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## Preface

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## Preface

Distinguished guests and participants,  
Assalamualaikum Warahmatullahi Wabarakatuh.

Good Morning Ladies and Gentlemen.

Welcome to International Conference on Advanced Science & Technology (ICAST) 2020

On behalf of the Organizing Committees, we would like to express a warm welcome to all delegates and participants to the ICAST International Conference on Science and Technology 2020. It is a great honor for all collaboration institution including universiti teknikal malaysia melaka, university of bung karno, university of HKBP Nommensen and Sada Utama Indonesia to support the conference.

This conference is an important forum for exchange of information and research results among us, who come from different countries, different educational and research institutes, and different research interest. The main theme of conference is Innovation Research for Science and Technology in Industry 4.0 has been chosen. ICAST 2020 aims to bring together researchers, scientists, engineers, and scholar students to exchange and share their experiences, new ideas, and research results about all aspects of science, engineering and Technology, and discuss the practical challenges encountered and the solutions adopted. The conference invites delegates from across Indonesian and South East Asian region and beyond, and will be attended by participants from abroad university academics, researchers, practitioners, and professionals across a wide range of industries. Due to Covid-19 outbreak, the conference 1st International conference on advanced science and technology has been successfully held virtual on November 28th, 2020. Total more than 100 participants in the plenary room were enthusiastic about listening to the keynote speakers from Assoc. Prof. Muhammad Imran Qureshi, Ph.D (Universiti Teknikal Malaysia Melaka), Assoc. Prof. Dr. Dahlan Abdullah, ST, M.Kom (Univeritas Malikussalleh).

In closing, we would like to thank the Rector of Universitas Budi Luhur, Universitas Bung Karno, Universiti Teknikal Malaysia Melaka and all parties, for supporting the successfull conference. We would also like to thank all contributors for your good cooperation. Special thanks for OC members for their hard work and patience.

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## Peer review declaration

All papers published in this volume of *IOP Conference Series: Materials Science and Engineering* have been peer reviewed through processes administered by the Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

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- **Number of submissions received:** 53
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## Evaluation of Internal Forces and Support Reaction of Column and Shearwall in 15<sup>th</sup> Building Design

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# Evaluation of Internal Forces and Support Reaction of Column and Shearwall in 15<sup>th</sup> Building Design

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**Abstract.** In the case of 15<sup>th</sup> building, the structure type to earthquake resistant code is dual system reinforced concrete consists of frame and shear wall. The structure is analysis by dynamic analysis for whole structure and compare base shear by static analysis. By several trial position of shear wall can give first and second mode is translation and the third mode is rotation. In this case planar shear wall is used and placed in two direction of axis. The category of structural system is Other Structure for calculation of fundamental period (T). Fundamental Period (T) of structure is more than T maximum, so value of static seismic coefficient (C<sub>s</sub>) taken from T maximum. Each of important element is column where the dimension and reinforcement are must satisfied for requirements. Shear wall have joint together with others shear wall, so one node used by several shear wall, make duplication forces in support reaction. For foundation design we can used 1<sup>st</sup> story internal forces in finding forces and compare them with after correction of support reaction caused duplication node in used with several shear walls. This exercise could solve the problem to anticipate duplication forces in several planar shear wall using one foundation assembly from several shear walls. The results of preliminary design column based on axial forces is 23,12 % lower than internal forces. From preliminary design based on axial forces. The dimension of preliminary design columns are lower than ideal dimension with 3 % reinforcement ratio. The result of difference between internal forces columns and support reaction columns is 12,99 %. The result of difference between internal forces shear walls and support reaction shear wall is 0,80 %.

## 1. Introduction

In the case of 15<sup>th</sup> building the structure is dual system reinforced concrete consist of frame and shear wall. The structure is analysis by dynamic analysis for whole structure and compare base shear by static analysis. By trial position of shear wall can give first and second mode is translation and the third mode is rotation. In this case planar shear wall is used and placed in two direction of axis. The category of structural system is Other Structure for calculation of fundamental period. Period of structure is more than T maximum, so value of C<sub>s</sub> taken from T maximum. Dimension and reinforcement of column is very important because must be resist a large portion of forces and have performance as strong column weak beam. Evaluation of column by compare preliminary design column and internal forces because there are several aspects in structure such earthquake load can change dimension to large from referred by dimension from preliminary design. The effect of axial load and moment will be evaluation for to have prediction about reinforcement or dimension, where ideal reinforcement column is about 3 %, if do not want use mechanical connection to joint reinforcement bar [1], [2]. Using shear wall can reduce building period and story drift because



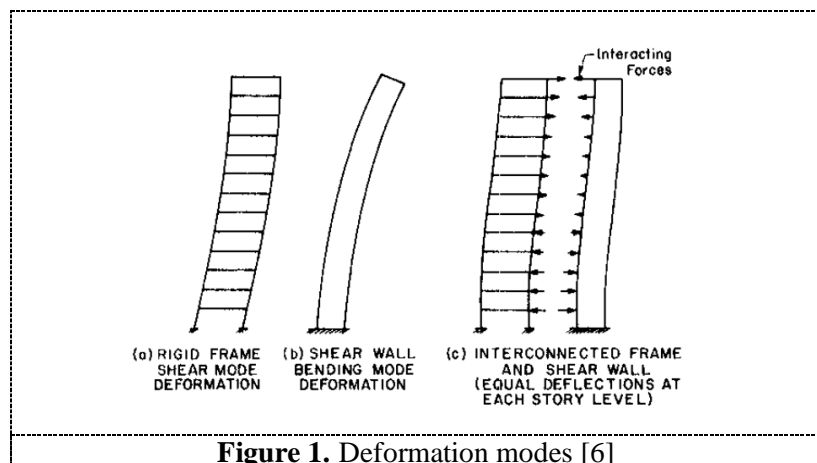


behavior of fixed joint at restraint. Evaluation of shear wall by compare internal forces especially axial forces in shear walls with support reaction. In support reaction gives forces in every node, this will be duplication forces in same node for two or three or four walls connected to this node. For foundation design because there are several walls so each wall will give forces to one pile cap assembly to several walls. Correction forces in support reaction can referred to internal forces of shear walls, and by modelling separate foundation with forces from several shear walls will take number of piles.

## 2. Literature Study

In high rise buildings, combination of shear walls and frames in normally provide the required stiffness and strength to withstand lateral loads. Shear walls normally are much stiffer than the frames system to take of lateral load more than frame system [3], [4]. Because of larger stiffness, the contribution of the frame system in resisting lateral load is usually ignored. This practical procedure must be corrected because there is important that the effect of the frames be considered in seismic resistant building [5].

A rigid frame consist of vertical columns and horizontal beams, bends predominantly in a shear mode shown in Figure 1 (a) [6] and a shear wall in a bending mode, i.e, as a cantilever, as illustrated in Figure 1(b). In some building structure (stair opening, elevator shafts) which reinforced concrete walls normally show the behavior [7]. The combination between rigid frame and shear wall interacting will tend to deflect in a bending mode [8]. The analysis is comparatively simple when all vertical units of a structure show the same behavior under lateral load which the seismic system in all rigid frames or all shear walls. The load can be distributed to the units proportionally to their stiffnesses. The difference in behavior under lateral load, in combination with the in-plane rigidity of the floor slabs, causes nonuniform interacting forces to develop when walls and frames are present Figure 1 (c). This makes the analysis more complex.

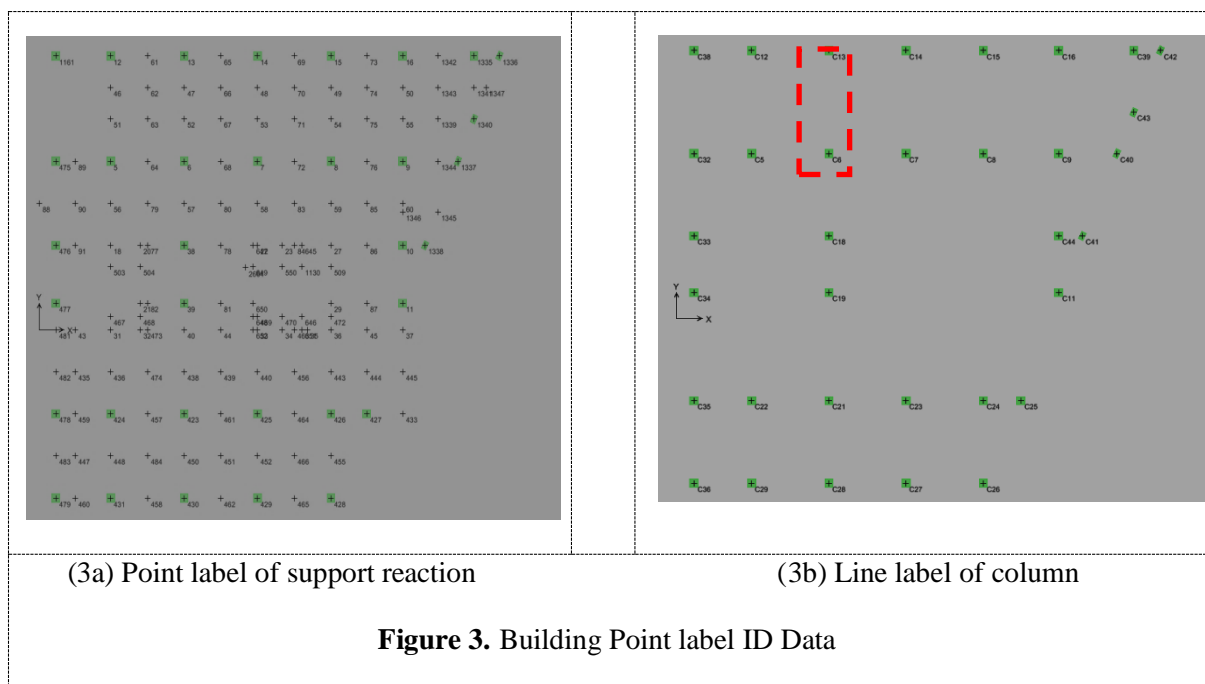
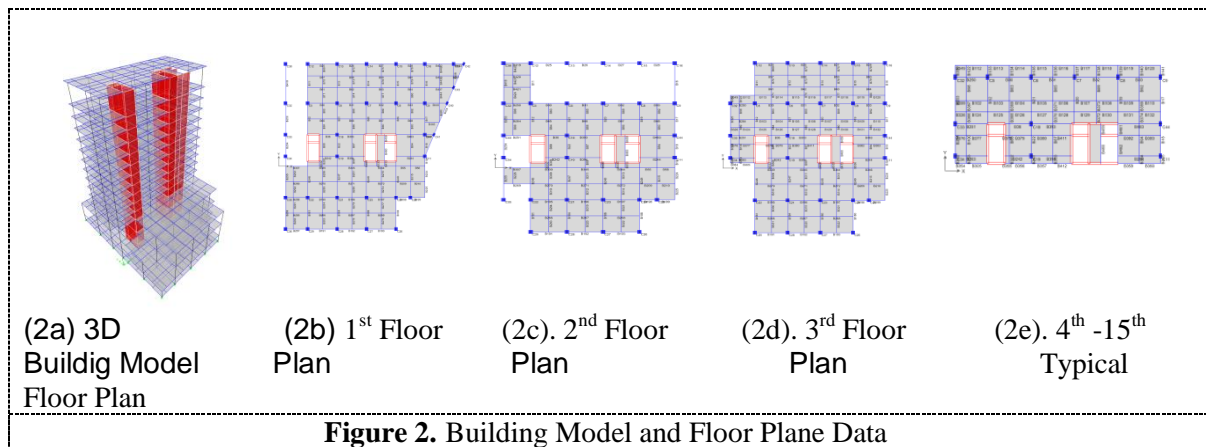


**Figure 1.** Deformation modes [6]

For analysis, the floor slabs are normally considered to be fully rigid within their own planes. This means that there will be no relative movement between the vertical units at each story level.

## 3. Analytical Model

In this study, building model is 15 story dual system with other Structure System. The function of this building is hotel in Jambi City with seismic parameter  $S_s = 0,7 g$ ,  $S_1 = 0,4 g$  with site class D [9]. Material property of the building of concrete is  $f'_c = 28 \text{ MPa}$  and steel reinforcement is  $f_y = 420 \text{ MPa}$  for plate, beam, column and wall. The gravity load for this building functioned as hotel facilities [10]. The structure is given in the Figure 2, and in Figure 3a shows point label and line label to indicate the support reaction output location in building[11].



#### 4. Result and Discussion

Output ETABS and preliminary dimension of column is shown in table below, it is known that axial force ETABS bigger 23,12 % than axial force preliminary show in 0.

**Table 1.** Comparison of Colum Axial Force.

Story	Column	P Etabs (kg)	P Prelim (kg)	Magnify Factor	% Difference
STORY1	C6	1212399	999591.6	1.21	21.29
STORY1	C18	1019156	815688	1.25	24.94
Average					23.12

In 0 and 0 shown column dimension with variance reinforcement for getting ideal dimension.

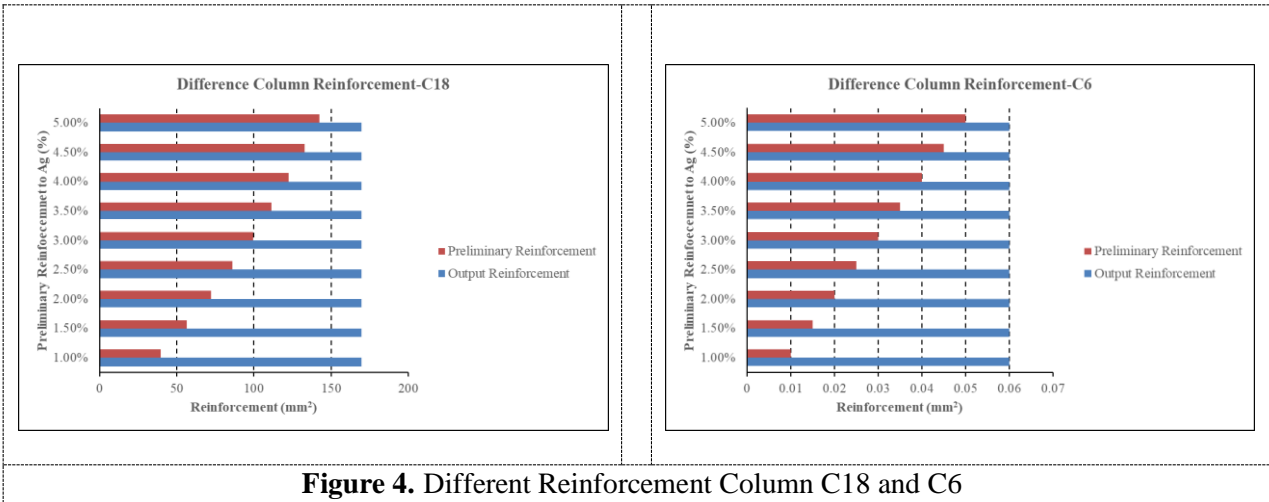
**Table 2.** ETABS Column dimension with variance reinforcement.

Column ID	Reinforcement Rebar Area, As (mm <sup>2</sup> )	Parameter	Column Section Area										
			1.00 % As	1.50 % As	2.00 % As	2.50 % As	3.00 % As	3.50 % As	4.00 % As	4.50 % As	5.00 % As	5.50 % As	6.00 % As
C6	294.38	Section Area, Ag (mm <sup>2</sup> )	29438	19625	14719	11775	9813	8411	7360	6542	5888	5352	4906
		Dimension (cm)	172x172	140x140	121x121	109x109	99x99	92x92	86x86	81x81	77x77	73x73	70x70
C18	169.76	Section Area, Ag (mm <sup>2</sup> )	16976	11317	8488	6790	5659	4850	4244	3772	3395	3087	2829
		Dimension b x h (cm)	130x130	106x106	92x92	82x82	75x75	70x70	65x65	61x61	58x58	56x56	53x53

**Table 3.** Preliminary Column dimension with variance reinforcement

Column ID	Reinforcement Rebar Area, As (mm <sup>2</sup> )	Parameter	Column Section Area										
			1.00 % As	1.50 % As	2.00 % As	2.50 % As	3.00 % As	3.50 % As	4.00 % As	4.50 % As	5.00 % As	5.50 % As	6.00 % As
C6	294.38	Section Area, Ag (mm <sup>2</sup> )	4841	4617	4413	4227	4055	3897	3751	3615	3489	3371	3261
		Dimension (cm)	70x70	68x68	66x66	65x65	64x64	62x62	61x61	60x60	59x59	58x58	57x57
C18	169.76	Section Area, Ag (mm <sup>2</sup> )	3950	3768	3601	3449	3309	3180	3061	2950	2847	2751	2661
		Dimension b x h (cm)	63x63	61x61	60x60	59x59	58x58	56x56	55x55	54x54	53x53	52x52	52x52

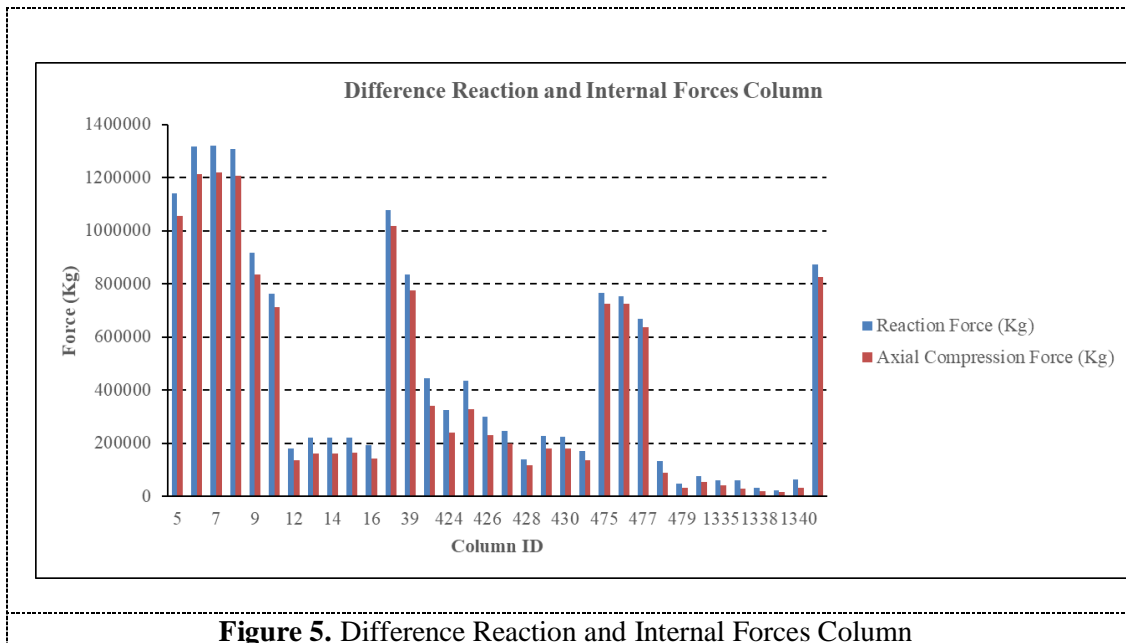
From the above table can get the magnify reinforcement between preliminary and output ETABS as shown in Figure 4 below. The ideal dimension for column C18 and column C6 is shown in Table 4 below.



**Figure 4.** Different Reinforcement Column C18 and C6

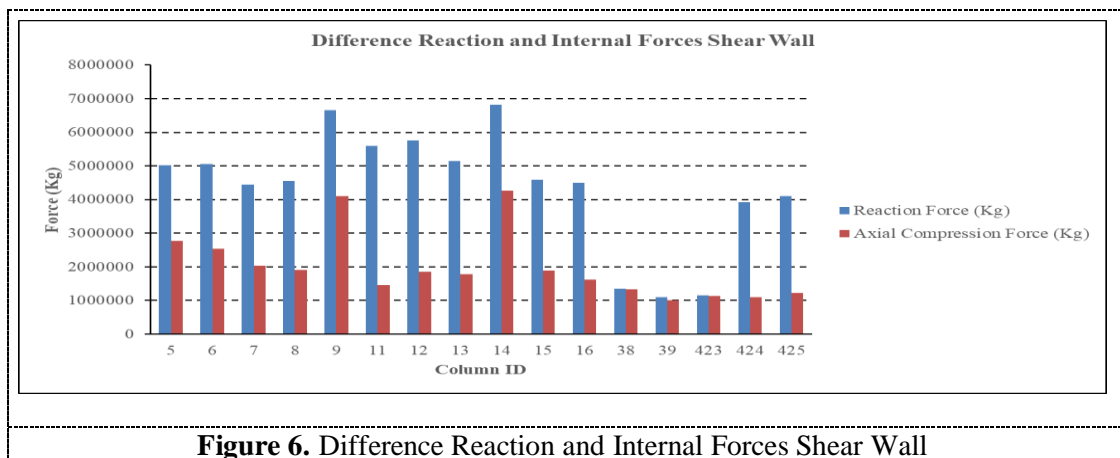
**Table 4.** Ideal dimension column C18 and C6

Ideal Dimension C18			Ideal Dimension C6		
Ag (cm <sup>2</sup> )	As (cm <sup>2</sup> )	Magnifying Factor	Ag (cm <sup>2</sup> )	As (cm <sup>2</sup> )	Magnifying Factor
5658	0.03	1.43	9812	0.03	2.03
75x75			100x100		



**Figure 5.** Difference Reaction and Internal Forces Column

Figure 5 shown that ideal dimension is 43,2 % in C18 and 202, 7 % in C6 upper than preliminary dimension.



**Figure 6.** Difference Reaction and Internal Forces Shear Wall

Figure 6 shows that difference column reactions are 12,99 % bigger than column internal forces, and that difference shear walls are 0,89 % then shear walls internal forces.

## 5. Conclusion

The result of preliminary design based on axial forces is 23,12 percent lower than internal axial force. The dimension of preliminary design C18 column is 43,2 % lower than reality dimension and C6 column is 202, 7% lower than reality dimension with 3 percent reinforcement ratio. The result of difference between internal forces columns and support reaction columns is 12,99 %. The result of difference between internal forces shear walls and support reaction shear walls is 0,89 %.

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