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ANALYSIS STRUCTURE OF BUILDING LOCAL GOVERNMENT 2 KARAWANG WITH CONCRETE STRUCTURE

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ABSTRACT

Desire to have a local government of Karawang office is quite magnificent service complete with adequate facilities that can support a variety of work activities of Government Officials and employees, it is the hope of the ideal and coveted by all circles. However, of course, in realizing a high desire that must be supported by substantial costs sourced from local revenue sources that in fact the people's money too, would be comparable and parallel with the level of service to the community.

However, fears as above hopefully not happen because the purpose 5th floor of building local government 2 Karawang certainly has a good purpose for increased imagery and public services for the people in the city's mayor. Thus will be realized an order of life is getting better with the presence of a complete service of policy makers in the Karawang City, which in turn will encourage improvements in the economy of the community.

The building local government 2 using concrete structure. On the basis of the criteria safety and excellent service then loading the planning process should be in accordance with SNI-1727-2013 as well as the structural design of the building should refer to SNI-2847-2013 specification for structural steel buildings, other than that in the calculation of earthquake engineering should also refer to the SNI-1726-2012.

Keyword : *Analysis structure, Etabs, frame section, deflection*.

I. PREMILINARY

Desire to have a local government of Karawang office is quite magnificent service complete with adequate facilities that can support a variety of work activities of Government Officials and employees, it is the hope of the ideal and coveted by all circles. However, of course, in realizing a high desire that must be supported by substantial costs sourced from local revenue sources that in fact the people's money too, would be comparable and parallel with the level of service to the community.

Because, what is a magnificent and beautiful building with adequate facilities if mentalities Officials and employees still want to be served rather than serve so that people still do not get the perfect service. Moreover, if the presence of Reviews These magnificent buildings will only increase of the budget for maintenance and monthly budget as pay electricity needs, taps, energy cleaning service and others are increasingly bloated, of course, the term an Increase in service would be difficult, to get the public.

However, fears as above hopefully not happen because the purpose 5th floor of building local government 2 Karawang certainly has a good purpose for increased imagery and public services for the people in the city's mayor. Thus will be realized an order of life is getting better with the presence of a complete service of policy makers in the Karawang City, which in turn will encourage improvements in the economy of the community.

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1.1. Problem identification

a. Formulation of the problem

1. How the imposition of the building local government 2 Karawang using concrete structure.
2. How is the planning dimension of the slab, beams, columns and foundations at the building local government 2 Karawang.
3. How to design a local government building 2 Karawang.

b. Identification of problems

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

1. How to plan the building structure local government 2 Karawang in accordance with the regulations SNI?
2. How is the planning dimension of the slab, beams, columns, and foundations?
3. How seismic forces that occur in the structure of building local government 2 Karawang?
4. How to calculate the structure of local government RAB 2 Karawang?

The purpose of this research in Karawang Government Office are :

1. Plotting plate, beams, columns and foundations in the construction of building structures local government 2 Karawang.
2. Analyzing the structure of local government 2 Karawang with ETABS.

II. METHOD

The method used is the method of quantitative and qualitative methods, the explanation is as follows:

1. Quantitative method is a method that is done by studying references and literature for the preparation of the thesis.
2. The qualitative method is a method that is done by collecting data to be used as the preparation of the thesis. The data obtained are the data of the object of research.

The data source is anything that can provide information about the data. Based on the type, the data is divided into two, that are primary data and secondary data.

1. Primary data is data created by researches for the special purpose of solving the problem being handled. The data is collected by the researcher directly from the first source or place of the research (survey). Data obtained from primary data are :
   - Sorted implementation work from start to finish of project
     (ex : Before doing the beam work, must complete the column work).
   - Worker, tools, and materials productivity
     (ex : 1 worker can do $10m^2$ wall painting using a can of paint and a brush in 1 day).
   - Methods used to built the building
     (ex : The method used in the building is Bottom-Up).

2. Secondary data is data that has been collected for purposes other than solve the problem is being done. This data can be found quickly. In this study the secondary data sources are literature, articles, journals and internet sites related to research which is conducted. Data obtained from secondary data are :
   - Structure and architecture shop drawing
   - Unit price analysis
   - Unit price of worker, tools, and materials
   - The rules for planning, scheduling and analyzing the management construction (SNI)

III. ANALYSIS STRUCTURE WITH ETABS

In general the steps of performed in ETABS analysis consist of modeling the structure, determination of material properties and frame structure, and then determination of loading and analysis model of the structure, which will be described below.

3.1. Modeling Structure

In modeling structures with Etabs, the first thing done is set the unit to be used for analysis. The unit used is kN,m,C. After determining unit, the next step is to create a model grid structure that will do the analysis.

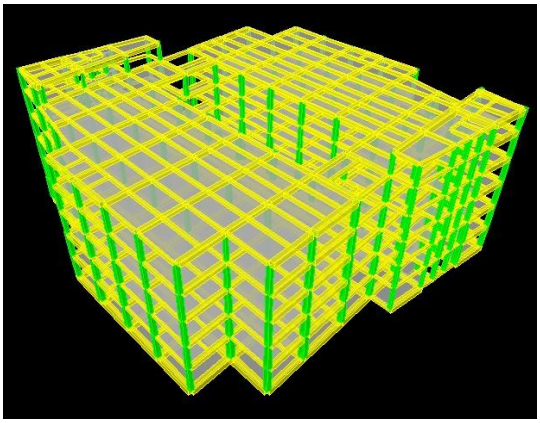


Figure 1. Modeling Structure

3.2. Define Mateial Structure

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 :

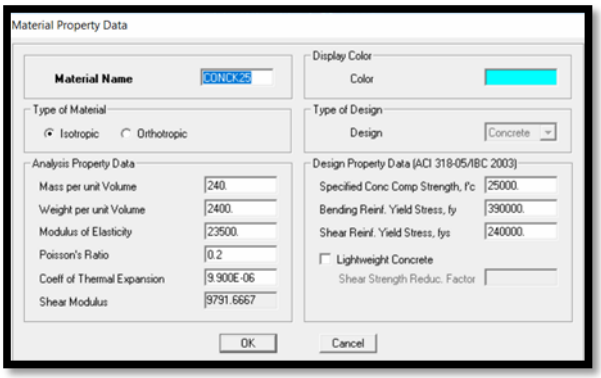


Figure 2. Material Property Data

3.3. Define The Section Properties

After define the material, the next steps are define and design frame section (sloof, beam, column and slab),

3.4. Define Load

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

a. Dead Load

- Loading Slab dak/roof :

Self-weight	(0,1 x 24)	= 2,4 kN/m²
Waterproffing	(0.02 x 14)	= 0,28 kN/m²
Water load	(0.01 x 10)	= 0,1 kN/m²
Plafond load		= 0,18 kN/m²
etc load		= 0,25 kN/m²
	DL	= 3,21 kN/m²

Input to etabs

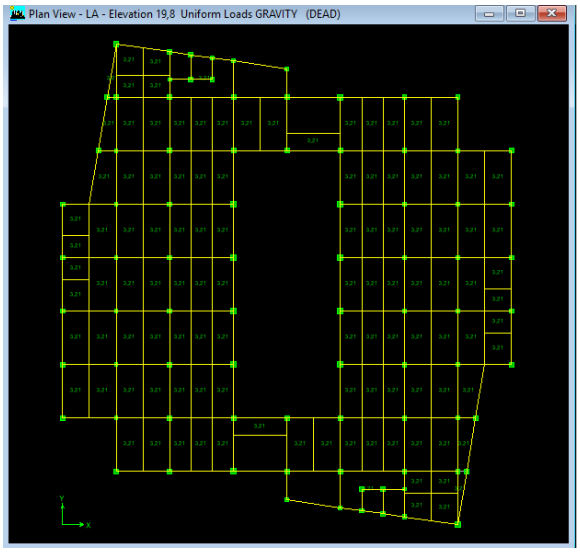


Figure 3.

- Loading Slab of 1st – 4th floor

Self-weight	(0,12 x 24)	= 2,88 kN/m²
Sand load 1 cm	(0.01 x 16)	= 0,16 kN/m²
Spacing load 3 cm	(0.03 x 21)	= 0,63 kN/m²
Keramik 1cm	(0.01 x 24)	= 0,24 kN/m²
Plafond load		= 0,18 kN/m²
etc load		= 0,25 kN/m²
	DL	= 4,34 kN/m²

Input to etab

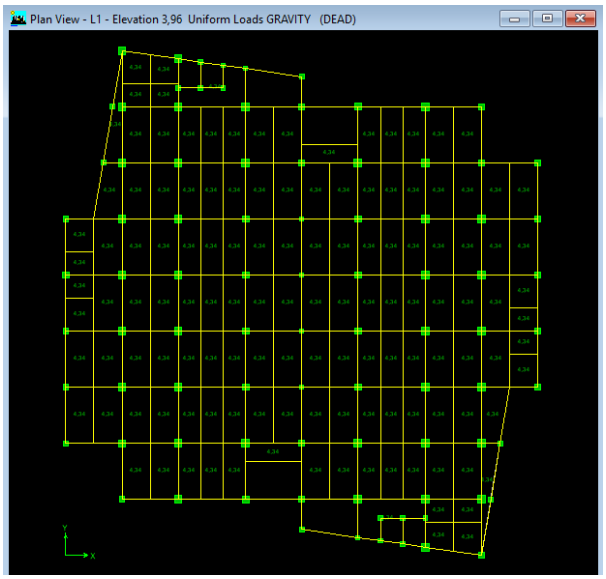


Figure 4.

- Loading Slab ground floor

Self-weight	(0,12 x 24)	= 2,88 kN/m²
Sand load 1 cm	(0.01 x 16)	= 0,16 kN/m²
Spacing load 3 cm	(0.03 x 21)	= 0,63 kN/m²
Keramik 1 cm	(0.01 x 2400)	= 0,24 kN/m²
etc load		= 0,25 kN/m²
	DL	= 4,16 kN/m²

Input to etabs

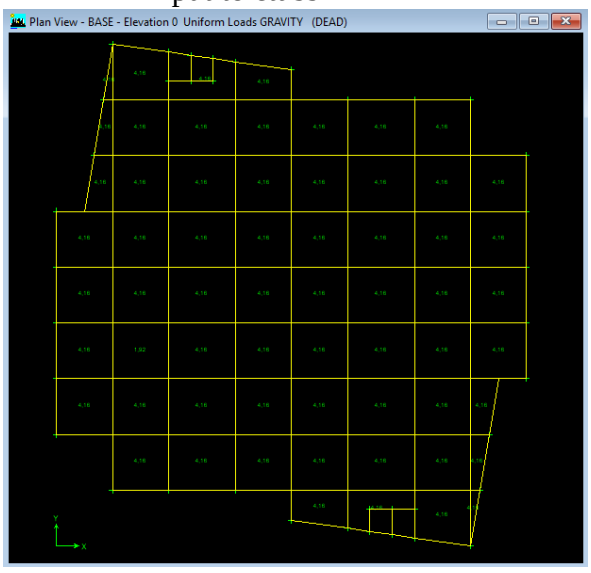


Figure 5.

b. Live Load

- Loading Slab dak/roof

  Flat roof, continue and curved (SNI 1727 -2013)

  LL = 0,96 kN/m^2

- Loading slab of 1^{st}-4^{th} floor

  Live load of office (SNI 1727 - 2013)

  LL = 2,4 kN/m^2

- Loading slab of ground floor

  Park area (SNI 1727 -2013)

  LL = 1,92 kN/m^2

Live load reduction factor

For planning of Beam and portal from system of load bearing and holder horizontal load, live reduction as :

Structure used	coefficient live load reduction	
	For gravity load	For earthquake
Office stucture	0,60	0,30

Live load reduction for load of vertical column, as :

Total of floor that shouldered	Reduction factor	
1	1,00	
2	1,00	
3	0,90	
4	0,90	

Input live load to etabs

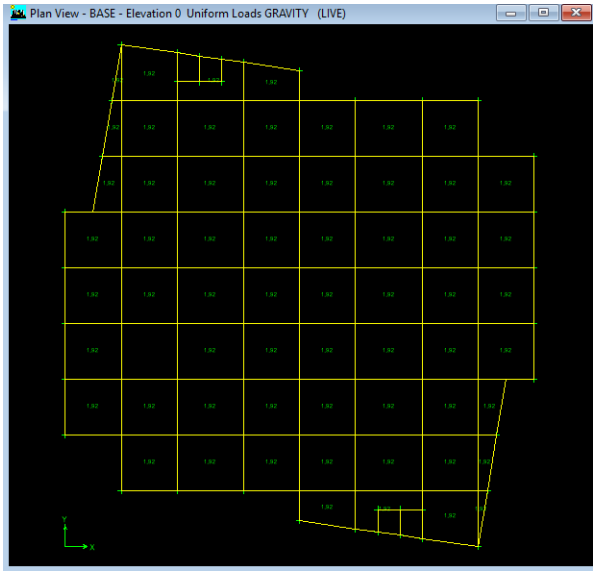


Figure 6. Ground floor

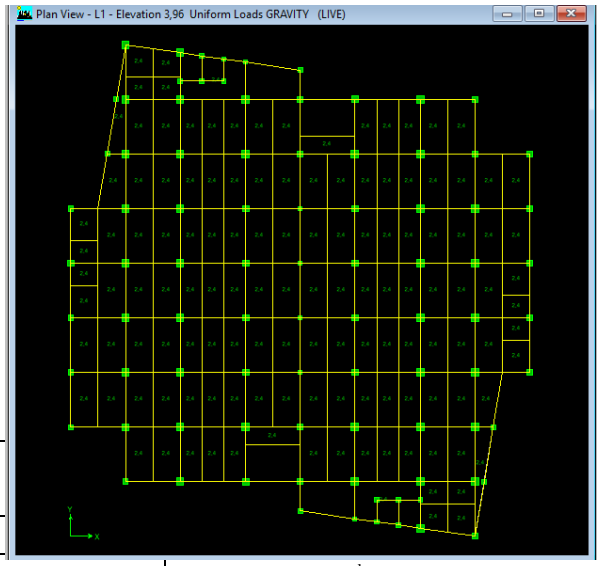


Figure 7. 1^{st} – 4^{th} floor

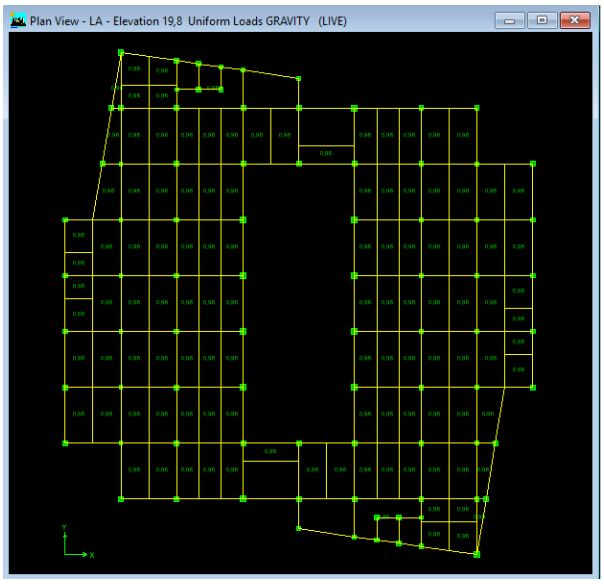


Figure 8. Dak / roof floor

c. Wind Load

Wind pressure must be taken by minimal 25 kg/m^2 with wind coefficient (-0,02 α- 0.40) / (on the wind) and +0.40 (behind of wind). So wind load taken by 0,30 kN/m^2.

Input to etabs

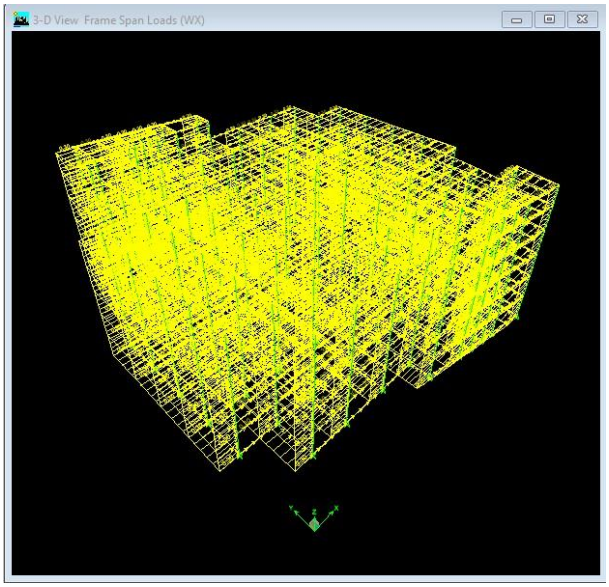


Figure 9.

d. Wall Load

The load a half brick wall is 2,5 kN/m2. (qD = 2,5 kN/m2, including dead load according PPPURG 1987)

- To be as a uniform load to beam : W = qD * h = 2,5 * h (height each story).
- Height each story h1 = 3.00 m and h2 = 4.00 m

W1 = 2,5 * 3 = 7,5 kN/m
W2 = 2,5 * 3,96= 9,9 kN/m.

Input wall load, im named this load swlwalll in the etabs

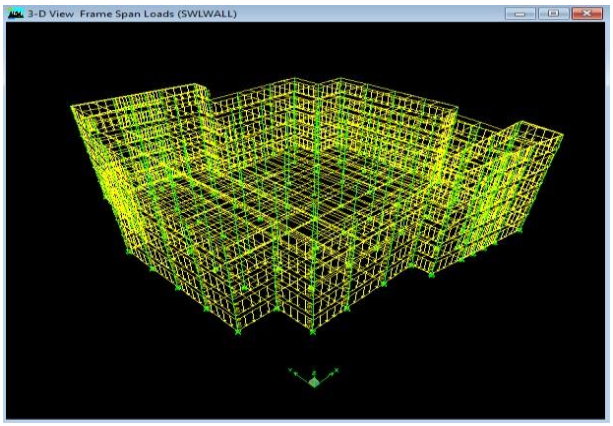
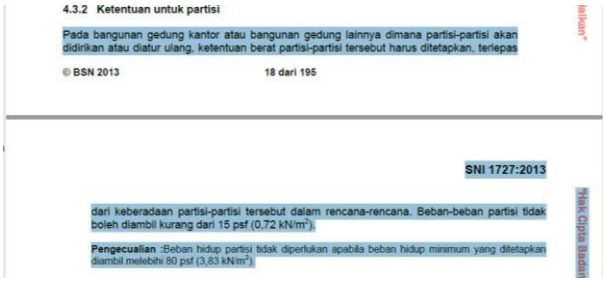


Figure 10.

Partisi wall Load :

As we know in SNI 1727 2013, in office building accordance load of partisi can take from >0,72kN/m^2 so in this project partisi load take by value 75kg/m^2 or 0,75kN/m^2.


4.3.2 Ketentuan untuk partisi

Pada bangunan gedung kantor atau bangunan gedung lainnya dimana partisi-partisi akan didirikan atau diatur ulang, ketentuan berat partisi-partisi tersebut harus ditetapkan, terlepas

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SNI 1727:2013

dari keberadaan partisi-partisi tersebut dalam rencana-rencana. Beban-beban partisi tidak boleh diambil kurang dari 15 psf (0,72 kN/m^2).

Pengecualian :Beban hidup partisi tidak diperlukan apabila beban hidup minimum yang ditetapkan diambil melebihi 80 psf (3,83 kN/m^2).

Figure 11.

Input load partisi in etabs

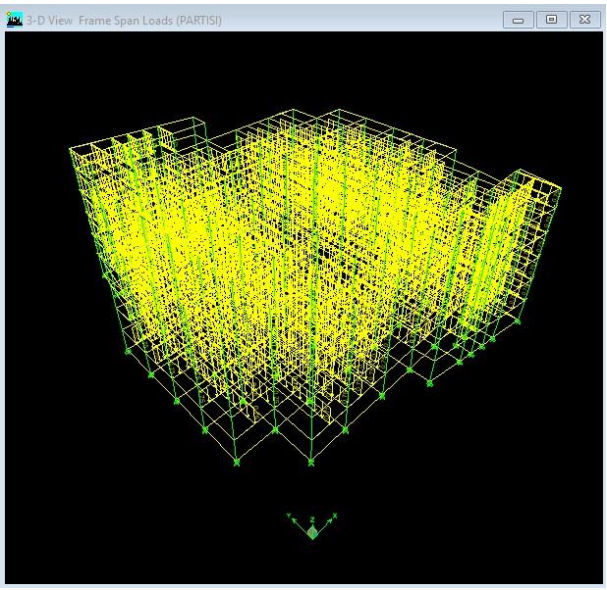

Figure 12.

e. Earthquake Load

Analysis of seismic load this time only by response spectrum, calculate analysis of building structures against earthquake loads refer to the Earthquake Resilience Planning.

Procedures for Building Structures and Non-Building (SNI-1726-2012) with the following stages:

Risk category Building Structure and Virtue Factors Virtue According to Article 4.1.2 SNI-1726-2012 states that "The office building is included in the risk category II by virtue factor I_e earthquake of 1.0.

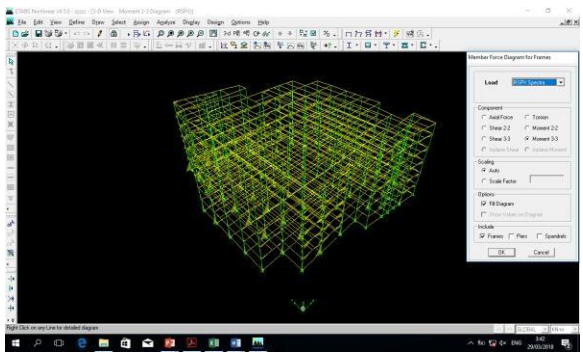

Figure 13. Momen x-direction response sprectrum effect

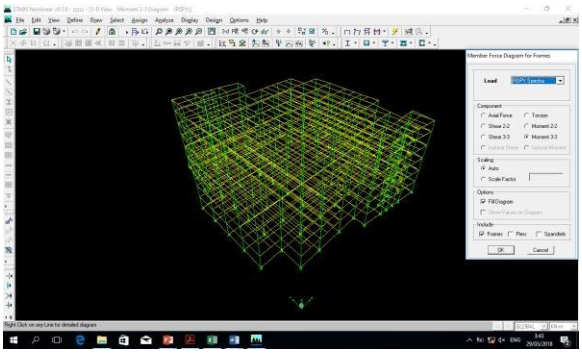

Figure 14. Momen x-direction response spectrum effect

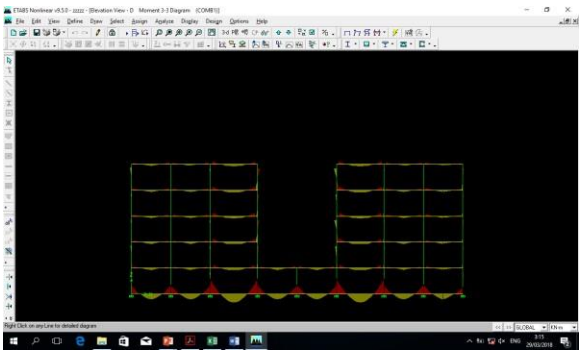

Figure 15. Analysis of bending moment

From that figure we can see location that have highest bending moment. Long of frame section has effected to this moment and story level of frame section too.

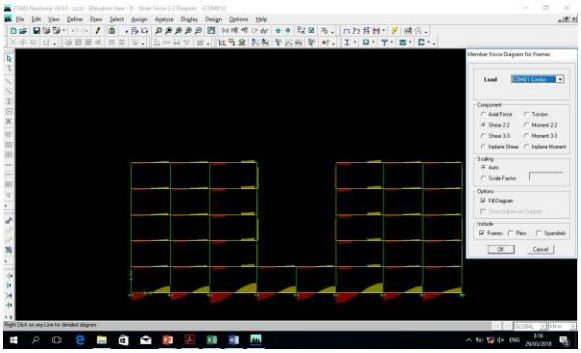

Figure 16. Shear forces against reinforcement

On that figure we can see, shear forces in sloof highest than beam.

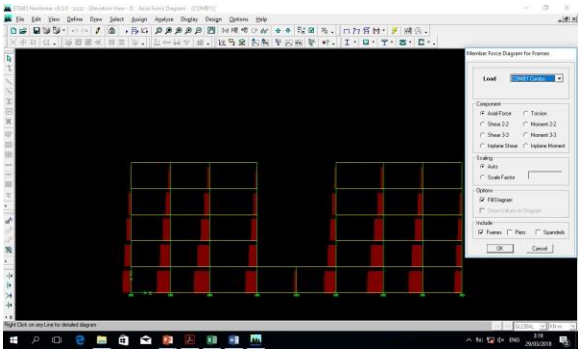

Figure 17. Normal force effect

Story of building effected to normal force, highest level story of building more than minim normal force.

IV. OUTPUT OF ETABS

a. Output Earthquake Analysis (EQx & EQy)

Self Weight each floor (output Etabs)

Group	Self-Weight (kN)
BASE	3801,73
L1	76697,02
L2	89442,09
L3	101833,01
L4	113660,85
LA	124585,54
LA+	126388,58

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

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Where :

F_X = lateral force each floor.

W_X = Self weight structure is work each floor.

1st floorFrom the calculate result, can be summary in the table, as follow :

Group	Self-Weight (kN)	Fx = 0.01*Wx (kN)
BASE	3801,73	38,02
L1	76697,02	766,97
L2	89442,09	894,42
L3	101833,01	1018,33
L4	113660,85	1136,61
LA	124585,54	1245,86
LA+	126388,58	1263,89
Total	636408,82	6364,09

b. Output Rebar Design

Output rebar area, given by Etabs are rebar require (design rebar), and then for calculate rebar used, using manual method. The following are, output longitudinal reinforcing and shear reinforcing by etabs in analysis structure the local government 2 karawang building.

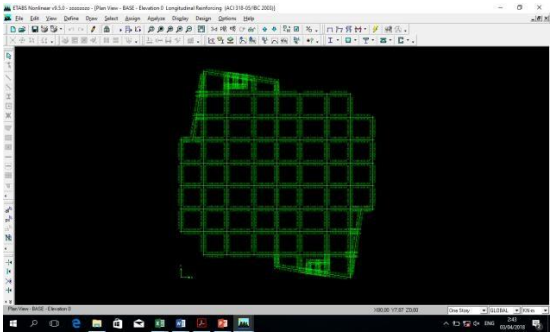


Figure 18. Base

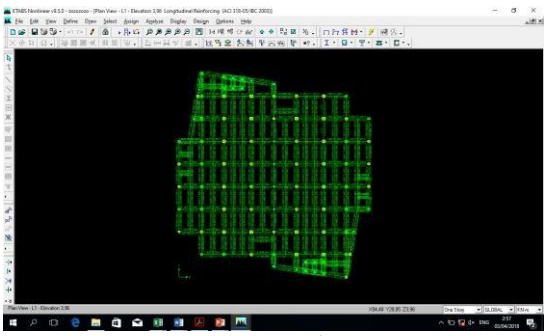


Figure 19. 1st floor

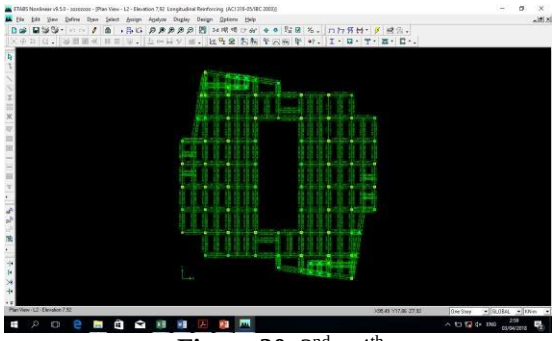


Figure 20. 2nd – 4th

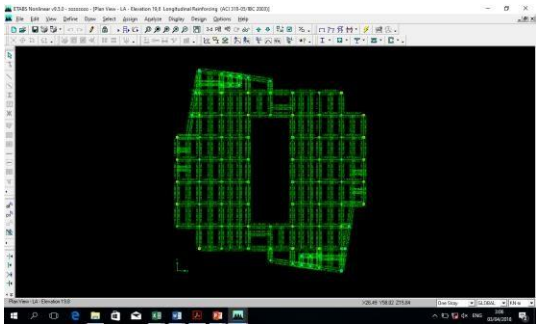


Figure 18. Dak / roof floor

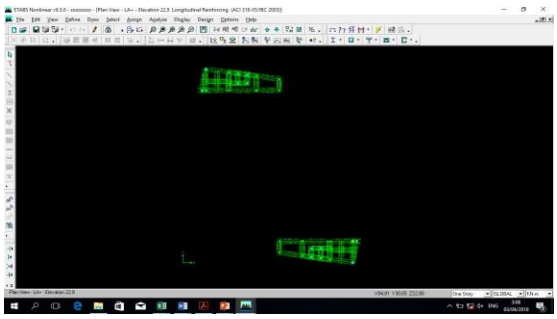


Figure 18. Dak / roof floor +1

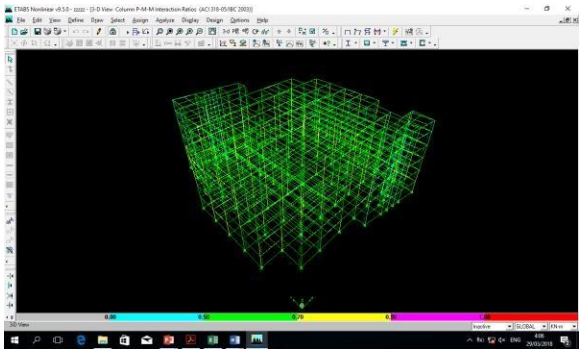


Figure 18. Column P-M-M Interaction

4.1. Result Analysis

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

FRAME		DATA PROYEK	RESULT ANALYSIS	DATA PROYEK		RESULT ANALYSIS	
		Dimensi	Dimensi	Longitudinal	Shear	Longitudinal	Shear
S1	Tump.	40X25	80X80	4D16	Ø10-10	24D19	Ø13-10
	Lap.			2D16	Ø10-20	12D19	Ø13-20
S1A	Tump.	#	90X90	-	-	37D19	Ø13-10
	Lap.			-	-	17D19	Ø13-20
SA	Tump.	30X20	50X50	3D13	Ø8-10	11D19	Ø13-10
	Lap.			3D13	Ø8-20	6D19	Ø13-20
BA	Tump.	50X25	50X25	4D16	Ø10-10	7D19	Ø13-10
	Lap.			2D16	Ø10-20	4D19	Ø13-20
B1	Tump.	60X30	60X60	7D19	Ø10-10	16D19	Ø13-10
	Lap.			4D19	Ø10-20	8D19	Ø13-20
B1A	Tump.	#	80X60	-	-	8D19	Ø13-10
	Lap.			-	-	4D19	Ø13-20
B1B	Tump.	#	80X80		-	13D19	Ø13-10
	Lap.			-	-	7D19	Ø13-20
B2	Tump.	50X30	60X50	5D19	Ø10-10	9D19	Ø13-10
	Lap.			3D19	Ø10-20	3D19	Ø13-20
B3	Tump.	50X25	50X25	5D19	Ø10-10	5D19	Ø13-10
	Lap.			2D16	Ø10-20	3D19	Ø13-20
B4	Tump.	20X30	40X30	3D13	Ø10-10	2D19	Ø13-10
	Lap.			3D13	Ø10-20	2D19	Ø13-20
B5	Tump.	25X15	30X30	2D13	Ø10-10	5D19	Ø13-10
	Lap.			2D13	Ø10-20	3D19	Ø13-20
K1		50X50	50X50	16D19	Ø10-10	16D19	Ø13-10
					Ø10-20		Ø13-20
K1.2A		#	50X50	-	-	20D19	Ø13-10
					-		Ø13-20
K1A		#	60X60	-	-	24D19	Ø13-10
					-		Ø13-20
K1B		#	70X70	-	-	24D19	Ø13-10
					-		Ø13-20
K1C		#	80X80	-	-	24D19	Ø13-10
					-		Ø13-20
K2		50X50	50X50	12D19	Ø10-10	12D19	Ø13-10
					Ø10-20		Ø13-20
K3		40X40	40X40	12D19	Ø10-10	12D19	Ø13-10
					Ø10-20		Ø13-20
K4		40X25	40X25	6D16	Ø10-10	6D16	Ø13-10
					Ø10-20		Ø13-20
K5		40X20	40X20	6D16	Ø10-10	6D16	Ø13-10
					Ø10-20		Ø13-20
K6		30X20	30X20	4D16	Ø10-10	4D16	Ø13-10
					Ø10-20		Ø13-20

The following are result for analysis structure slab :

SLAB TYPE		PROJECT DATA		ANALYSIS DATA	
		Reinforcement (mm)		Reinforcement (mm)	
Atap A	two-way	Aslx	Ø10-200	Aslx	Ø10-230
		Asly	Ø10-200	Asly	Ø10-270
		Astx	Ø10-200	Astx	Ø10-230
		Asty	Ø10-50	Asty	Ø10-60
Atap B	one-way	Asx	Ø10-200	Asx	Ø10-210
		Asy	Ø10-200	Asy	Ø10-210
Atap C	one-way	Asx	Ø10-200	Asx	Ø10-210
		Asy	Ø10-200	Asy	Ø10-210
Lantai A	two-way	Aslx	Ø10-150	Aslx	Ø10-170
		Asly	Ø10-200	Asly	Ø10-200
		Astx	Ø10-150	Astx	Ø10-170
		Asty	Ø10-50	Asty	Ø10-50
Lantai B	one-way	Asx	Ø10-150	Asx	Ø10-160
		Asy	Ø10-150	Asy	Ø10-160
Lantai C	one-way	Asy	Ø10-150	Asy	Ø10-160
Dasar A	two-way	Aslx	Ø10-150	Aslx	Ø10-170
		Asly	Ø10-150	Asly	Ø10-180
		Astx	Ø10-150	Astx	Ø10-70
		Asty	Ø10-150	Asty	Ø10-80
Dasar B	two-way	Aslx	Ø10-150	Aslx	Ø10-150
		Asly	Ø10-100	Asly	Ø10-120
		Astx	Ø10-50	Astx	Ø10-60
		Asty	Ø10-50	Asty	Ø10-40

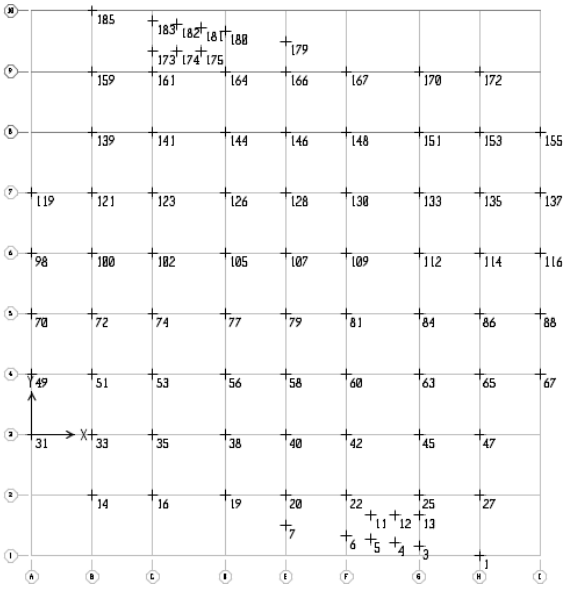
c. Check The Structure

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 "Perencanaan Struktur Gedung Beton Bertulang". The result for check deflection are as follow :

FRAME	Result Analysis of Deflection (mm)	Deflection Permission (L/480) (mm)
S1	5,278	12,500
S1A	8,004	15,000
SA	0,069	5,781
BA	10,502	12,500
B1	11,660	15,000
B1A	2,014	12,632
B1B	3,471	15,000
B2	10,323	12,500
B3	7,858	12,500
B4	0,116	5,000
B5	2,363	6,250

4.2. Foundation

In this project use foundation pile cap 25cm X 25cm, point of plot foundation :



Design of foundations :

DAYA DUKUNG PONDASI :

No.	X	Y	D	X^2	Y^2	Nn	Ny	Nx	N tot
	(m)	(m)	(cm)			(ton)	(ton)	(ton)	(ton)
1	0.700	0.350	25.00	0.490	0.123	34.80	3.604	2.270	38.40
2	0.700	(0.350)	25.00	0.490	0.123	34.80	(3.604)	2.270	37.07
3	0.000	(0.350)	25.00	0.000	0.123	34.80	(3.604)	0.000	34.80
4	(0.700)	(0.350)	25.00	0.490	0.123	34.80	(3.604)	(2.270)	32.53
5	(0.700)	0.350	25.00	0.490	0.123	34.80	3.604	(2.270)	38.40
6	0.000	0.350	25.00	0.000	0.123	34.80	3.604	0.000	38.40
				1.960	0.735				

DAYA DUKUNG TIANG PONDASI TIANG PANCANG 25x25 cm ===> 45,00 TON/PER TIANG

Total pile that use for foundations :

Data Kolom	Berat beban	Posisi	∑Tiang
AS. 9' / E	NORMAL KOLOM = 58.380 KG	JOINT NO.180	2
AS. 5 / I	NORMAL KOLOM = 120.531 KG	JOINT NO.88	3
AS. 5 / F	NORMAL KOLOM = 135.861 KG	JOINT NO.81	4
AS. 5 / H	NORMAL KOLOM = 171.341 KG	JOINT NO.86	5
AS. 5 / G	NORMAL KOLOM = 196.333 KG	JOINT NO.84	6

4.3. Budget Plan

The Budget Plan is a calculation of the amount of costs required for materials and wages, as well as other costs associated with building or project implementation. Budget cost is the price of building materials that are carefully calculated, meticulously and qualified. Budget costs in the same building will vary in each region, due to differences in material prices and labor costs.

Basically, there are 5 main functions of the Building Budget Plan :

a. Budget Plan as a settlement of the cost amount of each field of work in the process of build a building. Budget plan includes detailed costs covering the procurement of construction materials, workers wages, and other expenses such as licensing fees and infrastructures costs.
b. Budget Plan as the total determinant of material needs of building materials required. The calculation of material requirements is based of the measurement of the volume of building structures.
c. Budget Plan as the basis for the selection of labor used. Budget plan describes the construction works to be performed and the labor needed to do the work.
d. Budget Plan as a determinant of equipment used to support the smooth of construction. Budget plan also decides whether the equipment needs to be purchased or leased.

Budget Plan as monitoring of savings of development implementation activities. From budget plan also can be spending budget cost that yield profit.

Result of Budget Plan

No	Job Description	Rp.
1	Toto Excavation and Pile Up Work	220.946.280,00
2	Toto Pile Foundation Work	546.975.000,00
3	Toto Lone Concrete Work	33.387.400,00
4	Toto River Stone Foundation Work	988.794.380,00
5	Toto Reinforced Concrete Work	3.509.230.950,00
6	Toto Formwork Work	9.374.474.420,00
7	Toto Reinforced Work	3.666.082.152,00
8	Toto Steel Construction Work	194.131.191,00
ALL		18.623.691.772,00

V. CONCLUSON

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

i. In analyzing the structure with Etabs, 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.

ii. The results from analysis structure are as follows:
   1. Internal forces (moment, axial and shear) that will be used in the design phase of the structure. In the design of the structure (output Etabs) is produced rebar required by the elements (frame) structure. Than the result of this structure is safe.
   2. The result from analysis lateral force (earthquake), it can concluded the lateral force greatest is 6364,09 kN.
   3. The data project use SNI 2002 that make different load that used in this structure and under calculate again, the structure is safe.

iii. The total of budget structure is Rp.18.623.991.772,-

REFERENCES

A. The Rules of Standar Nasional Indonesia (SNI)

Departemen Pekerjaan Umum (1987). P*edoman Peraturan Pembebanan Untuk Rumah dan Gedung (PPPURG 1987).* Yayasan Lembaga Penyelidikan Masalah Bangunan , Bandung

Departemen Pekerjaan Umum (2013). *Beban Minimum Untuk Perancangan Bangunan Struktur Gedung (SNI–1727 –2013).* Yayasan Lembaga Peyelidikan Masalah Bangunan, Bandung.

Departemen Pekerjaan Umum (2013). *Persyaratan Beton Struktural Untuk Bangunan Gedung (SNI –284 –2013).* Yayasan Lembaga Peyelidikan Masalah Bangunan, Bandung.

B. BOOKS

Yusuf, 2015. *Analisis Perencanaan Gedung Aula dan Rektorat.* Universitas Swadaya Gunung Jati, Cirebon. Universitas Swadaya Gunung Jati, Cirebon.

Linda Widyastani dan Takhmid Ulya, 2010. *Perencanaan Bangunan Gedung Kuliah Diploma III Fakultas Teknik.* Universitas Diponegoro, Semarang.

Anggi Helmiyansah (2017), analyzing the structure, namely research Title Structure Analysis Of The Distric Administrations Building Of The Cirebon City goverments.

C. Internet

http://puskim.go.id/

http://purbolaras.wordpress.com

http://ilmuispil.blogspot.com