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Structure Design Evaluation of Muhammadiyah Banjarmasin University Convention Centre Building Due to Functional Change Based on SNI 03-2847-2019

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Abstract
The Muhammadiyah Banjarmasin University Convention Centre Building was originally built as a guesthouse, over time it changed its function to become a place for lecture activities. Therefore, an evaluation of the initial structural design is carried out on the reliability of the building structure as regulated in Government Regulations in Permen PU No. 25 of 2007 concerning Certificate of Building Functioning or SLF. The data used in this study are primary and secondary data, where primary data is in the form of field tests to determine the uniformity of concrete quality, namely the bounce test using the Hammer Test tool on the beams and columns of the 1st floor and 2nd floor as many as 10 points, while secondary data uses preliminary planning data. Modeling is done in 3D using SAP2000 software. The results of research on the value of uniformity of concrete quality show mixed results, this is due to several factors, one of which is different casting methods in the field. Meanwhile, from the results of the analysis of the service ability of the building structure, the value of the Ultimate Moment (*Mu*) and Ultimate Load (*Pu*) as well as the Maximum Ultimate Moment (*Mr*) and Maximum Ultimate Load (*Pr*) is still able to withstand the loads acting on the structure even though it has changed its function based on SNI 03-2847-2019.

INTRODUCTION

The change of building function is an activity to change the loading on an old building according to the loading function of the new building used so that in this case an analysis of the structural strength of the building is needed, if the beam and column structure carries a load that exceeds its ability or is not in accordance with planning, it will experience local buckling and result in cracks or fractures in the structure. Building conversion is carried out to meet the functional needs of infrastructure as long as the building is still efficient to withstand the working load rather than building a new building. Building conversion can be an appropriate alternative. According to Nurhaliza (2021), structural analysis is a science that serves to determine the effect of loads on physical structures and their components. The results of structural analysis are used to see the strength of structures that will or have been built.

Nurhaliza, Nuklirullah, and Bahar (2021) conduct research with the title "Analysis of the structure of beams and floor plates due to the change of building function (case study: Rectorate Building, Jambi University)" resulting in loading that occurs on beams and floor plates due to the change of building function that occurs in the rectorate building of Jambi University that can withstand new loads as a library, with analysis using manual calculations and ETABS software.

Building has a very important function for human life, especially to carry out daily activities so that the building needs to be maintained so that the building is able to stand firmly for a long period of time. The Muhammadiyah Banjarmasin University Convention Centre building stands for about three years and has changed its function which was originally planned as a guesthouse on the first floor and a hall on the second floor that turned into a place of teaching and learning activities for students and staff of the Faculty of Engineering, University of Muhammadiyah Banjarmasin on the first floor and remains a hall on the second floor. According to Musyafa (2018), building must include requirements; safety, health, comfort and ease. To fulfill the criteria in the

building reliability rules, the government issued a regulation regarding the Certificate of Building Functioning or SLF. Therefore, this research was conducted to determine the service condition of the Muhammadiyah Banjarmasin University Convention Centre building due to changes in the function of the building with the title " Structure Design Evaluation of Muhammadiyah Banjarmasin University Convention Centre Building Due to Functional Change Based on SNI 03-2847-2019".

RESEARCH METHOD

Location and Time of Research

This research In this research activity, a review of the dimensions of structural components was carried out directly in the field, taking several documents such as plan drawings and initial structural data and conducting rebound tests to determine the uniformity of concrete quality using hammer tests to obtain concrete quality at the Muhammadiyah Banjarmasin University Convention Centre Building, Main Campus of Muhammadiyah University Banjarmasin located on Jl. Gubernur Syarkawi, Handil Bakti, Kab.Barito Kuala, Provinsi. South Kalimantan.

Research Equipment

The equipment used to support the smooth implementation of research at the Muhammadiyah Banjarmasin University Convention Centre Building is as follows: Hammer test type HT225 is useful for testing concrete quality samples. Meter, used to measure the dimensions of the Muhammadiyah Banjarmasin University Convention Centre Building.

Methods

The research method used is the case study method (Evaluation). This method includes knowing the reactions that occur due to changes in the function of the building on the working load and can be done to analyse the strength of the building structure, especially on beams and columns in buildings that have been converted into lecture halls. The analysis process is in the form of remaking using the existing model in the initial plan drawing and conditions using SAP2000 student Version software. The stages in analysing the strength of the building structure consist of 4 stages which can be detailed as follows:

Data checking and collection stage

In the form of stages of collecting and checking data related to the implementation of research to analyse the structure of the Muhammadiyah Banjarmasin University Convention Centre Building that has changed its function.

Input Stage

This stage is a stage that explains the dimensions and specifications of structural elements, determining the working loads and 3D modelling using SAP2000 student Version Software.

Analysis Stage

The analysis stage is a continuation of the second stage carried out using SAP2000 student version software. Entering the calculation of forces in beam and column structural elements and combinations of working loadings. This analysis stage will get the Ultimate Load (Pu) and Ultimate Moment (Mu) values.

Output Stage

This last stage discusses the results of the forces in the structural elements that occur. At this stage the results of the analysis will be reviewed to see if it meets the requirements of the reduced nominal moment greater than the ultimate moment ($Mr \geq Mu$) and nominal ultimate load greater than the ultimate ultimate load ($Pr \geq Pu$). This review is used to see the strength of the structural elements in service condition for resisting the loading that works due to the change in building function.

RESULTS AND DISCUSSION

Rebound Test Results using the Hammer Test

The hammer test was carried out on the columns and beams of the 1st floor, and the 2nd floor. The sampling points for the uniformity of concrete quality on the beams and columns of the 1st and 2nd floors of the Muhammadiyah Banjarmasin University Convention Centre Building can be seen in figure 1.

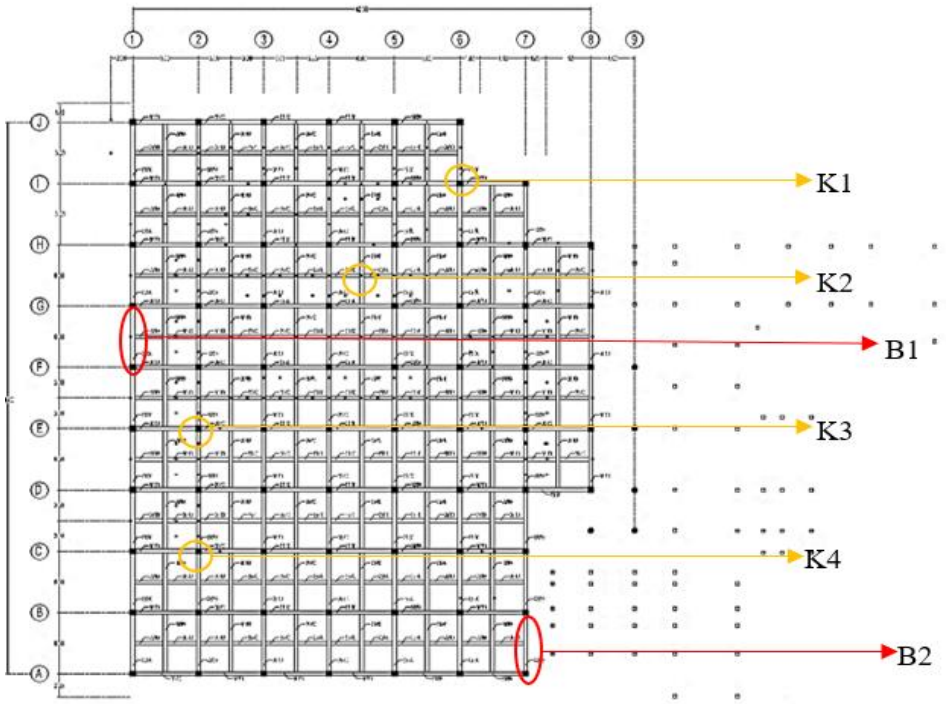

Figure 1. Plan for taking the uniformity of concrete quality in beams and columns on Floor 1 of the UMBCC building

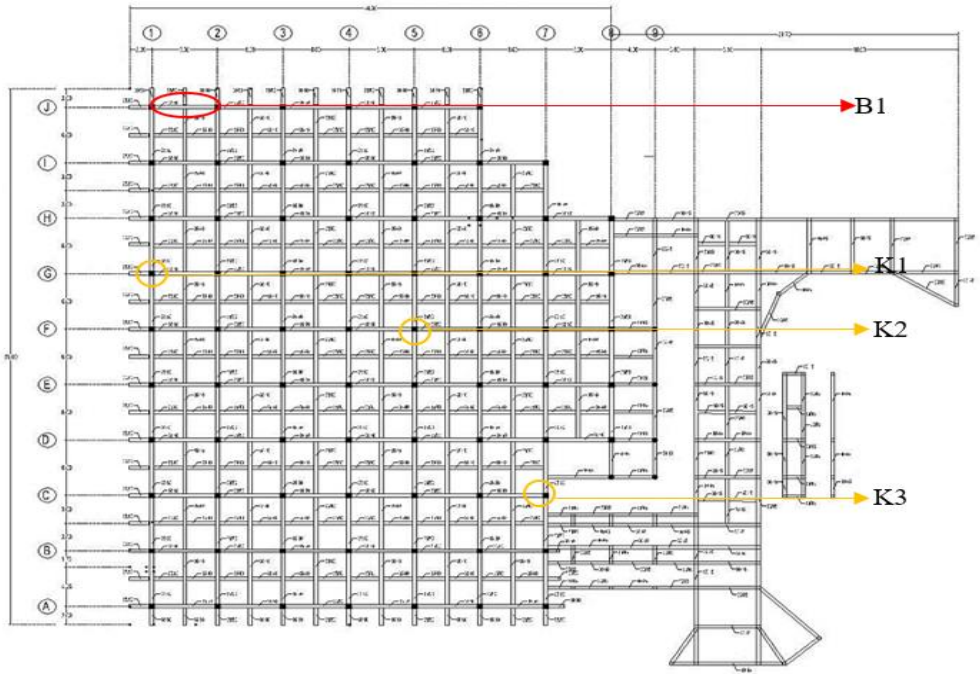

Figure 2. Plan for taking the uniformity of concrete quality in beams and columns on Floor 2 of the UMBCC building

Table 1. Hammer Test Results

No	Structure Elements	Concrete Strenght (R)	(Mpa)
1	1st Floor Column		
	a. K1	46,20	45,16
	b. K2	35,50	28,76
	c. K3	34,70	25,66
	d. K4	37,40	28,85
2	2nd Floor Column		
	a.K5	46,00	47,99
	b. K6	44,00	40,95
	c. K7	45,00	43,33
3	1st Floor Beams		
	a. B1	50,00	47,82
	b. B2	42,00	43,08
4	2nd Floor Beams		
	a. B3	44,40	42,02
	Average	42,48	39,36

In table 1, the test results of the uniformity value of the beam and column concrete quality on the 1st and 2nd floors of the Muhammadiyah Banjarmasin University Convention Centre Building get an average of 39.36 MPa so that it has reached the planning concrete quality value of 25 MPa, so in this research the modeling uses the planning concrete quality to calculate the safety factor. From the test results it can also be seen that the concrete quality obtained at several points is relatively different, the cause of the non-uniformity of the concrete quality is because the casting process in the field uses two methods, namely manually and using a concrete pump machine.

Loading Assignment

The loading data used for the calculation of the reliability of the Muhammadiyah Banjarmasin University Convention Centre Building which will be converted into a lecture hall for the Engineering Faculty of Muhammadiyah Banjarmasin University uses live loads based on the function of the building in accordance with SNI 1727-2020.

Table 2. Live Loads

Live Load 1st – 2nd Floor		**Wu (kN/m^2)**
1	Building function as an educational facility	220
Total		220
Live Load 3rd Floor		**Wu (kN/m^2)**
1	Water tank load	15
Total		15
Rooftop Load		**Wu (Kg/m^2)**
1.	Rainfall Load	100
Total		100

The self-weight of the structure has been assumed in the SAP2000 student version software as self-weight. Additional dead load according to PPIUG 1983.

Table 3. Additional Dead Load

Additional Dead Load 1st Floor		**Height (m)**	**Specific Weight (kg/m³)**	**Wu (Kg/m²)**
1.	Species Weight	0,03	2100	63
2.	Ceramic Weight	0,01	2400	24
3.	Mechanical Electrical and Plumbing			40
Total				127
Additional Dead Load 2nd – 3rd Floor		**Height (m)**	**Specific Weight (kg/m³)**	**Wu (kg/m²)**
1.	Species Weight	0,03	2100	63
2.	Ceramic Weight	0,01	2400	24
3.	Ceiling and frame			20
4.	Mechanical Electrical and Plumbing			40
Total				147
Rooftop Dead Load		**Height (m)**	**Specific Weight (kg/m³)**	**Wu (kg/m²)**
1.	Light Steel		15	15
2.	Asbes		10	10
Total				25
Wall Deadweight		**Length (m)**	**Specific Weight (kg/m³)**	**Wu (kg/m²)**
1.	1st floor brick wall	6	300	1800
2.	2nd floor brick wall	6	300	1800
3.	3rd floor brick wall	6	300	1800

Wind load calculation using SNI 03-1727-2013, the value of the wind load can be seen in Table 4 and Table 5.

Table 4. Wind load away

Pressure on the Side Wall Wind Away*	
qh (N/m²)	P (N/m²)
696,72	-303,07

Table 5. Wind load side

Side Pressure Edge Wind Wall*	
qh (N/m²)	P (N/m²)
696,72	-539,96

For earthquake loading using the RSA PSGeN website, DBTPP, Directorate General of Human Settlements, Ministry of PUPR to get the response spectrum in the Handil area with longitude (Longitude) 103.8749 Degrees and Latitude (Latitude) -4.0549 Degrees is included in the SE - Soft Soil situ class, the spectrum response graph itself can be seen in Figure 3.

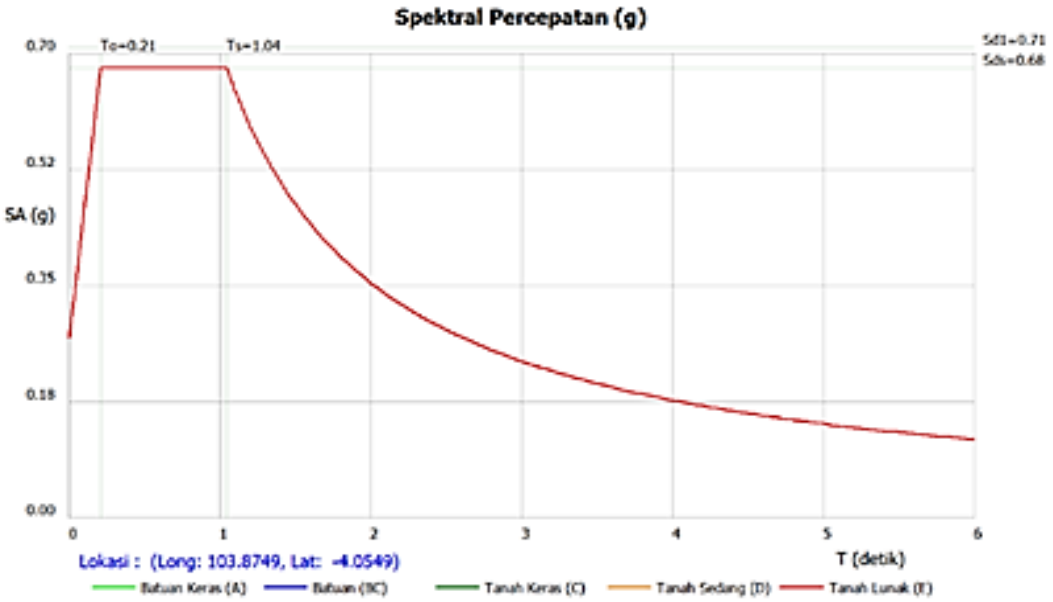

Figure 3. Respon Spektrum

Structure Design Evaluation Analyse

Structure Design Evaluation Analyse of the Muhammadiyah Banjarmasin University Convention Centre Building uses SAP2000 student version software in this study to obtain the ultimate load (*Pu*) and also the ultimate moment (*Mu*) on the structural elements to be reviewed. The 3D modeling image using SAP2000 on the Muhammadiyah Banjarmasin University Convention Centre Building.

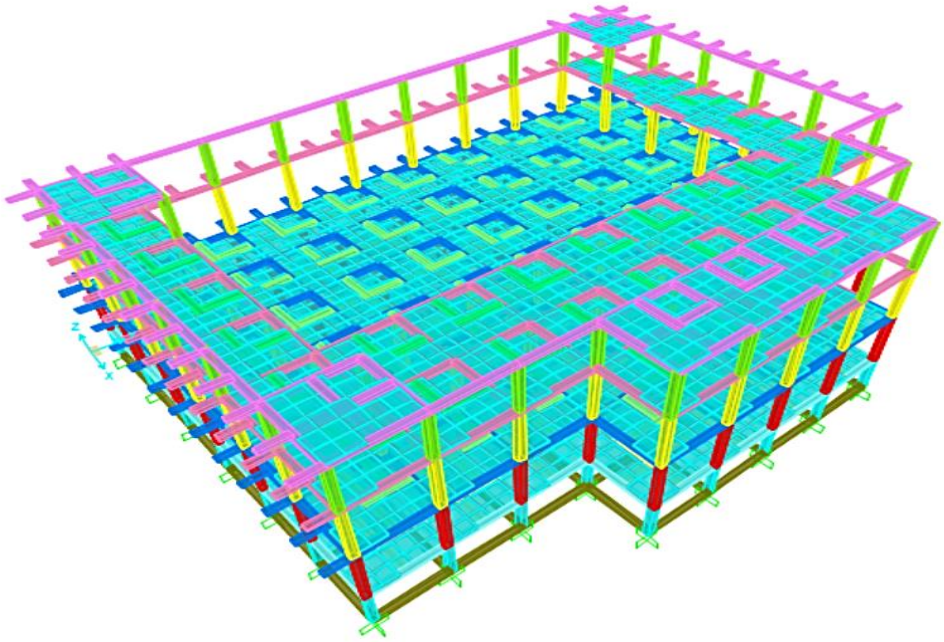

Figure 4. 3D Modeling

The result of analyzing the strength of the column structure using SAP2000 student version software analyzing manual calculations according to SNI 2847-2019 obtained the results as in Table 6.

Table 6. Results of Column Structure Analysis Pu ≤ Pr field area

Structural elements	Pu (kN.m)	Pr (kN.m)	Description
1st Floor Column	204,42	767,12	Reached
2nd Floor Column	936,96	2525,14	Reached
3rd Floor Column	473,28	2631,95	Reached
Pedestal Column	1864,41	4013,30	Reached

Based on the analysis results in Table 6, the column element has met the design criteria for service condition on the maximum ultimate load value (*Pr*) exceeding the ultimate load (*Pu*).

From the results of analyzing the strength of the beam structure using SAP2000 student version software and analyzing manual calculations according to SNI 2847-2019, the results are shown in Table 7.

Based on the analysis results in Table 7, the beam element has met the design criteria for service condition, based on the value of the maximum ultimate moment (*Mr*) greater than the ultimate moment (*Mu*).

Table 7. Results of Reanalysis of Beam Structure Strength against Initial Planning

Structural elements	Regional	Mu	Mr	Description
1st floor beams	support	119,63	225,12	Reached
	field	66,83	230,59	Reached
2nd floor beams	support	139,27	223,01	Reached
	field	79,07	152,89	Reached
3rd floor beams	support	111,48	139,68	Reached
	field	87,58	114,23	Reached
1st floor joists	support	20,4	92,54	Reached
	field	14,17	61,95	Reached
2nd floor joists	support	19,05	92,62	Reached
	field	22,03	61,03	Reached
3rd floor joists	support	41,04	60,83	Reached
	field	26,33	92,18	Reached
Sloof	support	19,79	117,62	Reached
	field	9,9	118,1	Reached
Daag	support	75,35	110,56	Reached
	field	60,77	77,07	Reached

CONCLUSION

Based on the results of the structural analysis review of the Muhammadiyah Banjarmasin University Convention Centre Building which has been converted into a lecture building, in accordance with SNI 2847: 2019, the following conclusions are obtained: (1) The uniformity of concrete quality in the Muhammadiyah Banjarmasin University Convention Centre Building was checked using the Hammer test type HT225 and obtained an average value of 39.36 Mpa. (2) Structure Design Evaluation Analyse of the Muhammadiyah Banjarmasin University Convention Centre Building using SAP2000 student version software modeling and manual calculations obtained a value of the maximum ultimate moment (*Mr*) and maximum ultimate load (*Pr*) greater than the value of the ultimate moment (*Mu*) and ultimate load (*Pu*), meaning that service condition of the building to change functions has met the requirements.

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