

Structural Analysis Building 5 of Aji Muhammad Parikesit Hospital Tenggarong Seberang

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Abstract— The construction of Building 5 of Aji Muhammad Parikesit Regional General Hospital in Tenggarong Seberang District, Kutai Kartanegara Regency, East Kalimantan Province, represents an effort to improve healthcare infrastructure, particularly for cancer and tumor treatment services. The three-story building employs a reinforced concrete structural system that must meet the requirements of strength, stiffness, and stability, especially against seismic loads. The research method includes collecting technical data of the building, calculating dead and live loads in accordance with SNI 1727:2020, seismic load calculation based on SNI 1726:2019, and structural analysis using SAP2000 software with reference to SNI 2847:2019. The calculated loads were modeled to obtain structural responses for P-delta effects, and internal forces of structural elements. The analysis results indicate the P-delta effects remain below the stability threshold 0,091, confirming structural stability. Furthermore, key elements including column K0, beam G1A, and slab S1 are verified to be safe in resisting axial forces, moments, shear, and torsion.

Keywords— earthquake load, SAP2000, structural analysis

I. INTRODUCTION

The increasing demand for public facilities drives the construction of high-rise buildings across various sectors, including healthcare infrastructure. These buildings have complex structural characteristics and must be designed to ensure the safety and comfort of users. Factors such as the type of materials, soil conditions, climate, and cost-effectiveness are important considerations in the planning process. Particularly in earthquake-prone areas, building structures are required to withstand dynamic loads that can significantly impact stability and the building's lifespan.

One crucial aspect in ensuring building safety is the structural analysis against various types of loads, such as dead loads, live loads, wind loads, and earthquake loads. This analysis forms the basis for determining whether a building meets strength standards and functional feasibility. Structural performance is evaluated not only from the strength of the materials but also from its ability to adapt to load characteristics and environmental conditions at the construction site.

The building of the 5th Regional General Hospital of Aji Muhammad Parikesit, located at Jalan Ratu Agung No. 01, Tenggarong Seberang District, East Kalimantan, is an example of healthcare facility development that requires structural safety assurance. This three-story building uses reinforced concrete as its main structural element and was completed in February 2025. Given its function as a cancer and tumor treatment center, the building demands a reliable structure resistant to earthquake loads according to regional classification.

To ensure the resilience and safety of the building's structure, a structural analysis was conducted using SAP2000 software, referencing national standards including SNI 2847:2019 concerning structural concrete, SNI 1726:2019 on earthquake resistance, and SNI 1727:2020 related to minimum building loads. This analysis aims to assess whether the building has met the technical requirements to be a safe and suitable structure for long-term use.

II. LITERATURE

The building structure is part of a building system that functions to transmit loads caused by the presence of the building above the ground.(Afifah Meilani et al., 2016)

A. Dead Load

According to SNI 1727-2020, dead load is the weight of all construction materials of the building that are permanently installed, including walls, floors,

roofs, ceilings, stairs, fixed partition walls, finishes, building cladding, and other architectural and structural components, as well as other installed service equipment, including the weight of cranes and material handling systems.

B. Live Load

Live load is a load that is variable and not permanent, caused by the occupants and users of the building or other structures, and does not include structural loads and environmental loads such as wind, rain, earthquake, flood, or dead load. The live load used in the design of buildings and other structures must represent the maximum expected load resulting from occupancy and usage of the building.

C. Earthquake Load

According to Himawan Indarto (in Saputra & Firmanto, 2017), earthquake loads are phenomena caused by the collision or friction of the Earth's tectonic plates occurring in fault zones.

When collisions between active tectonic plates take place, seismic energy is released in the form of energy waves that propagate either through the Earth's interior or along its surface (Hirel et al., 2018).

According to SNI 1726-2019, the magnitude of earthquake loads acting on building structures depends on several factors, namely: the mass and stiffness of the structure, the natural vibration period and damping effects of the structure, as well as the soil conditions and seismicity of the region where the structure is constructed.

D. Wind Load

According to SNI 1727-2020 wind loads on buildings are forces or pressures generated by wind interacting with the building structure. These loads represent one of the critical factors that must be considered in structural design and analysis, particularly for high-rise buildings or those located in regions with high wind speeds.

E. Displacement Analysis

Displacement refers to the relative movement or shift of points within a structure as a result of applied loads. (Zebua D, 2023)

Through displacement analysis, this study aims to understand the structural response to loads under earthquake conditions or other emergency events. A hospital building must be able to withstand such forces while maintaining safety and structural performance. Therefore, a comprehensive understanding of displacement in reinforced concrete structures is of paramount importance.

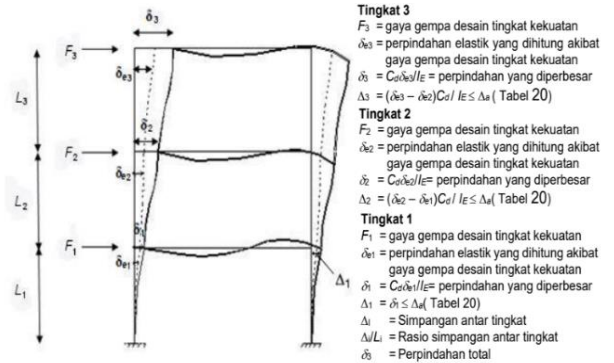


Fig 1. Inter story drift

The equation employed to determine the inter-story drift is expressed as follows.

$$\Delta = \frac{(\delta_n - \delta_{n-1}) \times C_d}{I_e} \leq \Delta_a \quad (1)$$

According to SNI 1726:2019, article 7.12.1.1, for seismic design categories D through F, the inter-story drift shall not exceed Δ_a/p at any story level, where the redundancy factor p is taken as 1.3.

In displacement analysis, additional forces besides inter-story drift must be considered to ensure that the structure remains truly safe and stable. These forces represent the additional moment effects that arise due to the combination of axial load (P) with the lateral displacement of the structure (Δ), commonly referred to as the P-delta effect. (Istiono & Ramadhan, n.d.)

$$\theta = \frac{P_x \Delta I_e}{V_x h_{sx} C_d} \quad (2)$$

The stability coefficient, θ , must not exceed θ_{max} , as defined by the following expression:

$$\theta_{max} = \frac{0.5}{\beta C_d} \leq 0.25 \quad (3)$$

F. Concrete Column

According to Ali Asroni (2010) columns function as load-bearing elements that transfer loads from beams and slabs to the subgrade through the foundation. The loads from the beams and slabs consist of axial compressive forces as well as bending moments.

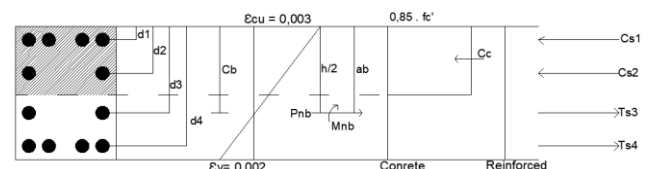


Fig 2. Column stress strain diagram

The nominal axial force is determined using the following expression.

$$P_n = 0.80 \times P_o$$

$$P_n = 0.80 \times (0.85 \times f'_c \times (A_g - A_{st}) + f_y \times A_{st}) \quad (4)$$

The nominal moment of the column is determined using the following expression.

$$M_n = A_{st} \times f_y \times (c - d') + 0,85 \times f_c' \times a \times b \times (c - 1/2a) + A_{st} \times f_y \times (d - c) \quad (5)$$

The nominal shear strength of the column is determined using the following expression.

$$V_n = V_c + V_s \quad (6)$$

G. Concrete Beam

According to Asroni (2010), a reinforced concrete beam is defined as a concrete member strengthened with reinforcement placed in both the tensile and compressive zones of its cross-section. Such reinforcement enhances the beam's flexural capacity in resisting applied loads.

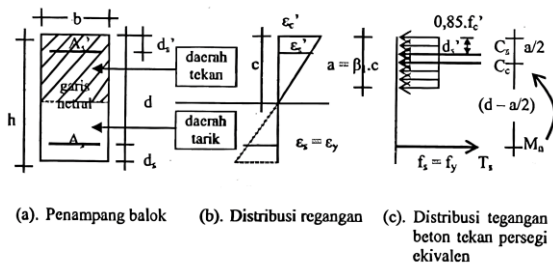


Fig 3. Beam stress strain diagram

The nominal moment of the beam is determined using the following expression.

$$M_n = A_{st} \times f_y \times (d - \frac{a}{2}) \quad (7)$$

The nominal shear strength of the beam is determined using the following expression.

$$V_n = V_c + V_s \quad (8)$$

The nominal torsion strength of the beam is determined using the following expression.

$$T_n = \frac{2A_o A_{tf} f_{yt}}{s} \cot \theta \quad (9)$$

$$T_n = \frac{2A_o A_{tf} f_y}{P_h} \cot \theta \quad (10)$$

H. Concrete Slab

The floor slab is a structural element subjected to both bending moments and shear forces. The tensile stresses resulting from flexure are resisted by steel reinforcement, while the shear forces are primarily resisted by the concrete itself. In the design of floor slabs, particular attention must be given to the slab thickness.

The nominal moment of the slab is determined using the following expression.

$$M_n = A_{st} \times f_y \times (d - \frac{a}{2}) \quad (11)$$

III. RESEACRH METHODOLOGY

A. Flowchart of Research Implementation

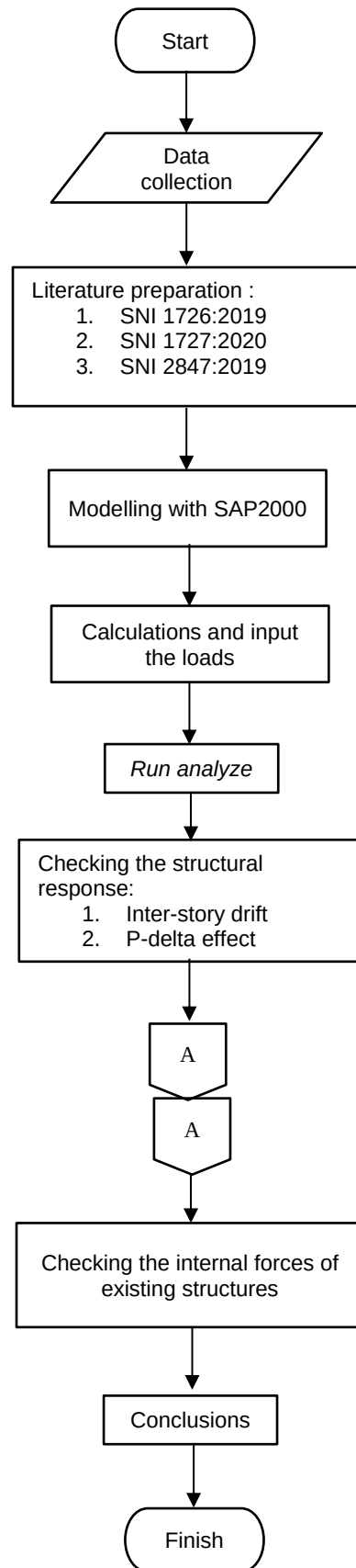


Fig 4. Research flowchart

B. Research Location

Building 5 of Aji Muhammad Parikesit General Hospital is located in Tenggarong Seberang, Kutai Kartanegara Regency, East Kalimantan Province, Indonesia.

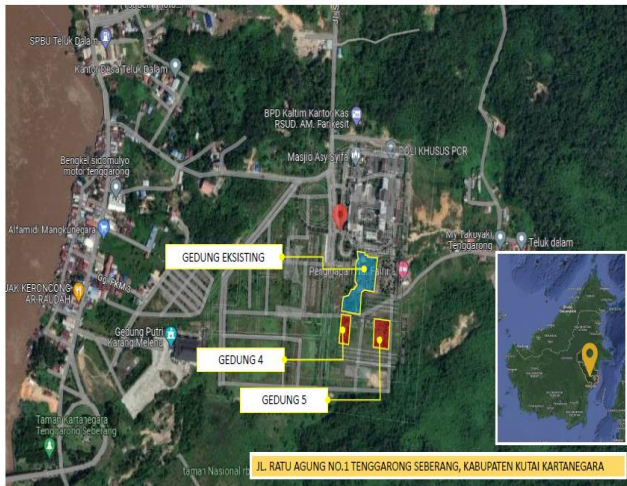


Fig 5. The research location

IV. RESULTS AND RESEARCH



Fig 6. View of building 5, Aji Muhammad Parikesit General Hospital

A. Design of Structures

The structural analysis of Building 5 at Aji Muhammad Parikesit General Hospital, Tenggarong Seberang, was carried out using material specifications based on the actual field conditions as documented in the as-built drawings.

Table 1. Summary of materials strengths of structural elements

1.	Concrete quality, f_c'	=	25 MPa
2.	Unit weight	=	2400 kg/m ³
3.	Modulus of elasticity, E_c	=	23500 MPa
4.	Reinforcement quality, f_y	=	420 MPa
5.	Shear reinforcement quality, f_{vt}	=	420 MPa
6.	Steel quality, f_y	=	BJ 37
7.	Steel modulus of elasticity, E_s	=	200000 MPa

Structural elements are generally classified into two categories: reinforced concrete elements and steel elements. The concrete elements include beams, columns, and floor slabs, while the steel

elements consist of steel profiles used in the roof truss system.

Table 2. Summary of primary beam dimensions

1.	Beam G1A	=	35 cm/70 cm
2.	Beam G1B	=	35 cm/70 cm
3.	Beam G2A	=	35 cm/60 cm
4.	Beam G2B	=	35 cm/60 cm
5.	Beam G3	=	35 cm/50 cm
6.	Beam G4A	=	35 cm/40 cm
7.	Beam G4B	=	35 cm/40 cm

Table 3. Summary of secondary beam dimensions

1.	Beam B0	=	25 cm/60 cm
2.	Beam B1	=	25 cm/50 cm
3.	Beam B2	=	25 cm/40 cm
4.	Beam B3	=	20 cm/40 cm
5.	Beam B4	=	20 cm/40 cm
6.	Beam B5	=	15 cm/40 cm
7.	Beam B6	=	15 cm/30 cm

Table 4. Summary of cantilever beam dimensions

1.	Beam GK1	=	35 cm/50 cm
2.	Beam GK2	=	35 cm/40 cm
3.	Beam BK2	=	25 cm/40 cm
4.	Beam B4+LS	=	20 cm/30 cm
5.	Beam BK1	=	25 cm/50 cm

Table 5. Summary of primary column dimensions

1.	Column K0	=	50 cm/60 cm
2.	Column K1	=	50 cm/50 cm
3.	Column K2	=	40 cm/40 cm
4.	Column K3	=	35 cm/35 cm
5.	Column K4	=	30 cm/40 cm

Table 6. Summary of slab thickness

1.	Slab S1	=	13 cm
2.	Slab S2	=	12 cm
3.	Slab S3	=	15 cm
4.	Slab SB	=	13 cm
5.	Slab SBA	=	30 cm

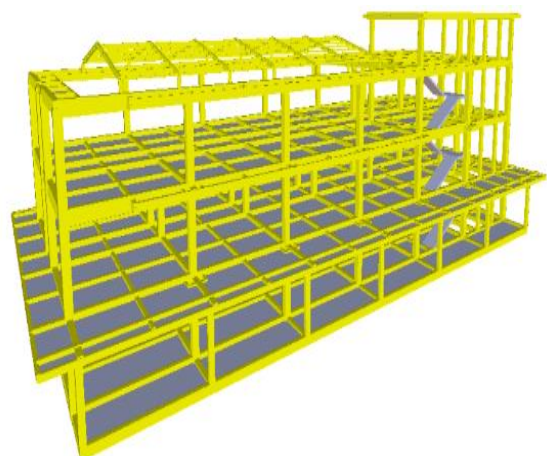


Fig 7. 3D Model of the structural system of building 5, Aji Muhammad Parikesit General Hospital

B. Input the Loads

Table 7. Summary of dead loads

1.	SDL on beam	=	324 kg/m
2.	SDL on CT scan room	=	426 kg/m
3.	SDL on cantilever beam	=	9,2 kg/m
4.	SDL on steel roof purlin	=	24,9 kg/m
5.	SDL on base floor slab	=	87 kg/m ²
6.	SDL on CT scan room slab	=	339 kg/m ²
7.	SDL on 2&3 floor slab	=	154 kg/m ²
8.	SDL on maintenance slab	=	274 kg/m ²

Table 8. Summary of live loads

1.	Balcony, lobby and corridor	=	479 kg/m ²
2.	Corridor above the base floor	=	383 kg/m ²
3.	Nurse dining room	=	479 kg/m ²
4.	Storage room	=	600 kg/m ²
5.	Patient room	=	192 kg/m ²
6.	Surgery room	=	287 kg/m ²

Table 9. Summary of wind loads

1.	Wind speed	=	71,5 mph
2.	Exposure type	=	B
3.	Topografic factor, K_{zt}	=	1
4.	Wind direction factor, K_d	=	0,85
5.	Gust effect factor	=	0,85
6.	Wall pressure coefficient, C_p	=	0,8 for windward
7.	Wall pressure coefficient, C_p	=	-0,4 untuk otherward
8.	Edge wall pressure coefficient	=	-0,7
9.	Roof pressure coefficient, C_p	=	-0,18 for windward
10.	Roof pressure coefficient, C_p	=	-0,3 for ottherward

Table 10. Summary of earthquake loads

1.	Building category	=	IV
2.	S_s	=	0,1069
3.	S_1	=	0,0912
4.	T_L	=	16 sec
5.	S_{ds}	=	0,11
6.	S_{d1}	=	0,15
7.	Sites Class	=	D
8.	Response modification coefficient, R	=	8
9.	Strong factor, Ω	=	3
10.	Deflection factor, C_d	=	5,5

Table 10. (Continue) Summary of earthquake loads

11.	Importance factor, I_e	=	1,5
12.	Coefficient, C_t	=	0,0466
13.	Coefficient, C_u	=	1,6
14.	Coefficient, x	=	0,9
15.	Minimum period, T_{min}	=	0,558 sec
16.	Maximum period, T_{max}	=	0,8928 sec

The load combinations considered in this study are as follows.

1. $1,4 D_L + 1,4 SDL$
2. $1,2 D_L + 1,2 SDL + 1,6 L_L$
3. $1,2 D_L + 1,2 SDL + 1,6 L_r + 1 L_L + 0,5 W_x + 0,5 W_y$
4. $1,2 D_L + 1,2 SDL + 1 W_x + 1 W_y + 1 L_L + 0,5 L_r$
5. $0,9 D_L + 0,9 SDL + 1 W_x + 1 W_y$
6. $1,222 D_L + 1,222 SDL + 1 L_L + 1 Spec E_x + 0,3 Spec E_y$
7. $1,222 D_L + 1,222 SDL + 1 L_L + 1 Spec E_x - 0,3 Spec E_y$
8. $1,222 D_L + 1,222 SDL + 1 L_L - 1 Spec E_x + 0,3 Spec E_y$
9. $1,222 D_L + 1,222 SDL + 1 L_L - 1 Spec E_x - 0,3 Spec E_y$
10. $1,222 D_L + 1,222 SDL + 1 L_L + 1 Spec E_y + 0,3 Spec E_x$
11. $1,222 D_L + 1,222 SDL + 1 L_L + 1 Spec E_y - 0,3 Spec E_x$
12. $1,222 D_L + 1,222 SDL + 1 L_L - 1 Spec E_y + 0,3 Spec E_x$
13. $1,222 D_L + 1,222 SDL + 1 L_L - 1 Spec E_y - 0,3 Spec E_x$
14. $0,878 D + 0,878 SDL + 1 Spec E_x + 0,3 Spec E_y$
15. $0,878 D_L + 0,878 SDL + 1 Spec E_x - 0,3 Spec E_y$
16. $0,878 D_L + 0,878 SDL - 1 Spec E_x + 0,3 Spec E_y$
17. $0,878 D_L + 0,878 SDL - 1 Spec E_x - 0,3 Spec E_y$
18. $0,878 D_L + 0,878 SDL + 1 Spec E_y + 0,3 Spec E_x$
19. $0,878 D_L + 0,878 SDL + 1 Spec E_y - 0,3 Spec E_x$
20. $0,878 D_L + 0,878 SDL - 1 Spec E_y + 0,3 Spec E_x$
21. $0,878 D_L + 0,878 SDL - 1 Spec E_y - 0,3 Spec E_x$

C. Inter Story Drift

Table 11. Displacement x and y direction

Joint	Loads	U1	U2
		mm	mm
Base floor	Spectrum Ex	0	0
Base floor	Spectrum Ey	0	0
Second floor	Spectrum Ex	3,775	0
Second floor	Spectrum Ey	0	5,352
Third floor	Spectrum Ex	10,323	0
Third floor	Spectrum Ey	0	14,621
Maintenance	Spectrum Ex	14,839	0
Maintenance	Spectrum Ey	0	24,655
Roof floor	Spectrum Ex	17,842	0
Roof floor	Spectrum Ey	0	28,274

Table 12. Inter-story drift x direction (Δ_x)

Story	hsx mm	δx mm	Δx mm	Δa mm	Check $\Delta x < \Delta a$
Roof	3450	17,842	11,011	26,538	OK
Maintenance	4200	14,839	16,559	32,308	OK
Third floor	4200	10,323	24,009	32,308	OK
Second floor	3950	3,775	13,842	30,385	OK
Base floor	0				

Table 13. Inter-story drift y direction (Δ_y)

Story	hsy mm	δy mm	Δy mm	Δa mm	Check $\Delta y < \Delta a$
Floor	3450	28,27	13,2	26,5	OK
Maintenance	4200	24,65	36,7	32,3	NOT OK
Third floor	4200	14,62	33,9	32,3	NOT OK
Second floor	3950	5,35	19,6	30,3	OK
Base floor	0				

D. P-Delta Effect

Table 14. Section cut forces for P-delta

SectionCut	OutputCase	F1	F2	F3
Text	Text	Kgf	Kgf	Kgf
Story 1	Spectrum Ex	72281,7	8578,64	1238,08
Story 1	Spectrum Ey	8347,98	73849,48	182,96
Story 1	P-Delta	-3758,03	-653,55	-2986285
Story 2	Spectrum Ex	48516,5	6571,72	2395,62
Story 2	Spectrum Ey	6145,77	56178,16	2026,64
Story 2	P-Delta	3764,31	-1341,95	1671595,8
Story 3	Spectrum Ex	26863,35	2617,64	1091,38
Story 3	Spectrum Ey	3266,13	30975,87	135,74
Story 3	P-Delta	-2190,87	-256,63	-616488,7
Story M	Spectrum Ex	3999,55	896,96	277,21
Story M	Spectrum Ey	693,49	4884,45	191,3
Story M	P-Delta	-247,82	127,85	-66188,98

Table 15. P-delta effect for x direction

Story	P	Vx	Stability Coefficient	Limit	θ_{max}	Check
	kg	kg	θ_x			
Roof	66188,98	3999,55	0,014404918	0,1	0,091	OK
Maintenance	616488,68	26863,35	0,024675706	0,1	0,091	OK
Third floor	1671595,8	48516,5	0,053715694	0,1	0,091	OK
Second floor	2986284,9	72281,7	0,039484145	0,1	0,091	OK
Base floor						

Table 16. P-delta effect for y direction

Story	P	Vy	Stability Coefficient	Limit	θ_{max}	Check
	kg	kg	θ_y			
Roof	66188,98	4884,45	0,014214759	0,1	0,091	OK
Maintenance	616488,68	30975,87	0,047547359	0,1	0,091	OK
Third floor	1671595,8	56178,16	0,065667027	0,1	0,091	OK
Second floor	2986284,9	73849,48	0,05479019	0,1	0,091	OK
Base floor						

E. Column Analysis

The column analyzed in this study is designated as Column K0, with details illustrated in the following figure.

MUTU BETON f'c(MPa)	TIPE KOLOM		KO
	TULANGAN		
25 MPA	DIMENSI		500x600
	TULANGAN		16 D19
	SENGKANG	Lo	D10-100
		1/2 HO	D10-100
	PENGIKAT	D10	
		X:4	Y:5

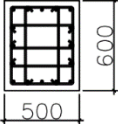


Fig 8. Column K0

The following external forces were obtained from the structural model developed in SAP2000.

Table 17. Maximum external forces of column K0

P_u	=	223111 kg	Combination 2
M_u	=	2454,18	Combination 2
V_u	=	1839,58	Combination 2

Subsequently, the internal forces in column K0 were examined to verify its safety against axial load, bending moment, and shear force.

1. The factored axial load, P_u must be less than or equal to the design axial strength, $\phi.P_n$,

$$\text{Requirements} = P_u \leq \phi.P_n$$

$$P_u = 223111,43 \text{ kg}$$

$$\phi.P_n = 0,65 \times 654826$$

$$= 425636,9 \text{ kg}$$

$$= 223111,43 \text{ kg} \leq 425636,9 \text{ kg} \rightarrow \text{OK}$$

2. The factored moment load, M_u must be less than or equal to the design axial strength, $\phi.M_n$,

$$\text{Requirements} = M_u \leq \phi.M_n$$

$$M_u = 2454,18 \text{ kg.m}$$

$$\phi.M_n = 0,65 \times 166703,55$$

$$= 108357,31 \text{ kg.m}$$

$$= 2454,18 \text{ kg.m} \leq 108357 \text{ kg.m} \rightarrow \text{OK}$$

3. The factored shear load, V_u must be less than or equal to the design axial strength, $\phi.V_n$,

$$\text{Requirements} = V_u \leq \phi.V_n$$

$$V_u = 1839,58 \text{ kg}$$

$$\phi.V_n = 0,75 \times 70814,55$$

$$= 53110,91 \text{ kg}$$

$$= 1839,58 \text{ kg} \leq 53110,91 \text{ kg} \rightarrow \text{OK}$$

F. Beam Analysis

The beam analyzed in this study is designated as beam G1A, with details illustrated in the following figure.

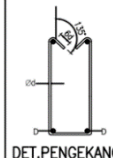
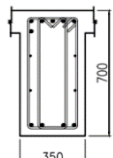
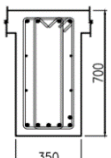
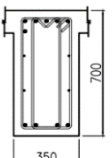
TYPE BALOK	G1A		
DIMENSI (MM)	350X700		
POSISI	TUMPUAN	LAPANGAN	TUMPUAN
			
TUL. ATAS	6 D19	4 D19	6 D19
TUL. BAWAH	4 D19	6 D19	4 D19
TUL. SENGKANG	2D10-100	2D10-150	2D10-100
TUL. PINGGANG	4D13	4D13	4D13

Fig 9. Beam G1A

The following external forces were obtained from the structural model developed in SAP2000.

Table 18. Maximum external forces of beam G1A

		End Support	Interior Support
M_u	=	15254,59 kg.m	13193,41 kg.m
V_u	=	9300,81 kg	7112,01 kg
T_u	=	1180,79 kg.m	1180,79 kg.m

Subsequently, the internal forces in beam G1A were examined to verify its safety against bending moment, shear force, and torsion.

1. The factored moment load, M_u must be less than or equal to the design axial strength, $\phi.M_n$,

Ends support :

Requirements = $M_u \leq \phi.M_n$

$M_u = 15254,59 \text{ kg.m}$

$\phi.M_n = 0,90 \times 42304,5$

$= 38074,05 \text{ kg.m}$

$= 15254,59 \text{ kg.m} \leq 38074 \text{ kg.m} \rightarrow \text{OK}$

Interior support :

Requirements = $M_u \leq \phi.M_n$

$M_u = 13193,41 \text{ kg.m}$

$\phi.M_n = 0,90 \times 42304,5$

$= 38074,05 \text{ kg.m}$

$= 13193,41 \text{ kg.m} \leq 38074 \text{ kg.m} \rightarrow \text{OK}$

2. The factored shear load, V_u must be less than or equal to the design axial strength, $\phi.V_n$,

End support :

Requirements = $V_u \leq \phi.V_n$

$V_u = 9300,81 \text{ kg}$

$\phi.V_n = 0,75 \times 61289,45$

$= 45967,09 \text{ kg}$

$= 9300,81 \text{ kg} \leq 45967,09 \text{ kg} \rightarrow \text{OK}$

Interior support :

Requirements = $V_u \leq \phi.V_n$

$V_u = 7112,01 \text{ kg}$

$\phi.V_n = 0,75 \times 47211,26$

$= 35408,45 \text{ kg}$

$= 7112,01 \text{ kg} \leq 35408,45 \text{ kg} \rightarrow \text{OK}$

3. The factored torsion load, T_u must be less than or equal to the design axial strength, $\phi.T_n$,

Requirements = $T_u \leq \phi.T_n$

$T_u = 1180,79 \text{ kg.m}$

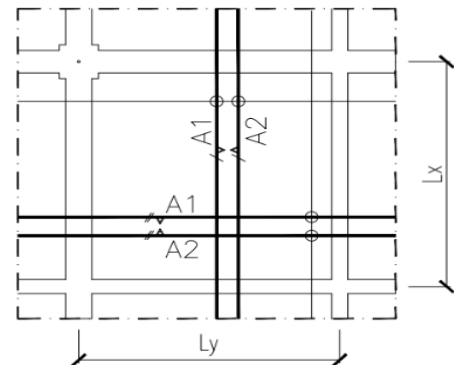
$\phi.T_n = 0,75 \times 3559,10$

$= 2669,33 \text{ kg.m}$

$= 1180,79 \text{ kg.m} \leq 2669,3 \text{ kg.m} \rightarrow \text{OK}$

G. Slab Analysis

The slab analyzed in this study is designated as slab type S1, with details illustrated in the following figure.



A1 = D10-150

A2 = D10-150

DETAIL S1 T=13 cm

Fig 10. Slab type S1

The following external forces were obtained from the structural model developed in SAP2000.

Table 19. Maximum external forces of slab S1

M_{11} , untuk arah x	=	1582,75 kg.m	Comb2
M_{22} , untuk arah y	=	1301,81 kg.m	Comb2

Subsequently, the internal forces in slab S1 were examined to verify its safety against bending moment.

1. M_{11} , The factored moment load, M_u must be less than or equal to the design axial strength, $\phi.M_n$,

Requirements = $M_u \leq \phi.M_n$

$M_u = 1582,75 \text{ kg.m}$

$\phi.M_n = 0,90 \times 1977,42$

$= 1779,68 \text{ kg.m}$

$= 1582,75 \text{ kg.m} \leq 1779 \text{ kg.m} \rightarrow \text{OK}$

2. M_{22} , The factored moment load, M_u must be less than or equal to the design axial strength, $\phi.M_n$,

Requirements = $M_u \leq \phi.M_n$

$M_u = 1301,81 \text{ kg.m}$

$\phi.M_n = 0,90 \times 1757,33$

$= 1581,60 \text{ kg.m}$

$= 1301,81 \text{ kg.m} \leq 1581 \text{ kg.m} \rightarrow \text{OK}$

H. Conclusions

Based on the structural analysis of Building 5 at Aji Muhammad Parikesit General Hospital, Tenggaraong Seberang, the following key findings were obtained :

1. Structural Loading

- Superimposed Dead Load (SDL): The SDL varied depending on the structural element, ranging from 9.2–426 kg/m for beams and 4–339 kg/m² for floor slabs.
- Live Load (LL): The maximum live load was recorded in the storage area at 600 kg/m², while the patient rooms carried 192 kg/m².
- Wind Load (WL): Calculated using the Main Wind Force Resisting System procedure in accordance with SNI 1727:2020, Clause 27.

- Earthquake Load (EL): Analyzed using the response spectrum method based on SNI 1726:2019.
2. Structural Performance under Earthquake Loading
- P-Delta Effect Control: The maximum stability coefficient was 0.0656 with a maximum P-Delta of 0.091, indicating that the structure is stable and safe against P-Delta effects.
3. Structural Element Design (in accordance with SNI 2847:2019)
- Column K0: Satisfied the axial, flexural, and shear capacity requirements and was therefore deemed safe.
 - Beam G1A: The nominal capacities in bending, shear, and torsion exceeded the ultimate demands, thus ensuring safety.
 - Floor Slab S1: The nominal flexural capacities in both the x and y directions were greater than the ultimate demands, indicating safety.

The structural system of Building 5 at Aji Muhammad Parikesit General Hospital satisfies the safety and performance requirements of the applicable SNI codes, with adequate resistance against dead, live, wind, and earthquake loads.

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