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# ANALYSIS STRUCTURE THE PT. TEMPO LAND BUILDING

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#### ABSTRACT

Mundu is an area in the district of Cirebon that passed by the Pantura lane, in the area of the Mundu there are various kinds of trading industry, one of which is the trading industry from PT. TEMPO LAND that are producing medicines for health. In order to create a good production and marketing, so in the area is built office production and marketing of PT. TEMPO LAND.

PT. TEMPO LAND is a group company in the form of by the TEMPO GROUP or PT. TEMPO SCAN PACIFIC Tbk. The company PT. TEMPO GROUP started its business on November 3, 1953. Production from this company produces a variety of pharmaceutical and healthcare products with different brands.

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, which is the latest regulations adapted from the latest material technology development refers to the AISC. 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 SAP2000, for the material of structures is used concrete including frame section (column, sloof, beam, and slab). And then the result from analysis are the PT. TEMPO LAND building is safe or not, with check the deflection and check load maximum permit from analysis foundation of PT. TEMPO LAND.

**Keywords** : Analysis structure, SAP2000, frame section, deflection.

# A. BACKGROUND

Cirebon is a city that quite rapidly progress in the field of tourism, economy, and services. The one factor that dominates development the Cirebon city is the economy, a wide variety field of the economy competition for example like trading industry.

Cirebon city itself has a very strategic geographical location, besides of Cirebon city is also a city track that connects West Java and Central Java, this condition potentially attracting tourists to visit the Cirebon city, causing the trade industry competition is very strict.

Mundu is an area in the district of Cirebon that passed by the Pantura lane, in the area of the Mundu there are various kinds of trading industry, one of which is the trading industry from PT. TEMPO LAND producing medicines for health. In order to create a good production and marketing, so in the area is built office production and marketing of the PT. TEMPO LAND.

PT. TEMPO LAND is a group company in the form of by the TEMPO GROUP or PT. TEMPO SCAN PACIFIC Tbk . The company PT. TEMPO GROUP started its business on November 3, 1953. Production from this company produces a variety of pharmaceutical and healthcare products with different brands.

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, which is the latest regulations adapted from the latest material technology development refers to the AISC.

Beside planning, the loading structure must be according to SNI - 1727 - 2013 then for calculation of earthquake engineering refers to SNI - 1726 - 2012.

# B. PROBLEM FORMULATION AND PROBLEM IDENTIFICATION

- 1. Problem Formulation
  - a. To design the PT. TEMPO LAND building, according to the SNI 2847 2013 reinforced concrete, PPPURG 1987 and SNI 1727 2013 for loading, and than calculate the seismic forces according to SNI 1726 2012.
  - b. Do not design Retaining Wall, ME and Plumbing.
  - c. Analysis Structure with SAP2000.
  - d. Calculate the budget structure.

# 2. Problem Identification

Based on the description formulation of the problem, so the problem can be identified as follows:

- a. How to design the structure PT. TEMPO LAND building according with the regulations of SNI?
- b. How to design the dimension of Slab, Beam, Column, and Foundation?
- c. How seismic force that occur in the structure PT. TEMPO LAND building?
- d. How to calculate the budget structure of PT. TEMPO LAND building?

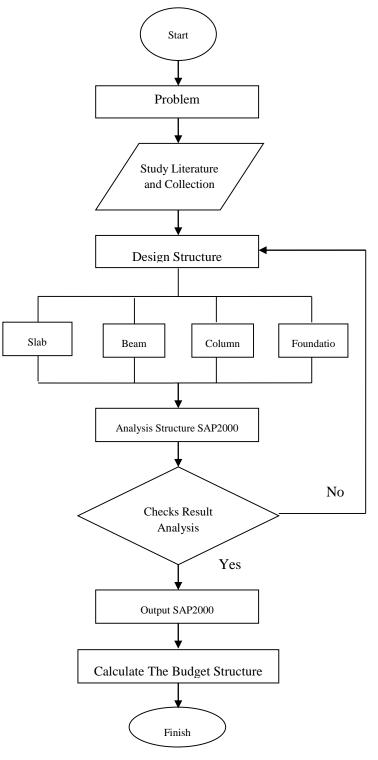
# C. RESEARCH PURPOSE

- 1. Design frame section with SAP2000 including Slab, Beam Column and Foundation of the PT. TEMPO LAND building.
- 2. Analysis structure PT. TEMPO LAND building with SAP2000.
- 3. Calculate the budget of the structure.

# **D. FRAMEWORK THINKING**

Framework thinking of this thesis use qualitative research methods, its conducting data collection. The collection data was obtained by way as follows :

- 1. References and study literature
- 2. Data obtained from the agencies
- 3. Field Observation
- 4. Browsing the Internet.



A. BASIS THEORY OF ANALYSIS STRUCTURE

# 1. Structural Portal System

Portal structure is the structure formed of elements of a straight stem, generally composed of beams and columns with the connection between the ends of the stem are assumed to be "stiff perfect" in order to prevent rotation of the relative rotation between the structural elements relate.

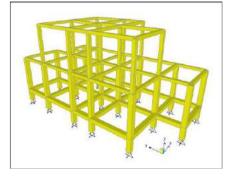
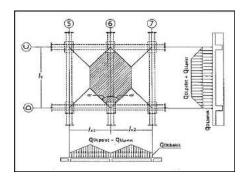


Figure 2.1 System structural

### 2. Loading System of The Structure

Load operation system for multistory building structural elements can generally be expressed as: load slab are distributed to the joist and beam portal, portal beam load distributed to load the column and the column is then forwarded to the sub-grade through the foundation.

For example, Figure in the below shows the distribution pattern of the slab load beam, the beam span of D-C to bear the burden on the span trapezoidal beams bear the burden of 5-6-7 triangle.



**Figure** 2.2 Loading system

Figure 1.1 Flowchart

#### 3. Structural Behavior

Portal structure consists of beams and columns, which have a rigid connection, if will be burdened load will arise deflection and forces (moments, shear, normal). For more details about changes to the structure of the portal due to the load can be seen in Figure 2.3.

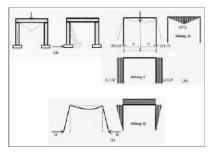


Figure 2.3 Structural behavior

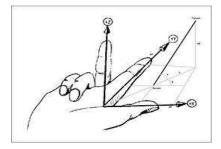
# **B. MODELING STUCTURE SAP2000**

#### 1. System Coordinate SAP2000

SAP2000, Structural Analysis Program, is one program civil engineering applications for structural analysis and design on a wide variety of buildings.

Analysis of the structure is meant is looking for any response to the loading a given structure, it is form of internal forces of structural elements or forces of reaction placement, as well as deformation (deflection) of the structure itself.

The coordinate system used is a square three-dimensional coordinate system (Cartesian) which refers to the right-hand rule. With the right hand (thumb, index and middle fingers) to form a line perpendicular to one another, and the direction indicated by the three right hand fingers shows the positive direction of the axis coordinate system. Where thumb as the X-axis, Y-axis and your index finger as middle as the Z axis.



**Figure** 2.4 Coordinate system

#### 2. Modeling the Structure

The initial stage before to do analysis of the structure is to create a model structure, structural modeling is numeric data generation (mathematical) represents the real structure used as computer data input.

On the program SAP2000 provided some of the structural model by default, see Figure 2.5 The model of this structure can be modified or create a new model that is in accordance with planning.



**Figure** 2.5 Modeling structure

#### 3. Material and Section Properties

At SAP 2000 are available various types of structural materials include concrete, steel and aluminum. Various types of materials can be applied to any element that has been modeled. In determining the property, the initial parameters relating to material that can be modified according to Planning for or standards used. Likewise, the section material.

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Figure 2.6 Material and section properties

4. Loads

A structure requires a review on the various loading conditions. It is generally in the section design process to find critical condition. In this case, the need to load grouping that has the same type. For example a group of dead load (self weight, walls) or live load (load workers) or lateral loads (wind, earthquake). The group within the meaning of expressed by Static Load analyzed separately from each other.

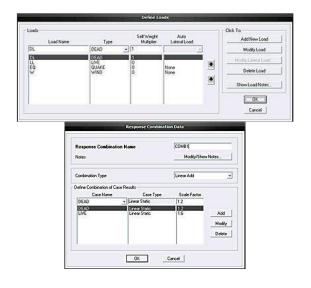


Figure 2.7 Loads

# A. OBJECT AND RESEARCH METHOD

# 1. Research Location

The research location of office PT. TEMPO LAND building, on Jl. Mundu Pesisir No. 35 Cirebon.



Figure 2.8 Project Location

### 2. Time Research

The time research, begin on March 12<sup>th</sup> 2016 until June 12<sup>th</sup> at the time of practical work, the activity done are survey and collecting the data.

The thesis preparation begins on November 8<sup>th</sup> 2016 until April 8<sup>th</sup> 2017, which predicted during five months.

# B. TYPE METHOD AND SOURCE OF DATA.

Based on the origin, the data are grouped to be two data, as follows :

1. Primary Data

Primary data are the data obtained from survey and direct observation to the location or object research.

2. Secondary Data

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

Collection data method used are the literature method and observation method, the explanation as follows :

 The literature method are the method performed by collecting, learning, and identifying from literature, that comes from books and the Internet, which is related to the building design. 2. The observation method are the method obtained from the survey directly, to the location or object research. With the survey to location of research, it can be seen and obtained data on the structural design of buildings PT. TEMPO LAND building.

# A. ANALYSIS AND DISCUSSION

# 1. Analysis Structure Data Building Specification

- a. Building function : Building office
- b. Building area 1504,80 m<sup>2</sup>
- c. Building height : 14,00 m (including dak roof)
- d. Building Configuration :

No.	Building	Elevation
1		(m)
1	Basement	-3,00
2	1 <sup>st</sup> floor	+0,00
3	2 <sup>nd</sup> floor	+3,00
4	3 <sup>rd</sup> floor	+6,00
5	4 <sup>th</sup> floor	+10,00
6	Roof	+14,00

#### 2. Material Specification

- a. Concrete : K-250, fc = 21 Mpa
- b. Rebar :

D19 (BJTD40), fy = 400 Mpa Ø10 (BJTP24), fy = 240 Mpa

# 3. Frame Structure Data

a. Slab :

Basement slab thickness (h) = 15 cm Slab  $1^{st} - 4^{th}$  thickness (h) = 12,5 cm Slab dak roof thickness (h) = 10 cm b. Sloof (Tie beam) :

No.	Type Sloof	Dimension (am)
1	Sidor	(cm) 45/25
2	S2	50/30
	~ -	
3	<b>S</b> 1	50/30

c. Beam

No.	Type Beam	Dimension (cm)
1	Ba	45/25
2	B2	50/30
3	B1	50/30

d. Column

No.	Type Column	Dimension (cm)
1	K1	55/55
2	K2	50/50
3	К3	40/40

# **B. ANALYSIS STRUCTURE**

# 1. Model Structure

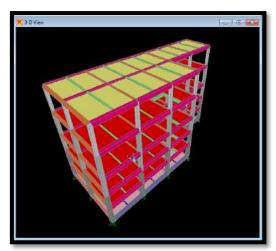


Figure 4.22 Model structure PT. TEMPO LAND

#### 2. Define Materials (Concrete and Rebar)

Material used are concrete, longitudinal reinforcing (deform) and transversal reinforcing (shear). And then for section `

property are sloof (tie beam), beam,  
column and slab.  
Define materials concrete, rebar, and  
specification are as follow :  
a. Concrete :  
Weight unit per volume  
$$(2400 \text{ Kg/m}^3) = 2,4.10^{-5} \text{ N/mm}^3$$
  
Concrete Quality  $f_c = 21 \text{ Mpa}$   
 $E_c = 4700*f_c^{1/2} = 21538,106 \text{ Mpa}$   
 $(\text{N/mm})$   
Poisson ratio = 0,2  
b. Longitudinal rebar (deform) :  
Weight unit per volume  
 $(7850 \text{ Kg/m}^3) = 7,850.10^{-5} \text{ N/mm}^3$   
Yield Stress, fy = 400 Mpa (N/mm)  
 $E_s = 200.000 \text{ Mpa} (\text{N/mm})$   
Poisson ratio = 0,3

c. Transversal rebar (shear) :

Weight unit per volume  $(7850 \text{ Kg/m}^3) = 7,850.10^{-5} \text{ N/mm}^3$ Yield Stress, fy = 240 Mpa (N/mm)  $E_s = 200.000 \text{ Mpa} (\text{N/mm})$ Poisson ratio = 0.3

To make it easily data input, then used the unit N, mm, C because the unit Mpa is equal to N / mm.

General Data	- Announcement of the	_
Material Name and Display Color	Material Beton	
Material Type	Concrete	*
Material Notes	Modily/Show Notes	2
Weight and Mass	- Units	
	00E-05 N. mm. C	
Mass per Unit Volume 24	47E-09	
Isotropic Property Data		
Modulus of Elasticity. E	21538.106	
Poisson's Ratio, U	0.2	
Coefficient of Thermal Expansion. A		
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Figure 4.23 Materials

#### 3. Define Section Properties

After define the material, the next steps are define and design frame section (sloof, beam, column and slab), frame section was define, must be same with the data from PT. TEMPO LAND :

a. Sloof

Sa, 45 x 25 cm S1, 50 x 30 cm S2, 50 x 30 cm

b. Beam

Ba, 45 x 25 cm B1, 50 x 30 cm B2, 50 x 30 cm c. Column

K1 55 x 55 cm K2 50 x 50 cm K3 40 x 40 cm

d. Slab

Basement slab, h = 15 cm Slab  $1^{st} - 4^{th}$ , h = 12,5 cm Dak roof, h = 10 cm

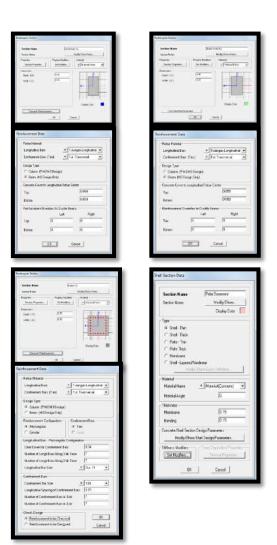


Figure 4.23 Section properties

# 4. Define Loads Dead Load

Self weight the structure :

Concrete material, weight unit per volume = 24 kN/m<sup>3</sup> with concrete quality fc 21 Mpa. Steel material deform (BJTD40) Steel material shear (BJTP24). The additional dead load inputted to slab, without added with "density concrete" (weight unit per volume of concrete 24  $kN/m^3$ ) are as follow :

Slab Basement =  $1,6 \text{ kN/m}^2$ 

No	Jenis Beban Mati	Berat satuan	Tebal (m)	Q (kN/m <sup>2</sup> )
1	Berat finishing lantai	22.0	0.05	1.100
2	Berat instalasi ME	0.5	-	0.500
Σ				1.600

#### Slab $1^{st} - 4^{th} = 1,8 \text{ kN/m}^2$

	9 -			
No	Jenis Beban Mati	Berat satuan	Tebal (m)	Q (kN/m²)
1	Berat finishing lantai	22.0	0.05	1.100
2	Berat instalasi ME	0.5	-	0.500
3	Berat plafon dan rangka			0.200
Σ				1.800

Dak roof  $= 0,42 \text{ kN/m}^2$ 

No	Jenis Beban Mati	Berat satuan	Tebal (m)	Q (kN/m <sup>2</sup> )
1	Waterproffing	22.0	0.01	0.220
2	Berat plafon dan rangka	0.2	-	0.200
Σ				0.420

### Live Load

Slab Basement = 1,92 kN (Lahan parkir SNI – 1727 – 2013) Slab 1<sup>st</sup> = 4,79 kN (Koridor lantai pertama SNI – 1727 – 2013) Slab 2<sup>nd</sup> - 4<sup>th</sup> = 3,83 kN (Koridor diatas lantai pertama SNI – 1727 – 2013) Dak roof = 1,00 kN (Beban hidup dak atap SNI – 1727 – 2013)

#### Wall Loads

The load a half brick wall is 2,5 kN/m<sup>2</sup>. ( $q_D = 2,5$  kN/m2, including dead load according PPPURG 1987)

- To be as a uniform load to beam :

 $W = q_D * h = 2,5 * h$  (height each story).

Height each story  $h_1 = 3.00 \text{ m}$ 

and  $h_2 = 4.00 \text{ m}$ 

 $W_1 = 2,5 * 3 = 7,5 \text{ kN/m}$ 

 $W_2 = 2,5 * 4 = 10 \text{ kN/m}.$ 

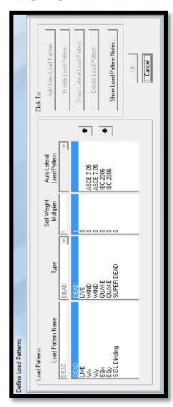
### Wind Loads (Wx and Wy)

In the define wind loads, the data must be known, is wind velocity on the area of building, with search data from BMKG the wind velocity in the Cirebon on Mundu is, (v = 9 km/h) because in SAP2000 input the wind velocity must be use unit mph, so (v = 5,592 mph).

#### Earthquake (EQx and EQy)

There are many parameter if define input the earthquake loads, the new earthquake analysis is based on SNI - 1726 - 2012, and website www.puskim.go.id it is the website if define site class earthquake.

This is, the steps input the loads in SAP2000 :



**Figure** 4.40 Load patterns

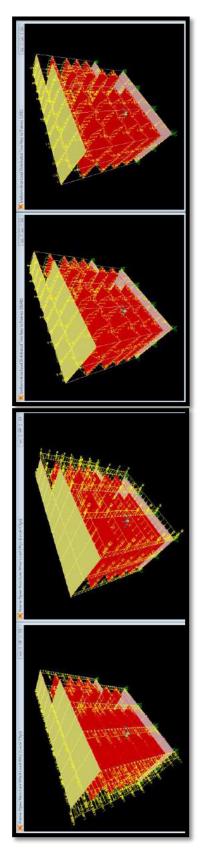


Figure 4.41 Kinds of loads



Analysis Structure The PT. TEMPO LAND Building

Figure 4.45 Earthquake loads

Load Direction and Diaphyagin Eccentricity -	Seimic Coefficients
G Blobal X Direction	C Sc and S1 tron USGS - by Lat./Long
C Slobal X Direction	C 5+ and 51 kow USGS - by Zip Code
A COLORED TO A COLOR	IF So and S1 User Specified
Ecc. Ralio (All Diaph.) 0.05	Site Latitude (degrees) ?
Ovende Diaph Eccen	verside Site Longitude (degrees) <u>7</u>
Tree Period	Site Zip Code (50 ight)
C Approx Period D HL x=	0.2 Sec Spectral Accel, Sr 0.715
Piogram Calo D. ML x = 0028	1 Sec Spectral Accel S1 0.291
C Use Delined T+	Long-Period Transition Period 8.
Lateral Load Elevation Range Program Ealoutated	Site Class B
	r Detailo   Site Coefficient, Fis
Hes 2	Site Coefficient, Pv
Min Z	
	Calculated Coefficients
Factors Response Modification, R 8	SD5 = [2/3]*F4*51 [0.1957 SD1 = (2/3)*F4*51 [0.194
System Overstrength, Omega	SD1=(2/3)*Fv*S1 (0.194
Deflection-Ancilication, Ed 55	Update Data
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Losd Direction and Displayage Eccentricity C Global X Discreen G [Bobal Y Direction] Ecc. Relia (AliDingh.) [0.05]	Second Continents C SavedSt hom/USOS-by Lat /Long C SavedSt hom/USOS-by Za Code SavedSt hom/USOS-by Za Code Ste Latitude(dagoes) Z
Losd Direction and Displayage Eccentricity C Global X Discreen G [Bobal Y Direction] Ecc. Relia (AliDingh.) [0.05]	Second Coefficients C Su and S1 hom/USOS - by Lati/Leng. C Su and S1 hom/USOS - by Zip Code Wilds
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LoedDirection andDirectorageEcontricty C Gebolt X Direction G (Eshald Y Directorage C Eco. Role (All-Orph) Eco. Role (All-Orph) Eco. Role (All-Orph) Eco. Role (All-Orph) C Role (Role (Ro	Second Continents         C Second Statutures           C Second Statutures         Second Statutures           Wetlids         Second Statutures           Vetlids         Second Statutures           Second Statutures         7           Second Statutures         7 <t< td=""></t<>
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LostOrection and/DisphageEcremitaly	Second Continents         C Second Statutures           C Second Statutures         Second Statutures           Wetlids         Second Statutures           Vetlids         Second Statutures           Second Statutures         7           Second Statutures         7 <t< td=""></t<>

Figure 4.48

### 5. Run Analysis

Before doing the Run Analysis, there are some parameters that must be edited and input, are as follows :

-Select the load combination, input and then move to the right, in order to design by SAP2000.

Contrinution Drongth		
Stergth		
		14
	DesignLoadContin	alors
AND 1	COMB1 1 40 COMB2 1.20 41.6L COMB5 WA COMB5 WA COMB5 WA COMB5 EQX COMB5 EQX COMB5 EQX COMB5 EQX COMB5 EQX COMB5 EQX COMB1 1 40 COM51 20 COM51 20 COM51 1 40 COM51 20 COM51 20 COM51 20 COM51 20 COM51 20 COM51 20 COM51 20 COM51 20 COM52 20 C	9
Design Load Combine	enter. 1	0
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	C Response Without The Code Search Daning Demon Load Content DR Code Search Daning C 1998 C 1997 C 1	ALL     COMPT 1.0-118.     OVER 1.0-118.

Figure 4.51 Design load to analysis

- Edit reduction factor based on design code ACI-99 :



Figure 4.55 reduction factor for concrete

- Choose the options from type of analysis structure :

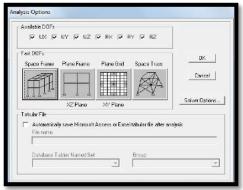
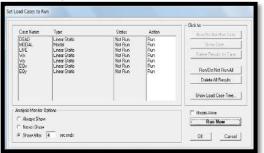


Figure 4.56 Type of analysis structure

- Run Analysis :



**Figure** 4.57 Run Analysis

# 6. Output SAP2000 (Analysis structure PT. TEMPO LAND) :

Output Earthquake Analysis : Self weight each floor on the structure,

TABLE: Groups 3 - Masses and Weights			
GroupName	SelfWeight		
Text	KN		
ALL	9531.3		
Lantai Basement	1486.44		
Lantai 1	1311.165		
Lantai 2	1311.165		
Lantai 3	1311.165		
Lantai 4	1311.165		
Lantai 5 Atap	1185.480		

### **>** Lateral Force on each floor (Fx) :

Each structure should be analyzed for the influence of static lateral force is applied independently in both directions orthogonal. In every direction were reviewed, lateral static force must be applied simultaneously in each floor. For analysis purposes, the lateral force in each floor is calculated by a formula, as follows :

$$F_x = 0,01 * W_x$$

With :

 $F_x$  = lateral force each floor

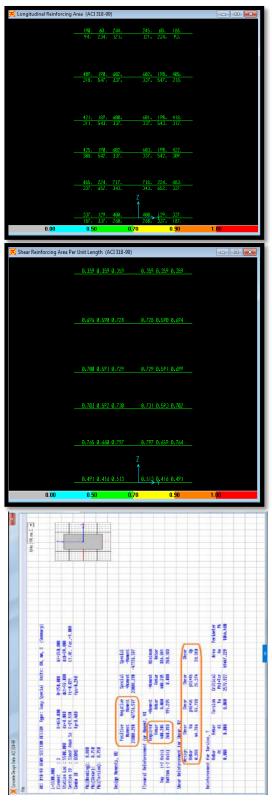
 $W_x$  = Self weight structure is work each floor.

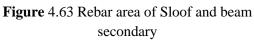
Table 4.6 The lateral force each floor

Lantai	Berat tiap lantai (kN)	Fx = 0,01Wx (kN)	
Lantai Basement	1486.44	14.8644	
Lantai 1	1311.165	13.11165	
Lantai 2	1311.165	13.11165	
Lantai 3	1311.165	13.11165	
Lantai 4	1311.165	13.11165	
Lantai 5 Atap	1185.480	11.8548	
Total	9531.3	95.313	

#### > Output Rebar Area :

Output rebar area, given by SAP2000 are rebar require (design rebar), and then for calculate rebar used, using manual method.





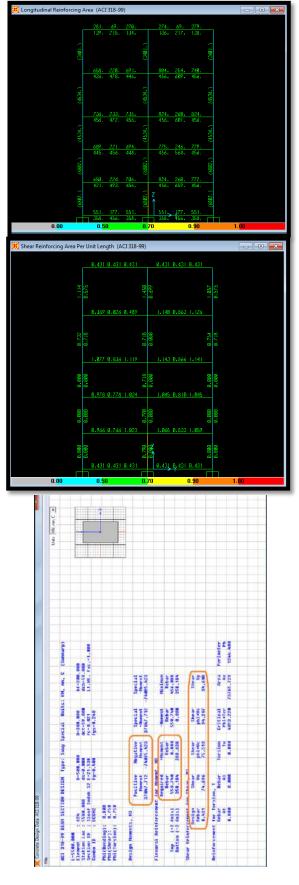
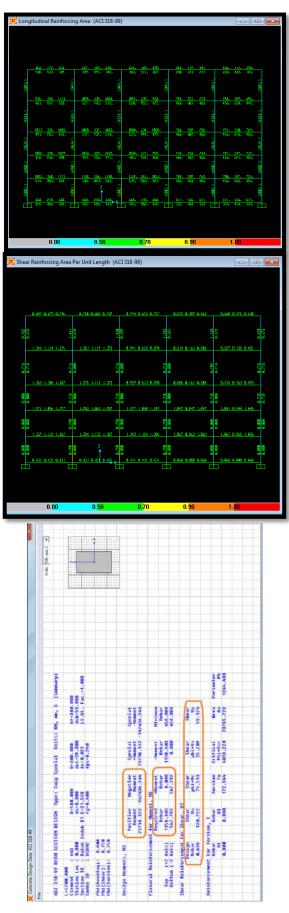


Figure 4.67 Rebar area of Sloof and beam primary

#### Subhan Manthofani, Arief Firmanto



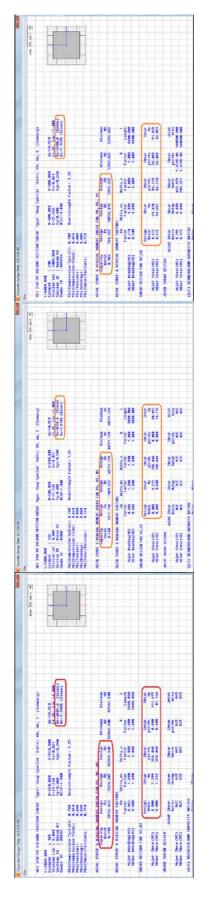


Figure 4.69 Rebar area of Sloof and beam primary

Figure 4.72 Rebar area of Column K1,K2,K3

# C. RESULT ANALYSIS AND CHECK THE STRUCTURE

#### > The result of Analysis

The result analyze are compare from manual with excel method and SAP2000. The following are result for analysis structure sloof (tie beam), beam, and column :

Table 4.7 The result of analysis

FRAME		SAP2000		Manual		Tulangan Terpakai	
		Longitudinal mm <sup>2</sup>	Shear mm <sup>2</sup> /mm	Longitudinal mm <sup>2</sup>	Shear mm <sup>2</sup> /mm	Longitudinal	Shear
Sloof Anak (Sa)	Tump.	400	0.359	401	0.350	2D19	Ø10 - 190
SIDDI Allak (Sa)	Lap.	260	0.359	280	0.350	2D19	Ø10 - 190
01	Tump.	657	0.431	658	0.420	3D19	Ø10 - 190
Sloof Induk (S1)	Lap.	425	0.431	391	0.420	2D19	Ø10 - 190
Sloof Induk (S2)	Tump.	551	0.431	551	0.420	3D19	Ø10 - 190
5100F INDUK (52)	Lap.	358	0.431	378	0.420	2D19	Ø10 - 190
Balok Anak (Ba)	Tump.	718	0.359	719	0.350	3D19	Ø10 - 190
DdiUK Alldk (Dd)	Lap.	342	0.359	414	0.350	2D19	Ø10 - 190
Balok Induk (B1)	Tump.	1158	0.696	1160	0.694	5D19	Ø10 - 190
Balok Induk (B1)	Lap.	548	0.696	761	0.694	4D19	Ø10 - 190
Balok Induk (B2)	Tump.	824	0.431	825	0.420	4D19	Ø10 - 190
balok Illuuk (b2)	Lap.	452	0.431	421	0.420	3D19	Ø10 - 190
Kolom (K1)	Tump.	6802	0.790	6800	0.764	24D19	Ø10 - 150
KOIOIII (KT)	Lap.	6802	0.790	6800	0.764	24D19	Ø10 - 150
Kolom (K2)	Tump.	4534	0.718	4525	0.700	16D19	Ø10 - 150
Rololli (R2)	Lap.	4534	0.718	4525	0.700	16D19	Ø10 - 150
Kolom (K3)	Tump.	3401	0.575	3392	0.560	12D19	Ø10 - 150
Kolom (K3)	Lap.	3401	0.575	3392	0.560	12D19	Ø10 - 150

Table 4.8 The result analysis manual slab

FRAME	Tulangan Arah x mm	Tulangan Arah y mm	
Pelat Lantai Type S	Ø10 - 125	Ø10 - 125	
Pelat Lantai Type A	Ø10 - 150	Ø10 - 150	
Pelat Lantai Type B	Ø10 - 150	Ø10 - 150	
Pelat Lantai Type C	Ø10 - 150	Ø10 - 150	

#### > 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 SAP2000 the beam frame. The formula for check deflection are (L/480) based on SNI – 2847 - 2013"Perencanaan Struktur Gedung Beton Bertulang". The result for check deflection are as follow :

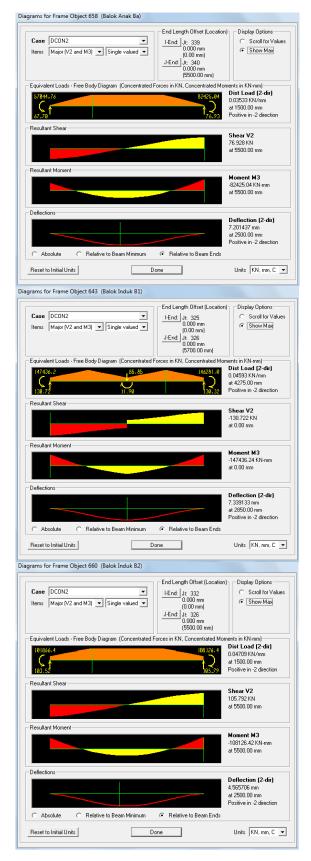


Figure 4.75

Check the deflection of beam

# D. THE BUDGET OF STRUCTURE

eker	jaan	GARAN BIAYA STRUKTUR : Gedung Kantor PT. TEMPO LAND . I. Munda Davidi No. 25 Gimbar				
okas umb	i er Dana	: Jl. Mundu Pesisir No. 35 Cirebon : THE TEMPO GROUP	_			
	n Anggaran	: 2016				
10		URAIAN PEKERJAAN	SAT	VOLUME	HARGA SATUAN (Rp)	JUMLAH SATUAN (Rp)
	PROYEK G	AN STRUKTUR EDUNG KANTOR PT. TEMPO LAND				
1	PEKERJA 1.1	AN PONDASI Galian Tanah Pile Cap	m3	26.24	70,000.00	1,837,080
	1.2	Urugan Tanah Bawah Lantai	m3	0.79	85,000.00	67,150
	1.3	Urugan Pasir Bawah Lantai Material Pile ukuran 25 x 25	m3 bh	1.98 64.00	130,000.00 2,280,000.00	256,750 145,920,000
	1.5 1.6	Biaya pemancangan dengan hidraulic jacking Pile Cap ukuran 13.5/13.5 K-250	m1 m3	804.00 26.24	500,000.00 1,485,500.00	402,000,000 38,979,520
	1.0	Tulangan Pile Cap	kg	1312.76	18,930.00	24,850,546
2	PEKERJA	Bekisting AN STRUKTUR LANTAI BASEMENT	m2	77.76	766,490.00	59,602,262
_	2.1	Kolom 1 55/55 K-250 ( K1 )	m3	14.52 3,855.36	1,485,500.00 18,930.00	21,569,460 72,981,964
		Tulangan Kolom Bekisting	kg m2	105.6	766,490.00	80,941,344
-	2.2	Sloof Anak 45/25 K-250 ( Sa ) Tulangan Sloof	m3 kg	4.95 746.88	1,485,500.00 18,930.00	7,353,225 14,138,381
	22	Begisting	m2	50.60	766,490.00 1,485,500.00	38,784,394
	2.3	Sloof Induk 50/30 K-250 ( S1 ) Tulangan Sloof	m3 kg	11.12 1,444.50	18,930.00	16,511,332 27,344,385
_	2.4	Begisting Sloof Induk 50/30 K-250 (S2)	m2 m3	96.33 6.60	766,490.00 1,485,500.00	73,835,981 9,804,300
		Tulangan Sloof	kg	857.20	18,930.00	16,226,796
	2.5	Begisting Plat lantai basement, h= 15 cm K-250	m2 m3	57.20 46.41	766,490.00 1,485,500.00	43,843,228 68,942,055
		Tulangan Plat Lantai Begisting	kg m2	6189.74 312.13	18,930.00 766,490.00	117,171,778 239,240,691
	2.6	Pintu (Alumunium Grade A)	bh	14.00	3,500,000.00	49,000,000
_	2.7 2.8	Jendela Toilet	bh	16.00 4.00	2,300,000.00 10,000,000.00	36,800,000 40,000,000
3	PEKERJA 3.1	AN STRUKTUR LANTAI 1 Kolom 1 55/55 K-250 (K1)	m3	14.52	1,485,500.00	21,569,460
	3.1	Tulangan Kolom	kg	3,855.36	18,930.00	72,981,964
_	3.2	Begisting Balok Anak 45/25 K-250 ( Ba )	m2 m3	105.6	766,490.00 1,485,500.00	80,941,344 7,830,070
		Tulangan Balok	kg	883.50	18,930.00	16,724,655
	3.3	Begisting Balok Induk 50/30 K-250 ( B1 )	m2 m3	50.60 11.12	766,490.00 1,485,500.00	38,784,394 16,511,332
_		Tulangan Balok Begisting	kg m2	2,330.00 96.33	18,930.00 766,490.00	44,106,900 73,835,981
	3.4	Balok Induk 50/30 K-250 ( B2 )	m3	6.60	1,485,500.00	9,804,300
		Tulangan Balok Begisting	kg m2	1119.87 57.20	18,930.00 766,490.00	21,199,101 43,843,228
_	3.5	Plat Lantai 1, h = 12.5 cm K-250 Tulangan Plat Lantai	m3 kg	38.60 5158.12	1,485,500.00 18,930.00	57,340,300 97,643,211
		Begisting	m2	312.13	766,490.00	239,240,691
	3.6 3.7	Pintu (Alumunium) Jendela	bh	17.00 26.00	3,500,000.00 2,300,000.00	59,500,000 59,800,000
1	3.8 PEKERJA	Toilet AN STRUKTUR LANTAI 2	set	2.00	10,000,000.00	20,000,000
	4.1	Kolom 2 50/50 K-250 ( K2 ) Tulangan Kolom	m3 kg	2,669.44	1,485,500.00 18,930.00	17,826,000 50,532,499
	4.2	Begisting Balok Anak 45/25 K-250 ( Ba ) Tulangan Balok	m2 m3 kg	96 5.27 883 50	766,490.00 1,485,500.00 18,930.00	73,583,040 7,830,070 16,724,655
	4.3	Begisting Balok Induk 50/30 K-250 ( B1 ) Tulangan Balok	m2 m3 kg	50.60 11.12 2,330.00	766,490.00 1,485,500.00 18,930.00	38,784,394 16,511,332 44,106,900
_	4.4	Begisting Balok Induk 50/30 K-250 ( B2 ) Tulangan Balok	m2 m3 kg	96.33 6.60 1119.87	766,490.00 1,485,500.00 18,930.00	73,835,981 9,804,300 21,199,101
	4.5	Begisting Plat Lantai 2, h = 12.5 cm K-250 Tulangan Plat Lantai	m2 m3 kg	57.20 38.60 5158.12	766,490.00 1,485,500.00 18,930.00	43,843,228 57,340,300 97,643,211
	4.6 4.7	Begisting Pintu (Alumunium) Jendela	m2 bh bh	312.13 17.00 26.00	766,490.00 3,500,000.00 2,300,000.00	239,240,691 59,500,000 59,800,000
5	4.8 PEKERJA 5.1	Toilet AN STRUKTUR LANTAI 3 Kolom 2 50/50 K-250 ( K2 )	set m3	2.00	10,000,000.00	20,000,000
	3.1	Tulangan Kolom Begisting	kg m2	3,559.25	1,485,500.00 18,930.00 766,490.00	67,376,659 98,110,720
	5.2	Balok Anak 45/25 K-250 ( Ba ) Tulangan Balok	m2 m3 kg	5.27	1,485,500.00 18,930.00	7,830,070
	5.3	Begisting Balok Induk 50/30 K-250 ( B1 )	m2 m3	50.60	766,490.00 1,485,500.00	38,784,394
_		Tulangan Balok Begisting	kg m2	2,330.00 96.33	18,930.00 766,490.00	44,106,900 73,835,981
	5.4	Balok Induk 50/30 K-250 ( B2 ) Tulangan Balok	m3 kg	6.60 1119.87	1,485,500.00 18,930.00	9,804,300 21,199,101
	5.5	Begisting Plat Lantai 2, h = 12.5 cm K-250	m2 m3	57.20 38.60	766,490.00 1,485,500.00	43,843,228 57,340,300
		Tulangan Plat Lantai Begisting	kg m2	5158.12 312.13	18,930.00 766,490.00	97,643,211 239,240,691
	5.6 5.7 5.8	Pintu (Alumunium) Jendela Toilet	bh	16.00 28.00 2.00	3,500,000.00 2,300,000.00 10,000,000,00	56,000,000 64,400,000
5	PEKERJA.	AN STRUKTUR LANTAI 4 Kolom 3 40/40 K-250 (K3)	set m3	10.24	1,485,500.00	20,000,000
	6.1	Kolom 3 40/40 K-250 (K3 ) Tulangan Kolom Begisting	m3 kg m2	2,689.28	1,485,500.00 18,930.00 766,490.00	50,908,070 78,488,576
	6.2	Balok Anak 45/25 K-250 ( Ba ) Tulangan Balok	m3 kg	5.27 883.50	1,485,500.00 18,930.00	7,830,070
	6.3	Begisting Balok Induk 50/30 K-250 ( B1 )	m2 m3	50.60 11.12	766,490.00 1,485,500.00	38,784,394 16,511,332
		Tulangan Balok Begisting	kg m2	2,330.00 96.33	18,930.00 766,490.00	44,106,900 73,835,981
	6.4	Balok Induk 50/30 K-250 (B2 ) Tulangan Balok Begisting	m3 kg m2	6.60 1119.87 57.20	1,485,500.00 18,930.00 766,490.00	9,804,300 21,199,101 43,843,228
	6.5	Plat Lantai 2, h = 12.5 cm K-250 Tulangan Plat Lantai Begisting	m3 kg m2	38.60 5158.12 312.13	1,485,500.00 18,930.00 766,490.00	57,340,300 97,643,211 239,240,691
	6.6 6.7	Pintu (Alumunium) Jendela	bh bh	15.00 25.00	3,500,000.00 2,300,000.00	52,500,000 57,500,000
7		Toilet AN STRUKTUR DAK ATAP Palek Angk 45/25 K 250 ( Pa )	set	2.00	10,000,000.00	20,000,000
	7.1	Balok Anak 45/25 K-250 ( Ba ) Tulangan Balok Benisting	m3 kg	5.27 883.50 50.60	1,485,500.00 18,930.00 766,490.00	7,830,070 16,724,655 38,784,394
	7.2	Begisting Balok Induk 50/30 K-250 (B1) Tulangan Balok	m2 m3 kg	50.60 11.12 2.330.00	766,490.00 1,485,500.00 18,930.00	38,784,394 16,511,332 44,106,900
	7.3	Tulangan Balok Begisting Balok Induk 50/30 K-250 ( B2 )	m2 m3	2,330.00 96.33 6.60	18,930.00 766,490.00 1,485,500.00	44,106,900 73,835,981 9,804,300
		Tulangan Balok Begisting	kg m2	1119.87 57.20	1,485,500.00 18,930.00 766,490.00	9,804,300 21,199,101 43,843,228
-	7.4	Plat Lantai Atap, h = 10 cm K-250	m2 m3	30.73	1,485,500.00	45,653,871
		Tulangan Plat Lantai	kg	5158.12	18,930.00	97,643,211

# A. CONCLUSION

Based on the result of analysis and discussion, it can be concluded as follows :

- 1. In analyzing the structure with SAP2000, the steps that must be done consists of modeling the structure, define material, define and design frame section, define the load patterns and run analysis model of the structure.
- 2. The results from analysis structure are as follows:
  - a. Internal forces (moment, axial and shear) that will be used in the design phase of the structure. In the design of the structure (output SAP2000) is produced rebar required by the elements (frame) structure.
  - b. The result from analysis lateral force (earthquake), it can concluded the lateral force greatest is 14,864 kN.
  - c. The result from analysis structure using SAP2000 with manual method, is the almost same, but there are some differences at number of rebar on sloof and beam, the result are as follows :

**Table 5.1** The different result analysisstructure.

FRAME		DATA PROYEK		DATA HASIL ANALYSIS		
		Longitudinal	Shear	Longitudinal	Shear	
Sloof Anak (Sa)	Tump.	3D19	Ø10 - 150	2D19	Ø10 - 190	
SIDDI Allak (Sa)	Lap.	2D19	Ø10 - 200	2D19	Ø10 - 190	
Sloof Induk (S1)	Tump.	3D19	Ø10 - 150	3D19	Ø10 - 190	
31001 Induk (31)	Lap.	3D19	Ø10 - 200	2D19	Ø10 - 190	
Sloof Induk (S2)	Tump.	3D19	Ø10 - 150	3D19	Ø10 - 190	
31001 Induk (32)	Lap.	3D19	Ø10 - 200	2D19	Ø10 - 190	
Balok Anak (Ba)	Tump.	3D19	Ø10 - 150	3D19	Ø10 - 190	
ваюк Апак (ва)	Lap.	2D19	Ø10 - 200	2D19	Ø10 - 190	
Balok Induk (B1)	Tump.	5D19	Ø10 - 150	5D19	Ø10 - 190	
Balok Illuuk (B1)	Lap.	4D19	Ø10 - 200	4D19	Ø10 - 190	
Palak Induk (P2)	Tump.	4D19	Ø10 - 150	4D19	Ø10 - 190	
Balok Induk (B2)	Lap.	3D19	Ø10 - 200	3D19	Ø10 - 190	

d. From manual analysis slab, there are differences from data project PT. TEMPO LAND, the differences are as follows :

**Table 5.2**The different resultanalysis manual slab

FRAME		ROYEK an (mm)	DATA HASIL ANALYSIS Tulangan (mm)		
	Arah x	Arah y	Arah x	Árah y	
Pelat Lantai Type S	Ø10 - 125		Ø10 - 125		
Pelat Lantai Type A	Ø10 - 200		Ø10 - 150		
Pelat Lantai Type B	Ø10 - 150		Ø10 - 150		
Pelat Lantai Type C	Ø10 - 200		Ø10 - 150		

- The result from check ratio color e (SAP2000) on the structure, that produce green color for beams and blue color for columns, but there are 2 (two) columns is get yellow colors, and then from check the deflection it can, the value greatest from balok induk B1 is 7,339 mm with span is 5700 mm, but not more than deflection permit (L/480) is 11,875 mm. So it can be concluded that, the structure from PT. TEMPO LAND is safe.
- f. The vertical load of pile group is 595,706 kN, less then more from the maximum load permitted is 1128,704 kN, it can be concluded that the foundation in PT. TEMPO LAND is safe.
- 3. From the result analysis budget of the structures, it can be total budget structures is Rp 6,170,934,880,400,-

# **B. RECOMMENDATION**

The recommendation submitted regarding this thesis, are as follows :

1. In the analysis using SAP2000, needed preliminary design and accurate when

inputted the data included material, section properties and loads.

2. Regarding the design of the structure, according to the design code (standar perencanaan).

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