727-2013 for loading.
b. Visualize through 2D drawing.
c. Analysis Structure with ETABS.
d. Not design Stairs, ME and Plumbing.

2) Identification Problem

The absence of rental flats building showed the planning to facilitate facilities and basic needs of the workers in the factory area are not optimal, as for the identification of the problem is as follows:

a. How Planning Design Structure Building Flats Rent For Factory Workers In Industrial Area Cirebon Regency?
b. How to plan slab, beams and columns and plan the foundation for the construction of Building Flats?

D. RESEARCH OBJECTIVES

1. To know how to Analysis Planning and Design Structure of Building Flats.
2. To know the planning of slab, beams, columns and foundation that will be used in the development Planning Structure of Building Flats.

E. RESEARCH BOUNDARIES

To limit the writing that aims for the preparation of Thesis, the restriction of the issue in the lift as follows:

1. Calculating the main of structure :
   a. Tie Beam (Sloof)
   b. Beam
   c. Column
   d. Slab
   e. Pile Foundation.
2. Visualize through 2D and 3D drawing.
3. For earthquake analysis, just calculating the static equivalent.
4. Calculating the budget of structure only, does not calculate the budget of architecture, mechanical electrical and plumbing.
5. Does not calculating the support structure Stairs, Mechanical Electrical (ME), and Plumbing.

II. THEORETICAL BASIS

A. THEORETICAL BASIS

1. Definition of Analysis

According to KBBI (2008: 59) Analysis is the decomposition of a subject on various parts and the study of the part itself and the relationship between parts to get the right understanding and understanding of the overall meaning.

The structure is the parts that make up the building such as foundations, sloof, wall, column, and roof. In principle, structural elements function to support the existence of non-structural elements so as to form a unity.

2. Basic Planning

Planning is a process that defines the purpose of making a strategy that is used to achieve goals and develops a plan of work planning activities. Planning is an important process of all management functions because without planning the function of organizing, controlling or directing will not work.

3. Basic Calculation And Loading Plan

The basic structure is one part of the overall process of planning and building. The design process is a combination of elements of art and science that requires the expertise in the process. Here is a part thereof which includes the design process:

a. Upper Structure

1) Roof

2) Slab

(a). Slab One-way

(b). Slab Two-way

- Determine the minimum slab thickness (h).

$$h = \frac{\ln(0{,}8 + \frac{fy}{1400})}{36 + 5\beta(\alpha m - 0{,}2)}$$

According to SNI 2847-2013 To $\propto fm > 0.2$ but not more than 2.0, h should not exceed 125 mm.

- Determine the bending moment on the slab.

Mlx = 0.001 Qu L2 x Clx

Mly = 0.001 Qu L2 x Cly

Mtx = - 0.001 Qu L2 x Clx

Mty = - 0.001 Qu L2 x Cly

Description:

Clx = X direction moment coefficient

Cly = Y direction moment coefficient

- Determine the value of k

$$k = \frac{Mu}{\emptyset \; x \; bd \; x \; deff^2}$$

- to get the ρ (reinforcement ratio) which obtained from the table Requiremen $\rho_{min} \leq \rho \leq \rho_{max}$

3) Beam

Beam are part of the structure of a building that is rigid and designed to bear and transfer the load to elements supporting column. Determine the quality of concrete and reinforcing steel:

- f'c ≤ 30 MPa then β1 = 0,85Mpa
- f'c ≥ 30 MPa then β1 = 0.65MPa

(b). Determining the value of reinforcement ratio (ρ):

- $\rho = \frac{0{,}8\ fy\sqrt{(0{,}8\ fy)^2 - 4\left(0{,}4704\frac{fy^2}{f'c}\right)\left(\frac{mu}{bd^2}\right)}}{2\ X\left(0.4704\ X\frac{fy^2}{f'c}\right)}$
- $\rho_{min} = \frac{1/4}{fy}$
- $\rho_{maks} = 0{,}75(\frac{0{,}75\ fc\ \beta}{fy})(\frac{600}{600+fy})$

Prerequisite: ρmin <ρ <ρ max

(c). Specifies the effective height (d) and width (b) concrete cross section

- b = ½ h
- d = h - dc - Øtulangan ½ - ½ Øsengkang

4) Column

The column is the structure that supports the load of the roof, beam and weight alone are forwarded to the foundation. In the structure of the column receives a large vertical load, but it must be able to withstand horizontal loads even a moment or torsion/torque due to the influence of the eccentricity of loading. the quality of concrete and steel used and the eccentricity of loading happens with other words, the column is also taken into account to support the axial load tap with a certain eccentricity.

Pu <Pn Pn = 0,1. Ag. Fc

Description:

Pu = Load In Column

Pn = Strength Column

Fc' = quality of the concrete used

Ag = Dimensions column (Area of Column)

0.1 = Factor Reduction

If Pu > Pn then the cross-section column must be enlarged or concrete quality should be increased.

b. Under Structure

1) Planning Sectional Foundation

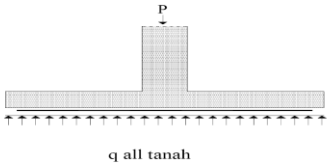

Image 2.1. Pieces Foundation

- $\sigma_{netto\ tanah} = \sigma_{tanah} - \Sigma(h.\gamma_{beton}) - \Sigma(h.\gamma_{tanah})$
- $\sigma_{netto\ tanah} = \frac{P}{A_{perlu}} + \frac{M_y}{1/6.B_x^2.B_y} + \frac{M_x}{1/6.B_y^2.B_x}$

Then, by trial and error in the capture value Lp (width of /the foundation) and Pp (length foundation) so obtained grades A No = Lp x Pp > A necessary

Contact voltage control that occurred bottom of foundation:

- $\boldsymbol{\sigma_{netto\ tanah} = \frac{P}{A_{ada}} + \frac{M_y}{a/6.P^2.L} + \frac{M_x}{1/6.L^2.P} < \sigma_{netto\ tanah}}$

Distance to centre reinforcement pull into the fibre of concrete:

- $\sigma_{netto\ tanah} = \frac{P}{A_{ada}} + \frac{M_y}{a/_{6.P^2.L}} + \frac{M_x}{1/_{6.L^2.P}} < \sigma_{netto\ tanah}$

Distance to centre reinforcement pull into the fibre of concrete:

$d = h.Pb - ½\ v_{tulangan\ pokok}$

Distance to centre reinforcement pull into the fibre of concrete:

Description: Rated P, Mx, My

The land = weight of soil volume (kn / m3).

2) Land Data

In planning the construction of Office Building Education Office of Cirebon conducted research of soil wonder the data results obtained from a nearby construction project.

4. Building

An infrastructure building made by humans which consists of components of the architecture, structures, and utilities established somewhere permanent / semi-permanent.

5. Selection Structure System

The system selection upper structure has a close relationship with the functional system of the building. Structural design will affect the overall design of the building.

6. Software Support

a. Autocad

AutoCAD is a CAD software (Computer Aided Design) that serves to draw or design an object either 2 dimensions or 3 dimensions by using CAD system.

b. ETABS

ETABS is one application that is specifically used to analyze five structural plans, namely steel frame analysis, concrete frame analysis, composite beam analysis, steel rod frame analysis, shear wall analysis. The use of this program to analyze structures, especially for high-rise buildings is very appropriate for structural planners because of the accuracy of the output produced and the time-effective analysis.

III. OBJECT AND METHOD OF RESEARCH

A. PREPARATION

The stage of preparation is the initial activity before starting data collection and processing. At this preparation stage, the things that must be done are done with the aim that the writing of this thesis becomes systematic, orderly and structured so that the work time of this thesis becomes effective and efficient.

B. RESEARCH METHOD

1. Research Design

The research design begins by collecting and studying the literature related to planning. Collect data to be used as data in the object.

2. Research Method Used

The methods used in the study Flats for Factory Workers in the Industrial Area of Cirebon Regency is a qualitative method. The explanations are:

a. Quantitative method is a method performed by learning the references and study literature for the preparation of the thesis.
b. Qualitative method is a method performed by collecting data to be used as a preparation of the thesis. The data obtained is data from the object research. There are

3. Type and Data Sources

Data type seen from the data source is divided into two types.

a. Primary Data

Primary data is data obtained directly from the first party that informants are subjective or personal data of observations or data source directly provide data to data collectors.

b. Secondary Data

Secondary data is data obtained from references, books and the internet related to the building design.

4. Collecting Data Method

In making an analysis, data is needed as reference material. To be able to do a good analysis, it is necessary to have data that includes information and basic concept theories related to the object to be analyzed. These data can be classified into two types of data, namely primary data and secondary data.

5. Flowchart Of Research

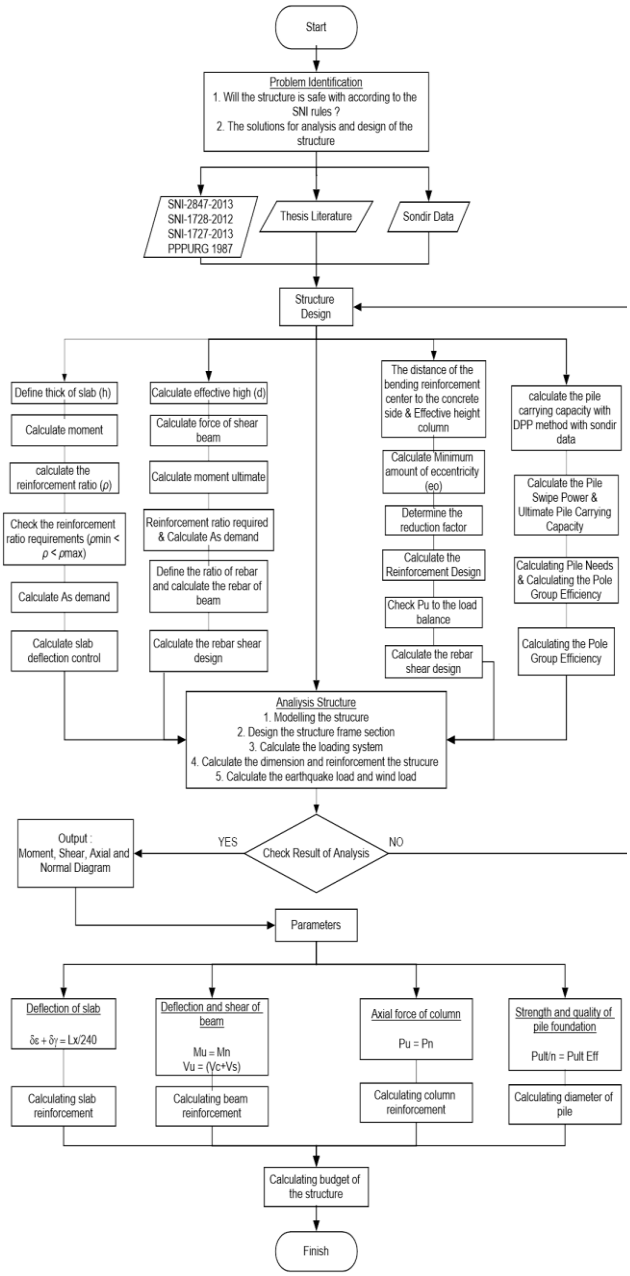

Image 3.1. Flowchart of research

C. LOCATION RESEARCH

1. Research Location

The research was conducted in Pangenan Sub-district of Cirebon Regency, which is located at Jalan Raya Pantura Kabupaten Cirebon.

Image 3.2. Research Location

IV. ANALYSIS AND DISCUSSION

A. STRUCTURE PLANNING DATA

1. Building Specification

a. Building function : Flats Rent
b. Land area : 8100 m^2
c. Building area : 1080 m^2
d. Building height : 14,00 m (including roof floor)
e. Building Configuration :

Table 4.1. Building configuration

Building	Elevation (m)
Base floor	+ 0,00
1st floor	+ 3,50
2nd floor	+ 7,00
3rd floor	+ 10,50
Roof floor	+14,00

2. Material Specification

a. Concrete : K-300, fc = 24,9 Mpa
b. Rebar
- D12 (BJTD40), fy = 400 Mpa
- D16 (BJTD40), fy = 400 Mpa
- D19 (BJTD40), fy = 400 Mpa
- Ø10 (BJTP24), fy = 240 Mpa

3. Data Frame Structure

a. Slab
1) Slab 1st – 3rd thickness (h) = 13 cm
2) Slab Roof thickness (h) = 13 cm
b. Sloof

Table 4.2. Type and dimension tiebeam

Type tiebeam	Dimension (cm)
S1	35/50

c. Beam

Table 4.3. Type and dimension beam

Floor	Type Beam	Dimension (cm)
F1	B1	35/50
F1	B1a	25/30
F2	B2	35/50
F2	B2a	25/30
F3	B3	35/50
F3	B3a	25/30
FR	B4	35/50
FR	B4a	25/30

d. Column

Table 4.4. Type and dimension column

Type Column	Dimension (cm)
K1	50/50
K2	35/35

B. PLANNING DRAWING DESIGN STRUCTURE OF FLATS

1. Floor Plan Design
2. Tiebeam and Pilecap Plan Design
3. Detail Pilecap and Tiebeam
4. Column and Beam Plan Design
5. Detail Column, Beam and Slab

C. ANALYSIS AND DESIGN WITH ETABS PROGRAM

1. Modeling Structure

The first step change the unit to KN-m.

a. Determine Grid Line and Edit.

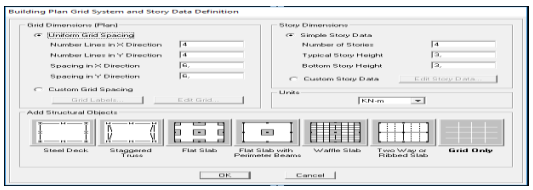

Image 4.1. Building Plan Grid System and Story Data Definition

2. Define Structure Data

a. Data On The Type And Strength Of Materials

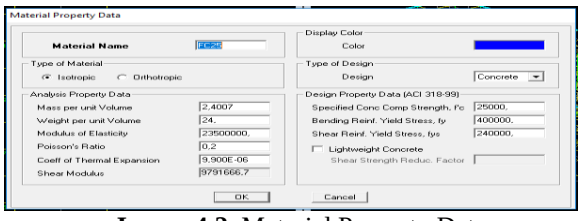

Image 4.2. Material Property Data

In this flats analysis the data included in the Etabs program are :

(1). *Mass per unit Volume*=2,4007

(2). *Weight per unit Volume* = 24

(3). *Modulus of Elasticity (Ec)* = 4700*$\sqrt{fc}$ = 23500 mPA

(4). *Spec. Conc. Comp Strength (fc)* = 25 mPA

(5). *Bending Reinf. Yield Stress (fy)*= 400 mPa

(6). *Shear Reinf Yield Stress (fys)*= 240 mPA

b. Defines Cross Sections Of Column And Beam

In planning this Flats the dimensions of columns and beams are inputted in Etabs, each column and beam is coded according to its dimensions

(1). Column Profile
(2). Tiebeam and Beam Profile
(3). Slab Profile

c. The Results Of Modeling

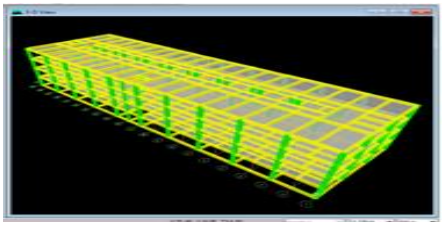

Image 4.3. The Results Of Modeling

3. Define Loads

The loads working on the structure of multi-story buildings, there are several kinds, which are as follows:

a. Dead Load (based on SNI-1727-2013 and PPPURG 1987)
   1) Self weight the structure :
      (a). Slab 1st – 3th floor, Q_D = 1,80 kN/m^2
      (b). Slab Roof floor, Q_D = 1,20 kN/m^2
      (c). Slab Roof floor with Torrent Water, Q_D = 19 kN/m^2

b. Live loads (based on SNI-1727-2013)
   1) Slab 1st – 3th floor Q_L = 2,50 kN/m^2
   2) Slab Roof floor Q_L = 1,50 kN/m^2

For living expenses on a roof based SNI-1727-2013 is Q_L= 1,00

kN/m^2, but here the burden of life is Q_L = 1,50 kN/m^2.

c. Wind loads (Wx and Wy)

To assign the wind load, data about wind velocity in the area building must be known. With searching data from BMKG, the wind velocity in Cirebon on Mundu sub-district is 15 km/h. (15 km/h = 9,321mph).

d. Earthquake load (EQx and EQy)

The method that used in analysis the earthquake load are static equivalent based on SNI-1726-2012 and also the data from website www.puskim.pu.go.id to know the response spectrum design in the building area and output result from Etabs for calculate the earthquake load.

4. Input Loads to ETABS Program

a. Dead Load

1) Click the area to be charged, Click menu ***Assign*** > ***Shell Area Load*** > ***Uniform***. Then select ***Load Case Name*** to Dead. Then load the load according to the type of floor plate that has been determined.

b. Live Load

1) Click the area to be charged, Click menu ***Assign*** > ***Shell Area Load*** > ***Uniform***. Then select ***Load Case Name*** to Live, Then load the load according to the type of floor plate that has been determined.

c. Earthquake Load

1) Load received from ETABS output. Click menu ***Display*** > ***Show Tables*** > ***Uniform*** > ***Building Data*** > ***Group*** > ***Group Masses and Weight.***

Table 4.5. Output Load ETABS

Group	SelfMass	SelfWeight	TotalMassX	TotalMassY	TotalMassZ
F 1	682,79	6825,91	682,79	682,79	0,00
F 2	682,79	6825,91	682,79	682,79	0,00
F 3	682,79	6825,91	682,79	682,79	0,00
F 4	652,44	6522,49	652,44	652,44	0,00
ALL	2700,81	27000,20	2700,81	2700,81	0,00

3) Distribution of earthquake load

Table 4.6. Calculation of Earthquake load

Tingkat	zi (m)	Wi (kn)	Wi x zi ^{k}	Cvx,y	Fix	Fiy
F ATAP	14	6522,49	132268,85	0,41	593,94	583,67
F 3	10,5	6825,91	99706,75	0,31	447,72	439,98
F 2	7	6825,91	62792,84	0,19	281,96	277,09
F 1	3,5	6825,91	28484,95	0,09	127,91	125,70
Σ		27000,20	323253,39			

Table 4.7. Earthquake load distribution

Tingkat	Perhitungan gempa 100% dan 30% arah tegak lurus			
	Fx(kN)	30% Fx(kN)	Fy(kN)	30% Fy(kN)
F ATAP	593,94	178,18	583,67	175,10
F 3	447,72	134,32	439,98	131,99
F 2	281,96	84,59	277,09	83,13
F 1	127,91	38,37	125,70	37,71

d. Wind Load

To Input Wind Load on Etabs, The steps taken:

1) Click ***Define*** > ***Static Load Case*** then select earthquake loading like Wx and Wy that have been made before.

5. Define Load Combination

a. Click menu ***Define*** > ***Load Combinations*** > ***Add New Combo.***

The load combination based on SNI 1727 2013, in the analysis just used 10 (ten) the main combination, the usual and commonly used in the structural analysis of the building, here are load combination will be input into ETABS :

a. 1,4D
b. 1,2D + 1,6L
c. 1,2D + 1,0W_X + 1,0L
d. 1,2D + 1,0W_Y +1,0 L
e. 1,2D + 1,0EQ_X + 1,0L
f. 1,2D + 1,0EQ_Y + 1,0L
g. 0,9D + 1,0W_X
h. 0,9D + 1,0W_Y
i. 0,9D + 1,0EQ_X
j. 0,9D + 1,0EQ_Y

6. Run Analysis ETABS Program

a. Click menu ***Analyze*** > ***Run Analysis*** > ***Run.*** Wait until the analysis process on the Etabs program is complete.

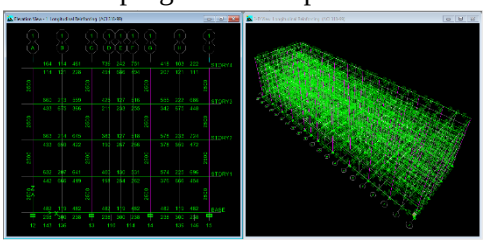

Image 4.4. Result of Concrete Frame Design

7. Result Analysis And Check The Structure

a. The result of analysis

Table 4.8. The result of analysis manual slab

Frame	Tulangan Arah X	Tulangan Arah Y
Pelat Atap Type A	Ø12 - 150	Ø12 - 150
Pelat Atap Type B	Ø12 - 100	Ø12 - 100
Pelat Atap Type C	Ø12 - 150	Ø12 - 150
Pelat Lantai 1,2,3 Type A	Ø12 - 150	Ø12 - 150
Pelat Lantai 1,2,3 Type B	Ø12 - 150	Ø12 - 150
Pelat Lantai 1,2,3 Type C	Ø12 - 150	Ø12 - 150
Pelat Lantai 1,2,3 Type D	Ø12 - 150	Ø12 - 150

Table 4.9. The result of analysis

Frame Structure		ETABS		Manual		Reinforcement Plan	
		Longitudinal	Shear	Longitudinal	Shear	Longitudinal	Shear
B4	Support	781	0,931	924	0,981	6D16	Ø 10 - 130
350X500	Field	508	0,931	483	0,981	3D16	Ø 10 - 130
B3	Support	979	1,347	1163	1,570	7D16	Ø 10 - 100
350X500	Field	555	1,347	559	1,570	4D16	Ø 10 - 100
B2	Support	1071	1,409	1274	1,570	7D16	Ø 10 - 100
350X500	Field	555	1,409	610	1,570	4D16	Ø 10 - 100
B1	Support	1023	1,368	1216	1,570	7D16	Ø 10 - 100
350X500	Field	555	1,368	584	1,570	4D16	Ø 10 - 100
TB1	Support	555	0,502	483	0,553	3D16	Ø 10 - 150
350X500	Field	329	0,503	483	0,553	3D16	Ø 10 - 150
B4a	Support	224	0,359	220	0,654	2D16	Ø 10 - 120
250X300	Field	119	0,359	189	0,654	2D16	Ø 10 - 120
B3a	Support	285	0,359	349	0,654	3D16	Ø 10 - 120
250X300	Field	186	0,359	189	0,654	2D16	Ø 10 - 120
B2a	Support	287	0,359	353	0,654	3D16	Ø 10 - 120
250X300	Field	187	0,359	189	0,654	2D16	Ø 10 - 120
B1a	Support	288	0,359	353	0,654	3D16	Ø 10 - 120
250X300	Field	188	0,359	189	0,654	2D16	Ø 10 - 120
K1	Support	2500	0,718	3770	0,785	12D19	Ø 10 - 100
500x500	Field	2500	0,718	3770	0,785	12D19	Ø 10 - 100
K2	Support	1225	0,588	1608	0,785	8D19	Ø 10 - 100
350x350	Field	1225	0,588	1608	0,785	8D19	Ø 10 - 100

b. Check The Structure

After getting the results of rebar used from frame section sloof (tie beam), beam and column, then will check the deflection from analysis ETABS the beam frame. The formula for check deflection are (L/480) based on SNI-2847–2013. The result for check deflection are as follow :

Table 4.10. Beam deflection

Frame Structure	Hasil Lendutan Analysis ETABS (mm)	Lendutan Ijin (L/480) (mm)
B4	9,101	12,500
B4a	4,201	6,250
B3	9,386	12,500
B3a	4,191	6,250
B2	9,423	12,500
B2a	4,302	6,250
B1	9,726	12,500
B1a	4,173	6,250

1) Result the deflection B4 from ETABS

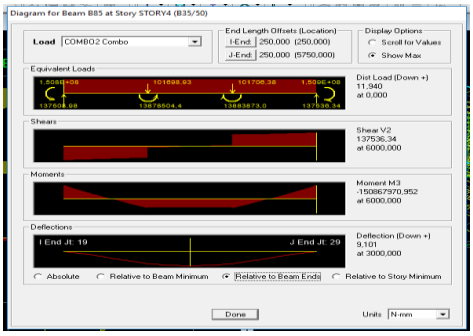

Image 4.5. Result Deflection B4

c. Output Result

Table 4.11. Output Column Result the biggest at each floor

Type	Floor	Column	Load. Co	Pu	Mu	Vu
K1	F1	C40	Combo2	2374,13	71,79	34,89
	F2	C40	Combo2	1680,11	119,37	67,37
	F3	C40	Combo2	1029,77	122,67	72,81
	F4	C43	Combo2	446,33	140,40	35,12
K2	F1	C65	Combo2	608,87	15,89	34,89
	F2	C65	Combo2	453,23	45,19	24,95
	F3	C62	Combo2	304,47	11,96	6,94
	F4	C43	Combo2	167,46	16,43	10,47

Table 4.12. Output Beam Result the biggest at each floor

Floor	Type	Beam.Loc	Load. Co	As	M_u^+	M_u^-	V_u^-
FR	B4a	B123	COMBO2	224	8,213	16,426	15,943
F3	B3a	B178	COMBO2	285	12,787	25,575	33,69
F2	B2a	B177	COMBO2	287	12,875	25,750	33,787
F1	B1a	B177	COMBO2	288	12,902	25,801	33,761

Floor	Type	Beam.Loc	Load. Co	As	M_u^+	M_u^-	V_u^-
FR	B4	B85	COMBO3	781	61,679	123,359	177,362
F3	B3	B82	COMBO3	979	76,406	152,812	211,813
F2	B2	B82	COMBO3	1071	83,119	166,239	216,928
F1	B1	B82	COMBO3	1023	79,631	159,262	213,570
FBASE	TB1	B101	COMBO6	555	40,225	80,450	64,166

Table 4.23. Output Result of Axial Force at each point

No.	Axial Force (kN)	No.	Axial Force (kN)	No.	Axial Force (kN)
1	1221,84	24	1986,55	47	558,11
2	2089,12	25	2537,50	48	541,61
3	2069,67	26	2275,76	49	542,70
4	2070,39	27	2277,68	50	544,93
5	2084,90	28	2283,35	51	537,21
6	1462,68	29	2065,43	52	539,87
7	720,77	30	2038,06	53	545,10
8	1597,93	31	2283,38	54	541,81
9	2537,50	32	2275,88	55	558,51
10	2069,24	33	2554,53	56	558,38
11	2089,22	34	1986,90	57	541,65
12	1221,76	35	1221,84	58	545,02
13	1986,91	36	2089,33	59	540,95
14	2554,34	37	2069,32	60	541,17
15	2275,80	38	2085,25	61	544,93
16	2283,58	39	1488,09	62	542,64
17	2063,87	40	726,11	63	541,57
18	2034,90	41	1601,24	64	558,11
19	2283,43	42	2083,37		
20	2277,67	43	2070,44		
21	2275,75	44	2069,70		
22	2537,50	45	2089,14		
23	1986,54	46	1221,85		

V. CONCLUSION AND SUGGESTION

A. CONCLUSION

After planning, collecting data, and analyzing the structure of the Factory Labor Rent Flats in the previous discussion, based on the data that has been planned and adjusted to SNI-2847-2013 (Persyaratan beton Struktural untuk Bangunan Gedung), SNI-1727-2013 (Persyaratan beban Minimum Untuk perancangan Bangunan Gedung Struktura lain), PPPURG 1987 (Pedoman Perencanaan Pemebabanan Untuk Rumah dan Gedung) dan SNI-1726-2012 (Tata Cara perencanaan Gempa Untuk Struktur Bangunan Gedung dan Non-Gedung), then a conclusion can be drawn as follows:

1. Determination of loading on the structure of the building is adjusted from the function of the building which refers to the SNI that has been previously determined.
2. Planning the 4 (Four) floor building for this flats is assisted by using Autocad software to visualize 2D Structural drawings and details, and to analyze the results of assisted planning using Etabs software.
3. There are some differences in the results of the As value in the Etabs results with the results of manual calculations, this difference does not significantly affect the strength of the structure because the difference is not too large in value. from the manual calculation the As value obtained is greater than the As value in the Etabs results, the difference in the As value will affect the number of reinforcement used in the planning.
4. From the planning results, it is obtained data that for planning the Flats require a land area of 8100 m2, and it consists of 2 Flats, Mosques, Car and motorcycle parking lots, Green open land and functional fields sports, shop areas.
5. From the results of planning and design planned in this thesis, the apartment consists of 4 floors and has a building area of 1080 m^2 and obtained 1 type of tiebeam with size 35/50 using reinforcement 6-D16 and shear reinforcement Ø10-150, then obtained 2 types of columns with a size 50/50 using reinforcement 12-D19 and shear reinforcement D10-100 and 35/35 using reinforcement 8-D19 and shear reinforcement D10-100, then obtained 2 types of main beams with a size 35/50 using reinforcement 12-D16 with shear reinforcement Ø10-100 and size 25/30 using reinforcement 5-D16 with shear reinforcement Ø10-120, then for floor and roof slab obtained a thickness 13cm using reinforcement D12-150.
6. Selection of foundations using Piles.
7. RAB structure obtained in this plan is Rp.15,920,000,000,- (Lima Belas Miliar Sembilan Ratus Dua Puluh Juta Rupiah), so that the price per meter is Rp.3,686,000,- (Tiga Juta Enam Ratus Delapan Puluh Enam Ribu Rupiah).

B. SUGGESTION

The suggestions submitted regarding this thesis are as follows :

1. Before starting a planning & designing step structure, it is more appropriate to understand in advance the applicable SNI requirements that have been determined in advance.
2. Before the structural planning, it is recommended to make an initial estimate for the size of structural elements in accordance with the requirements of SNI, so that there is no error and no determination of repetitive structural elements.
3. In inputting data on the ETABS program must be done carefully in accordance with the requirements of SNI and assumptions that have been determined in advance so that structural analysis can be produced that approaches the actual situation.

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