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Analysis Of The Calculation Of The Building Structure Of The Two-Story Mortuary Initiation Building Of Ngudi Waluyo Hospital With Sni 1726 Of 2019 And The Sap2000 Application

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Abstract
Indonesia is a country vulnerable to earthquakes, including the Blitar district located in zone 3. In the world of civil engineering, various types of building structures such as moment carrier frames and slider carrier frameworks are designed to meet different needs. Concrete structures, rigid frames, and wall frames are important components in building design. The Indonesian National Standard 1726 of 2019 sets out the methodology of earthquake resilience planning. Through quantitative research with the help of SAP2000, the structural analysis of RSUD Ngudi Waluyo's body recovery building showed sufficient strength and stability of the building in the face of earthquake loads.

Keywords: SAP2000, SNI 1726, Structure Analysis.

1. INTRODUCTION

The burden of life is a great burden and its position can change. Including this load is human weight, furniture that is moved, vehicles, and other loads of goods that often move places, thus resulting in changes in the load of the floor and roof. Especially on the roof, the living load can include loads that come from rainwater, both due to inundation and due to the pressure of falling water droplets. The depth of live load excludes wind loads, earthquake loads, and special loads.

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The definition of living load according to article 4.1 of SNI 1727 of 2020 is the load caused by the users and occupants of the building or other structures that do not include construction load and environmental load [1].

Standar Nasional Indonesia 1726 tahun 2019 berisi tentang tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non-gedung. Standar ini digunakan penulis untuk mengetahui kekuatan struktur pada bangunan gedung pemulasaraan jenazah RSUD Ngudi Waluyo. Untuk kategori resiko gedung pemulasaraan jenazah RSUD Ngudi Waluyo menurut SNI 1726 tahun an gempa 1,50. Ketahanan gempa untuk struktur bangunan gedung dan non-gedung, struktur gedung Rumah Sakit harus memiliki kekuatan 1,50 kali lebih tinggi dibandingkan gedung-gedung lainnya. Hal ini dikarenakan rumah sakit harus tetap berdiri setelah mengalami kondisi extreme dan gedung hanya boleh mengalami kerusakan tanpa mengalami keruntuhan [2].

The building of the funeral home of Ngudi Waluyo Hospital, Wlingi District, Blitar Regency is one of the supporting buildings for facilities to take care of the body before it is delivered to the family. This building was built to meet community services, therefore in the construction of this hospital a safe and strong building structure is needed so that comfort and convenience in providing services for everyone. The building for the commencement of the funeral of the Ngudi Waluyo Wlingi Hospital is a 2-storey building with a building structure consisting of a pilecap foundation, columns, beams, plates and a light steel roof frame. All foundation structures, sloofs, columns, beams, floor plates and roofs in the construction of the funeral building of the Ngudi Waluyo Wlingi Hospital have not been analyzed. Thus, the author will analyze the calculation of the funeral building of the Ngudi Waluyo Hospital referring to SNI 1726:2019 on how to plan earthquake resistance for the structure of the building and No-building using SAP2000 software.

2. LITERATURE REVIEW

Structural Load

Load refers to the external force applied to a structure. Determining exactly the magnitude of the load that will affect the structure over its service life is a complex and often challenging task. In addition, the determination of the amount of load can usually only be done through estimates. After estimating the load that will work at a specific location within the structure, the next step is to identify the most influential combination of loads that may affect the structure (Setiawan, 2008).

Dead Load

Dead load is a gravitational load derived from the weight of all the permanent components of a building during its lifetime. This includes the weight of the structure, piping system, electrical network, floor covering, ceiling, as well as additional elements and permanently installed machinery. The dead load for reinforced concrete according to PPIUG 1983 is 2400 kg/m2.

Living Load

Living load is included in the category of gravitational load, which is the load that arises from the use of a building during its lifetime. This type of load includes loads from people, movable equipment, motor vehicles, and other goods or objects that do not have a fixed position. Due to the magnitude and variety of live load locations, determining

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this load appropriately becomes a fairly complicated task. The living load of a building for a school or dormitory floor is 250 kg/m2.

Earthquake Load
Earthquake load is a horizontal load on the structure generated by ground movement due to an earthquake, both in the vertical and horizontal directions. In some situations, the impact of an earthquake in the vertical direction can be more significant than the impact in the horizontal direction (Setiawan, 2016).

Load Combination
Combination of Loading according to SNI 2847-2019 concerning Structural Concrete Requirements for Buildings Buildings are in equations (1) and (2):

$$U = 1{,}4D \quad (1)$$
$$U = 1{,}2D + 1{,}0E + 1{,}0L \quad (2)$$

Dimana :
U = Necessary Strength
D = Dead Load
E = Earthquake Load
L = Live Load

3. METHODS

This study uses a quantitative solution method by collecting and analyzing data from various sources that can be seen from the research steps, starting from determining the formulation of the problem, collecting data, analyzing data to the stage of determining conclusions and suggestions.

a. Data Collection The data used in this study are as follows:

1. Primary data is obtained directly from the source or in the form of interviews regarding more detailed information on the project.
2. Secondary Data, which is the power obtained from related agencies which includes working drawings, location maps, material quality data and also journals.

b. Research Stages

1. Primary data collection as well as secondary data
2. Modeling on the Structural Analysis Professional 2024 Robot application and providing loading
3. Structure analysis to obtain efficient dimensions of structural elements
4. Provide conclusions from the structural analysis using the SAP 2000 application.

4. RESULTS

The results of the research that have been carried out by the author are located at the Ngudi Waluyo Hospital Mortuary Building, Jl. Dokter Sucipto No.5, Beru, Wlingi District, Blitar Regency, East Java 66184. Here is a map of the research location shown in Figure 2 below.

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Figure 1. Research Location

The collection of data and information related to the Ngudi Waluyo Wlingi Hospital Mortuary Building, which is secondary and primary, was carried out carefully and obtained data in the form of As Built Drawings used in 3D structural modeling and analyzed with the help of SAP2000 software.
The data used in structural modeling are as follows:
1. The quality of concrete blocks, columns and plates is 19.5 Mpa
2. The quality of the bending reinforcement material is 420 Mpa
3. The quality of the sliding reinforcement material is 240 Mpa
The dimensions defined in SAP2000 software are as follows:

Table 1. Structure data

No	Tipe Struktur	Dimensi (mm)
1	Balok (B1)	300 x 500
2	Balok (B2)	250 x 500
3	Balok (B3)	200 x 300
4	Balok (B4)	150 x 300
5	Balok (B5)	100 x 200
6	Sloof (S1)	200 x 300
7	Sloof (S2)	150 x 250
8	Kolom (K1)	400 x 400
9	Kolom (K2)	200 x 200
10	Kolom (Kp)	100 x 150
11	Plat (Lantai)	150
12	Plat (Ramp)	120

Seismic data The seismic data on the location of the building obtained by the author from RSA PUSKIM based on SNI 1726 is as follows:

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1. Building location: Blitar Regency
2. Construction service function: Hospital
3. Soil type: Soft Soil (SE)
4. Building structure system: SRPMM

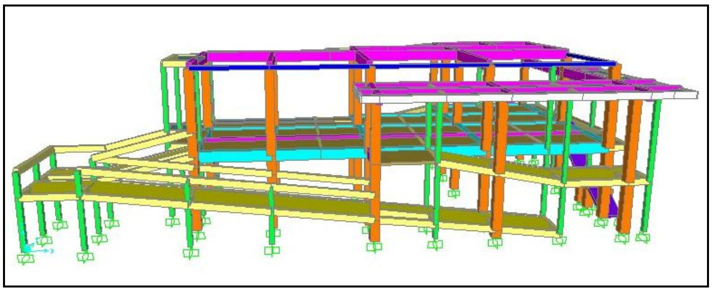

Figure 2. Building Structure Analysis

Building Structure Analysis In analyzing this structure, there are several weightings used as follows:

1. The loads acting on the structure only include dead loads, live loads, and earthquake loads.
2. The weight itself of the structural components such as beams, columns, plates is calculated by SAP2000 software.
3. The structure analyzed is a reinforced concrete structure.
4. The load of the plates calculated and entered in SAP2000 software are the ceiling load, mechanical electrical plumbing (MEP), and live load according to the function of each building.
5. The load on the beam calculated and entered in the SAP2000 software is the dead load due to the weight of the wall according to the position of the wall on the plan. Based on the results of the calculation of the structure using SAP2000 software using the definition above, the moment in the structure is obtained.

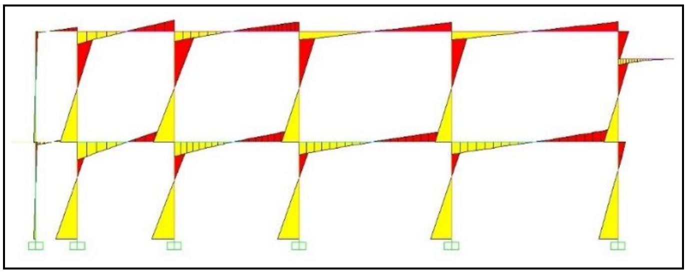

Figure 3. the distribution of the Z-direction bending moment

The image above shows the distribution of the Z-direction bending moment on the building structure based on SAP2000 software

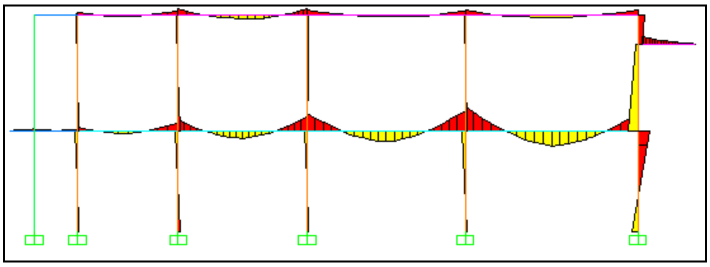

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Figure 4. the distribution of the Y-direction bending moment

The image above shows the distribution of the bending moment in the Y direction of the building structure based on SAP2000 software.

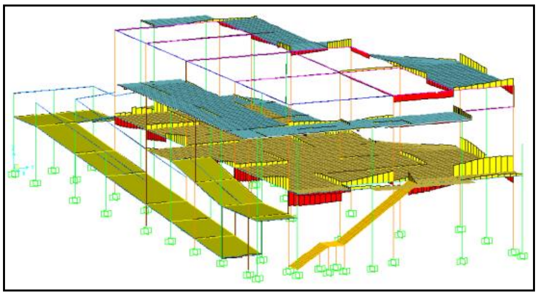

Figure 4 the calculation results of the SAP2000

The image above shows the calculation results of the SAP2000 in the form of a torque diagram working due to live load, dead load, earthquake load and wind load

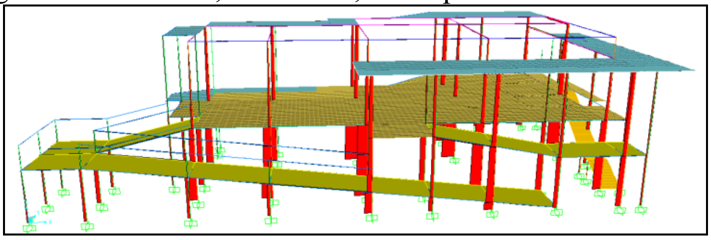

Figure 5 the calculation results of the SAP2000

The figure above shows the calculation results of the SAP2000 in the form of an axial diagram that works due to live load, dead load, earthquake load and wind load.

After conducting the analysis using SAP2000, the results of the inner force moment were obtained as follows:

Table 2 the results of the inner force moment

No	Struktur	Gaya	Nilai Momen (Kn/m)
1	Balok (B1)	Tumpuan (-)	-129,4792
		Tumpuan (+)	109,4373
		Lapangan (-)	-113,831
		Lapangan (+)	114,3653
		Vu Tumpuan	130,405
		Vu Lapangan	107,896
2	Balok (B2)	Tumpuan (-)	-60,8106
		Tumpuan (+)	34,8989
		Lapangan (-)	-60,1095
		Lapangan (+)	39,1559
		Vu Tumpuan	58,585
		Vu Lapangan	55,914
3	Balok (B3)	Tumpuan (-)	-22,75
		Tumpuan (+)	15,1107
		Lapangan (-)	-26,2854
		Lapangan (+)	15,177
		Vu Tumpuan	33,278

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		Vu Lapangan	29,221
4	Balok (B4)	Tumpuan (-)	-10,5566
		Tumpuan (+)	7,7705
		Lapangan (-)	-16,6718
		Lapangan (+)	8,0978
		Vu Tumpuan	-28,489
		Vu Lapangan	18,975
5	Balok (B5)	Tumpuan (-)	-5,2895
		Tumpuan (+)	2,4413
		Lapangan (-)	-4,5778
		Lapangan (+)	2,7895
		Vu Tumpuan	-6,428
		Vu Lapangan	9,717
6	Kolom	P max	-11,955
		P min	22,982
		M2 Max	93,227
		M2 Min	-50,756
		M3 Max	6,055
		M3 Min	-9,293
7	Plat Lantai	M22 Max	4.3992
		M22 Min	-9.032
		M11 Max	7.0906
		M11 Min	-15.0158
		Vu	6,055
8	Plat Ramp	M22 Max	0.6265
		M22 Min	-1.4905
		M11 Max	0.9172
		M11 Min	-3.9402
		Vu	2.25

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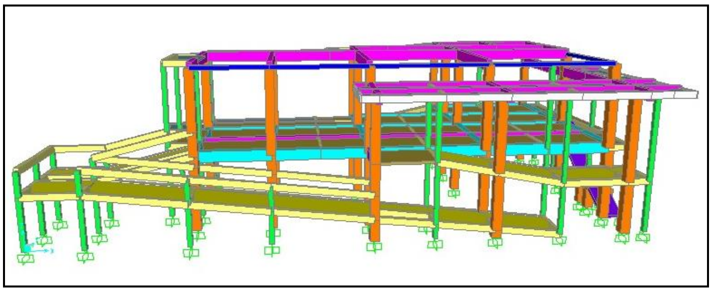

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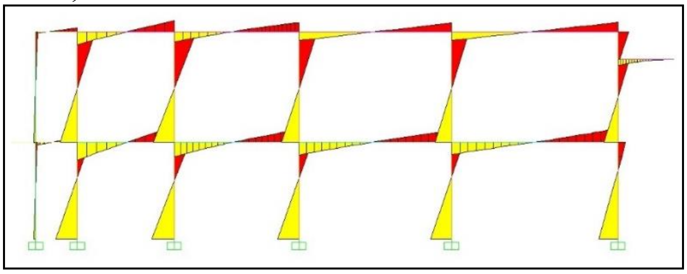

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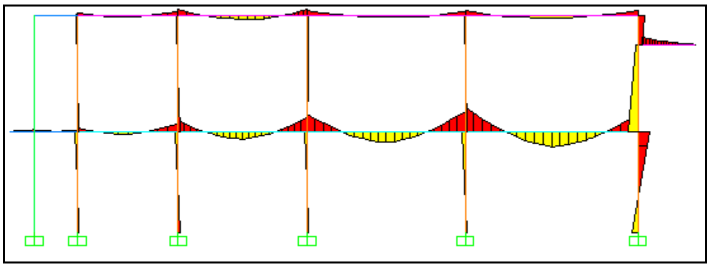

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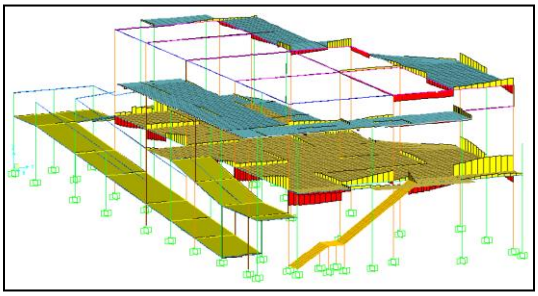

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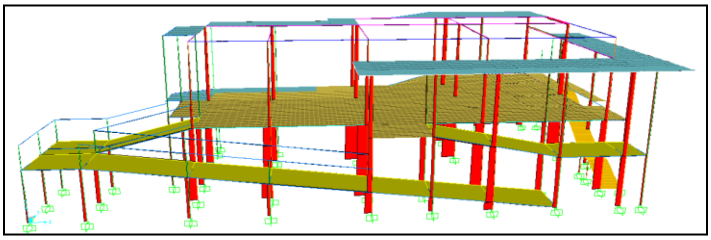

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		M2 Max	93,227

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		M2 Min	-50,756
		M3 Max	6,055
		M3 Min	-9,293
7	Plat Lantai	M22 Max	4.3992
		M22 Min	-9.032
		M11 Max	7.0906
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		M22 Min	-1.4905
		M11 Max	0.9172
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5. DISCUSSION

The output results of the SAP2000 for the Ngudi Waluyo Wlingi Hospital Mortuary Initiation Building provide an analysis of the strength and stability of the building, including bending moments, axial forces, shear forces, and torque in structural elements. The bending moment in the Y and Z directions shows how the vertical and horizontal loads affect the structural elements, while the axial force analysis shows the tensile and compressive forces to ensure that the elements are not excessively deformed. The shear force output indicates the distribution of lateral loads and critical points that require additional reinforcement, while the torque moment assesses the potential for rotation of the element due to load. Overall, these results help ensure the design of buildings is safe, stable, and efficient by identifying and correcting weak points in the structure.

Based on the results of the analysis that has been carried out on the structure of the Ngudi Waluyo Wlingi Blitar Hospital Mortuary Funeral Building using a combination of earthquake burdens in accordance with SNI 1726 of 2019 concerning Procedures for Earthquake Resilience Planning for Buildings and Non-Buildings with SAP2000 application, it was found that the structure of the Ngudi Waluyo Wlingi Blitar Hospital Mortuary Funeral Home is strong enough to withstand the burden of the earthquake that occurred.

From the results of the analysis using the SAP2000 application, then checks the inner forces that occurred, so that it was found that there were several differences in the form of repetition of the structure of columns, beams, and plates. The results of this research are expected to be a reference in evaluating or analyzing the structure of buildings, especially in critical buildings such as hospitals, offices, houses of worship, and so on.

6. CONCLUSION

Based on the analysis and discussion obtained in this study, several conclusions can be drawn as follows:

The results of the analysis of reinforced concrete structures using SAP2000 application show the distribution of forces and moments in the structure of the Ngudi Waluyo Hospital Mortuary Building. Axial forces are tensile or compressive forces that act

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parallel to the axis of the structural elements. The shear moment in the Y direction is generated from an external load that works perpendicular and parallel to the main axis of the structure and produces a moment at the largest column of 43.937 Kn/m, on the beam it produces a moment of 109.4373 Kn/m, on the floor plate it produces a moment of 7.4854 Kn/m, and on the ramp plate it produces a moment of 1.8989 Kn/m.
Based on the structural analysis carried out with the help of SAP2000 application, it was found that the structure of the Ngudi Waluyo Wlingi Blitar Hospital Mortuary Commencement Building has met the structural reinforcement by withstanding the required loads.

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