



“SEISMIC REPOSNCE OF RCC FRAME BUILDING HAVING EXCESSIVE OPENING IN SLAB”

^aPawan Sona, ^bGaurav Kumar Agrawal, ^cVivek Kumar Mishra

¹M. Tech Scholar, ^{2,3}Assistant Professor

^{1,2,3}Department of Structural Engineering

^{1,2,3}University Teaching Department, CSVTU, Bhilai

Abstract - The RCC building system should have sufficient stiffness, strength, and energy dissipation to resist the lateral load. The study about the building having different percentage variation in opening of slab in the plan. To build the seismically safe structure with adequate lateral resistance. The opening led to economical building and helps to provide proper ventilation in the structure. The structure is analyzed for seismic zone V with. The plan aspect ratio considered here is 2. The method for seismic analysis is response spectrum analysis. The load condition is applied as per IS 1893:2016. The response such as storey displacement is been evaluated. It has been seen that the larger the opening the higher will be displacement of the structure.

Keywords: *Aspect Ratio, Opening, Storey Displacement*

1. Introduction

When an earthquake occurs, the seismic forces, its magnitude, directions, its time are all events that cannot be predicted. It has been seen that not choosing the configuration of building, materials, structural system of the structure correctly may result in large damage to the building and may also result in the total destruction of the structure. (Bambang Siswanto and Afif Salim 2018). An earthquake has the ability to cause catastrophic damages to a building and other structures, for this reason it becomes very necessary for the designers to design the earthquake resistant buildings in a proper way so as to save the life of living things and also to ensure the safety of all the structures. Vinod V, Pramod Kumar H V in their paper compared the performance of two multi story RCC building (4 and 8 stories) having varying percentage of openings in slab like no openings, 10% opening, 20% opening and 30% opening. Different criteria were being compared like base shear, natural time period of the building, storey drift, displacement of stories, etc and used ETABS '15 software to analyze the results with the help of response spectrum method. The results obtained said that the natural time period goes on decreasing with the increase in percentage of openings, Maximum displacement for 4 and 8 stories buildings shows that less displacement in diaphragm with no openings in comparison to diaphragm with openings and the result was same for maximum drift of the stories, all these results shows that diaphragm with no or lesser discontinuities must be used in multi storied building. Arya V Manmathan and Aiswarya S (2017) studied that building which has openings in slab may get damaged due to the seismic loads. In this paper the effects of size or percentage of openings were studied and different buildings having varying percentage of openings in the slab (1%, 2%, 3%, 4%, 5%) were analyzed and compared with the help of Response spectrum method in Etabs. Results shows that the storey drift increased for 2% opening and then there is a slight decrease for 3% but for 4% and 5% openings the storey drift is same it was also observed that the base shear increases with increase in percentage of openings.

1.1 Research Objectives of the Current Study

- ❖ To model the RCC frames with percentage variation in the slab cut-off or discontinuity in slab.
- ❖ To investigate the output reports based on displacement of all model frame based on seismic parameter;
- ❖ To identify the vulnerable model cases based on percentage cut-off in slab.

1.2 General Consideration for Models

Different types of models were selected on the basis of percentage of openings in slab and the position of openings (i.e., openings at center). After selecting these models were made and subsequent analysis was done in these models and the results such as deflection, base shear, story drift was compared with the model having no slab opening. All the models considered are being described in the table below: -

Table 1 Worked Out Models

Location of openings	Percentage openings	Model id	Description
No openings	-	RM	This is the basic model which has no openings.
Centre	16.67%	CEN16	This model has 16% slab openings at the Centre of the slab
Centre	25%	CEN25	This model has 25% slab openings at the Centre of the slab

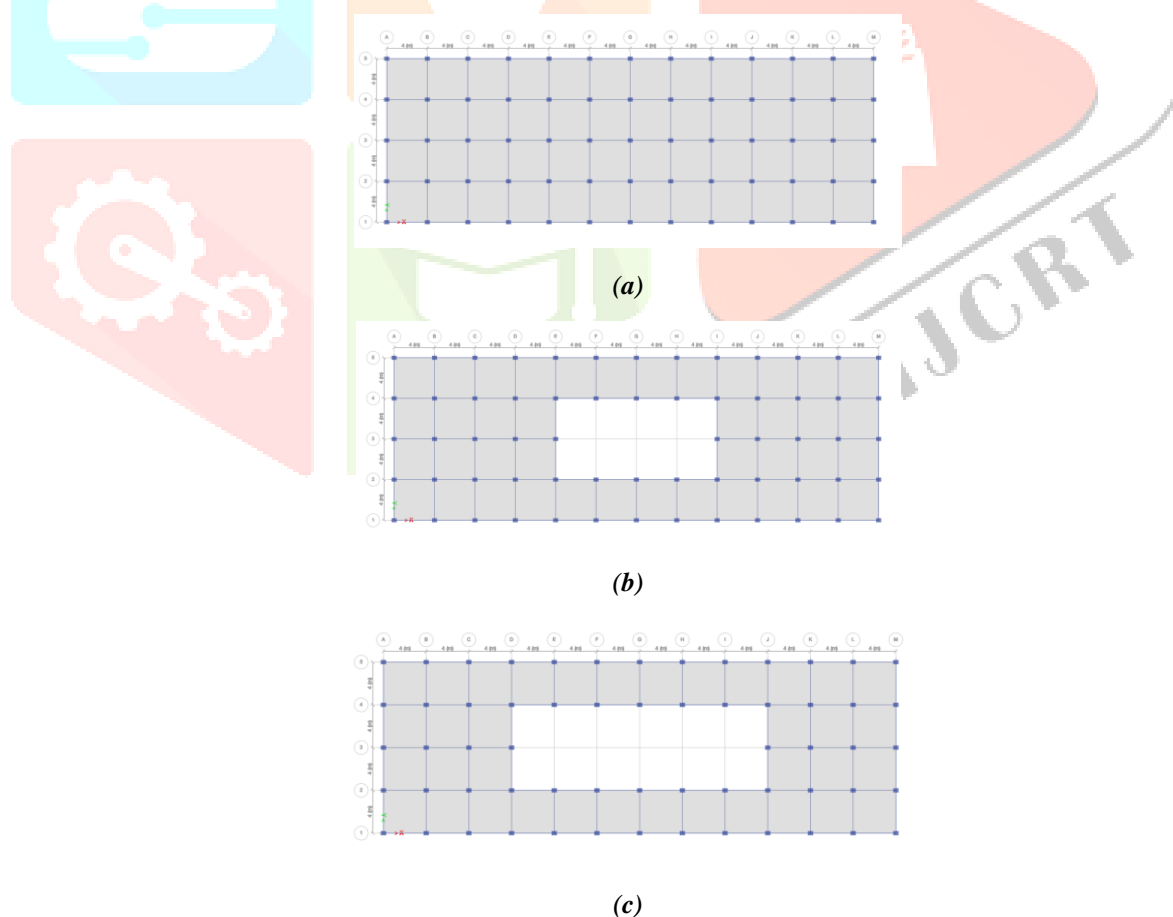


Fig. 1 Plan View of Models (a) RM (b) CEN16 (c) CEN25

2. Structural Configuration

The total height of the building is 41.1 m, consisting of 13 floors each of 3.3 meters and first floor of 1.5 m. The length of the building is 21 m, consisting of 6 bays in X-axis each of 3.5m. The width of the building is

32m, consisting of 7 bays in Y-axis each of 4m. The columns considered had a cross section of 450 mm X 500mm. The beam had a cross-section of 250mm X 450 mm. The slab considered was 125 mm thick.

3. Specifications for Design & Analysis of Cases

These building frames models are made up of two basic materials i.e., concrete and reinforced steel. The table given below shows the properties of materials considered for design and analysis of all RCC frame buildings.

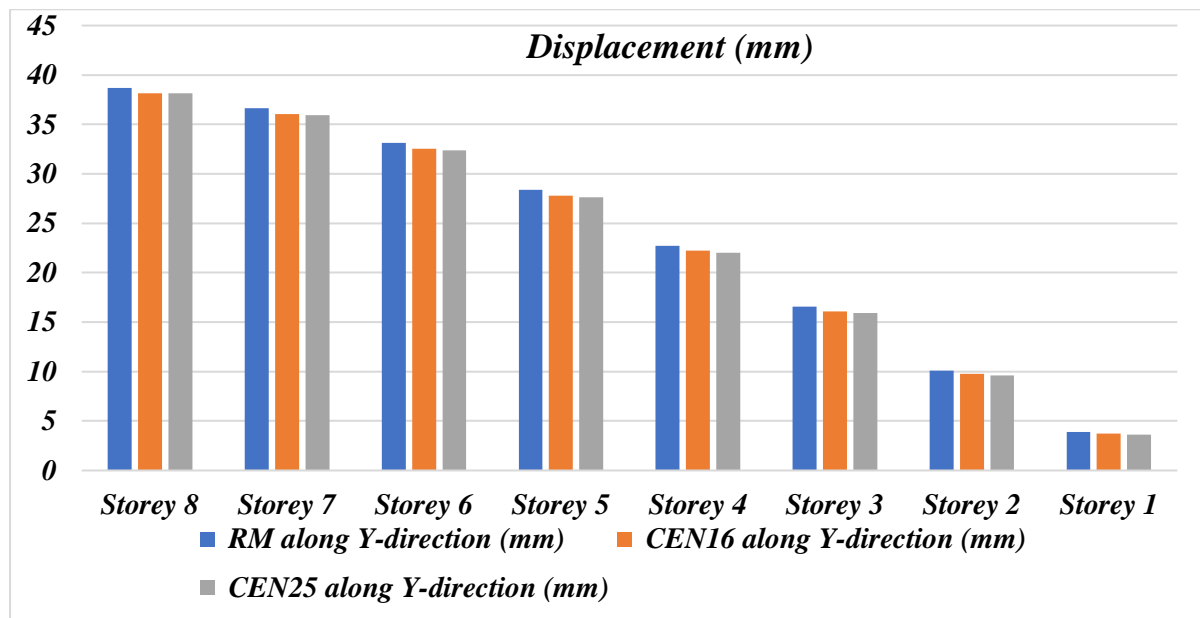
Table 2 Material Properties used in all Frames

Particular	Details
Grade of Concrete	M25
Grade of Main Steel	Fe500
Grade of Secondary Steel	Fe500
Beam & column cover	25 mm & 40 mm
Density of Reinforced Concrete	25 KN/m ³
Density of Brick walls, Plaster	18 KN/m ³
Young's modulus of steel	2 X 10 ⁵ N/mm ²

4.1 Storey Displacement Result

Table 5 Displacement Result

Storey	RM along Y-direction (mm)	CEN16 along Y-direction (mm)	CEN25 along Y-direction (mm)
Storey 8	38.69	38.15	38.12
Storey 7	36.66	36.06	35.96
Storey 6	33.15	32.54	32.40
Storey 5	28.39	27.81	27.64
Storey 4	22.75	22.22	22.04
Storey 3	16.55	16.11	15.94
Storey 2	10.10	9.78	9.63
Storey 1	3.90	3.73	3.65



Graph 1 Displacement Result

5. Conclusions

The description here below is after careful interpretation of all the testing for the parameters has been seen that the displacement value of building with 52 % opening at center of slab exhibit minimum value along the X-direction which is *approximately 11 % less* than Model with no opening in the slab. Among all type of cases, the frame with opening at the center show lower displacement value. It has been that if excessive opening is at some random portion of slab, then the displacement value is on higher side.

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