To Analyze the Effect of Irregularities on RCC Framed Building under Seismic Analysis

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Abstract— The concept of plan irregularity and vertical irregularity is not new to the structure world. In this paper, the combined effect of both the irregularities were considered in order to understand the behavior as well and to evaluate the performance of RCC multi-storied building with the help of staad.pro. for this purpose, 14 storey and 18 Storey S-shaped RCC building was taken in which the concept of mass irregularities was introduced at two different levels for each building. The study entails analysis of various models, collection of results and scrutinizing them, representation of the results and final comparison between the various parameters of different models. These models were analyzed under seismic forces and lateral stability was checked. From the results of present study, it can be concluded that if the total load of the building remains the same, then there will be slight variation in displacement of building as well as in material quantity. But there is a significant increase of 7% to 15% in bending moment and 12% to 18% in shear force of beams if the heavy mass is transferred from on floor to another floor.
Keywords: Dynamic Seismic Analysis, Staad.Pro, Central Core, High-Rise Building

I. INTRODUCTION

Now-a-days, the higher importance is given to the architectural appearance in a building construction. Due to this, the structure designing becomes critical and consideration of different design parameters has to be done for simple or complicated structure. With the good architectural appearance, the concept of plan and vertical irregularities is introduced in the building. Any irregularities related to stiffness, mass, vertical geometric in the building is called vertical irregularities. Whereas, any irregularities related to torsion, diaphragm or plan is called plan irregularities. The different kind of irregularities has been shown in the figure below:

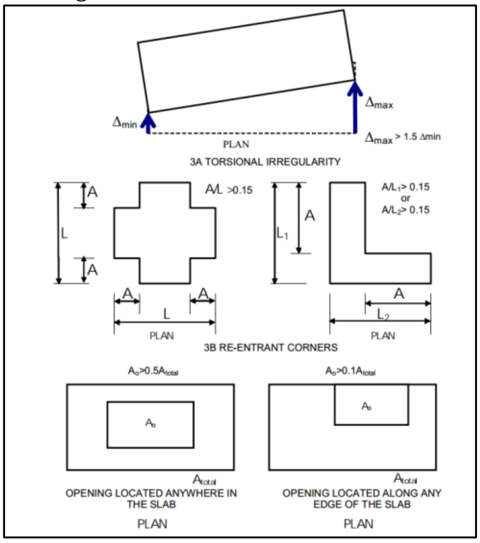

Fig. 1: Plan Irregularities.

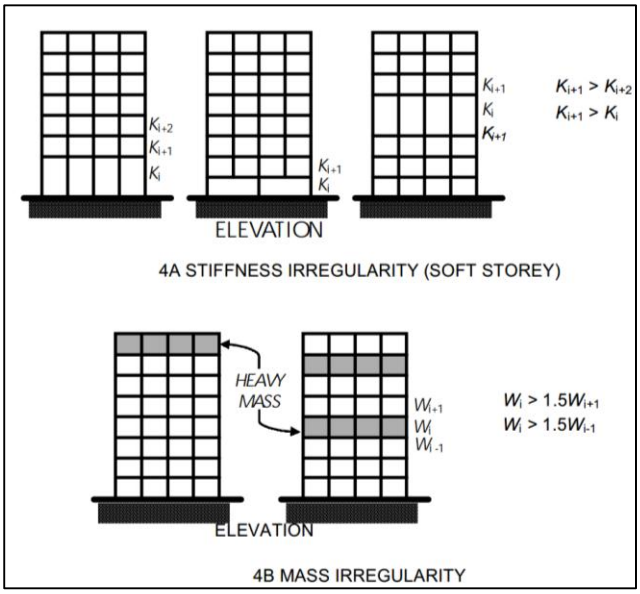

Fig. 2: Vertical Irregularities.

II. METHODS

As the present study is carried out on RCC framed irregular structures, S- shaped building was considered and various models with different height were prepared in the analyzing and designing software Staad.Pro. along with the plan irregularity, mass irregularity was also considered. Following are the descriptions of various models modelled. The floor height of the building was taken as 3.3 m and size of each bay was 5 x 5m.

Type	Building	Plan Irregularity	Mass Irregularity
Type 1	14 Storey Building	S-Shaped	On 5th floor
Type 2	14 Storey Building	S-Shaped	On 11th floor
Type 3	18 Storey Building	S-Shaped	On 6th floor
Type 4	18 Storey Building	S-Shaped	On 16th floor

Table 1: Description of different models.

Floors	Column Size in mm	Beam size in mm
1 to 5	900x800	500x400
6 to 10	750x600	400x350
11 to 14	600x450	350x300

Table 2: Properties of 14 Storey building.

Floors	Column Size in mm	Beam size in mm
1 to 4	900x850	500x450
5 to 9	900x800	500x400
10 to 14	750x600	400x350
15 to 18	600x450	350x300

Table 3: Properties of 18 Storey Building.

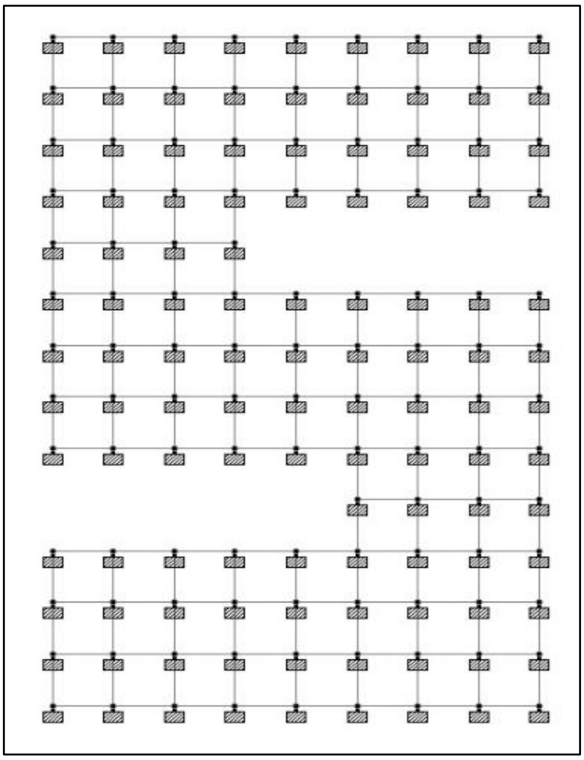

Fig. 3: Plan of the building.

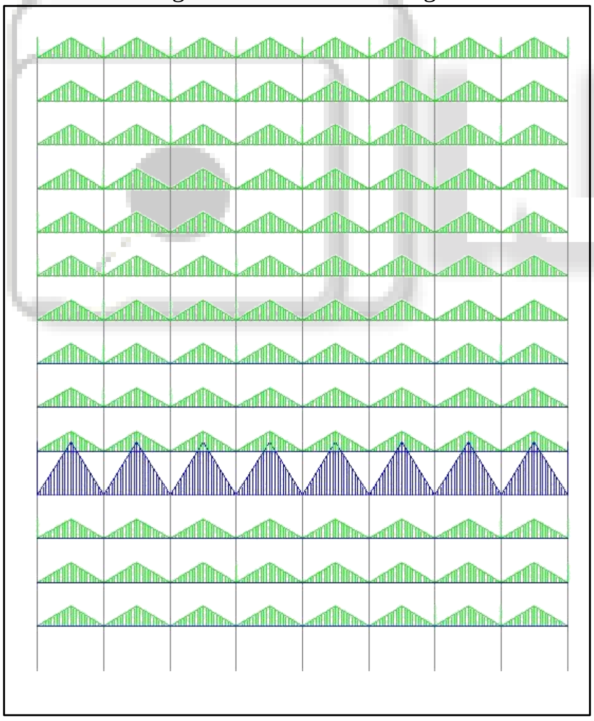

Fig. 4: Mass Irregularity at 5th floor of 14 Storey Building.

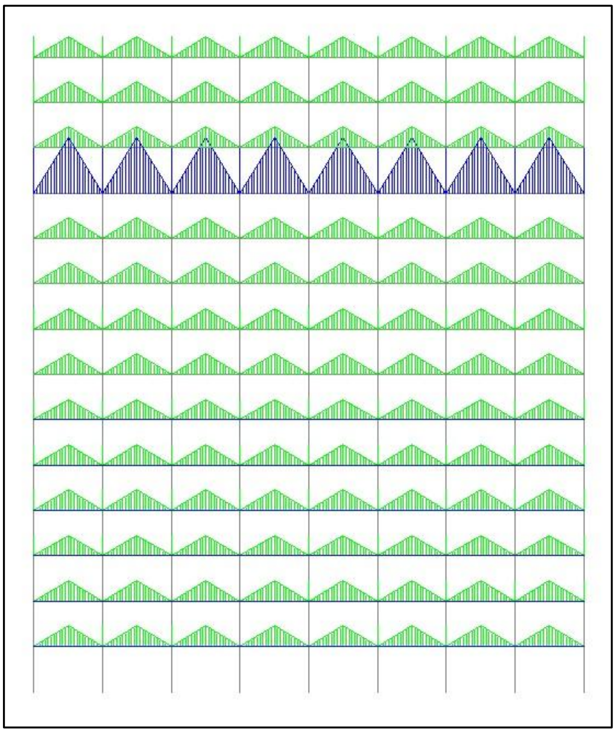

Fig. 5: Mass Irregularity at 11th floor of 14 Storey Building.

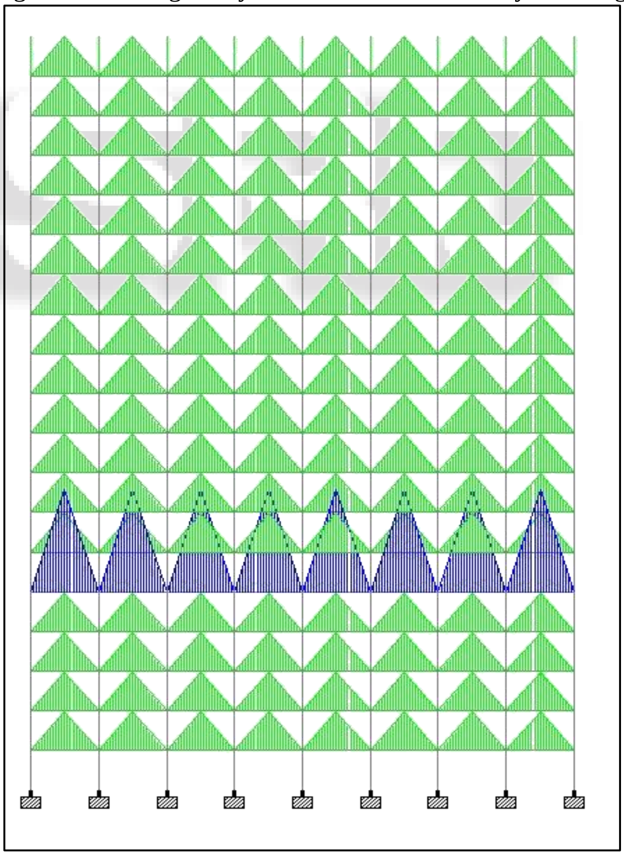

Fig. 6: Mass Irregularity at 6th floor of 18 Storey Building.

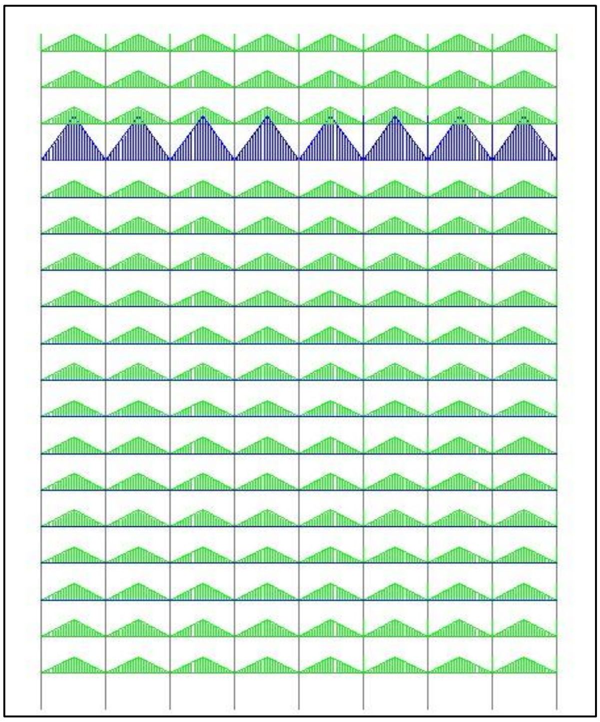

Fig. 7: Mass Irregularity at 16th floor of 18 Storey

Parameter	Value
Seismic Zone	III
Response Reduction Factor	5
Importance Factor	1.2
Damping ratio	5%

Table 4: Seismic Parameters for present study.

III. RESULTS AND DISCUSSION

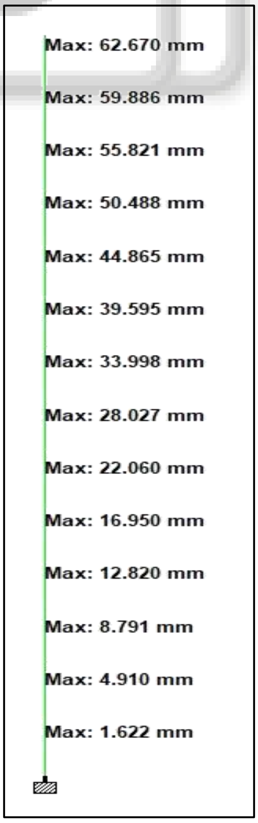

Fig. 8: Displacement of Type 1 Building.

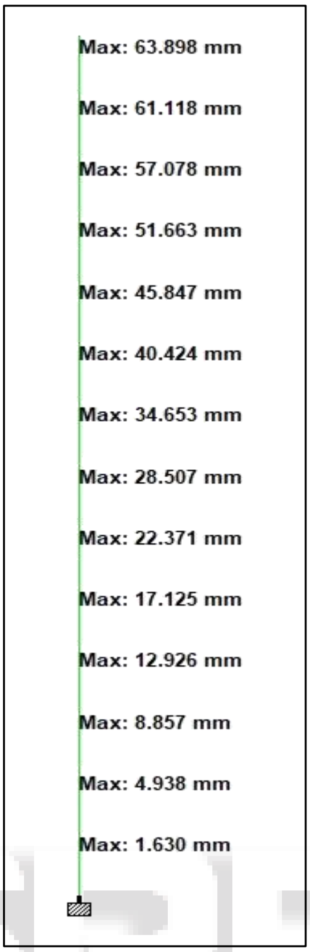

Fig. 9: Displacement of Type 2 Building

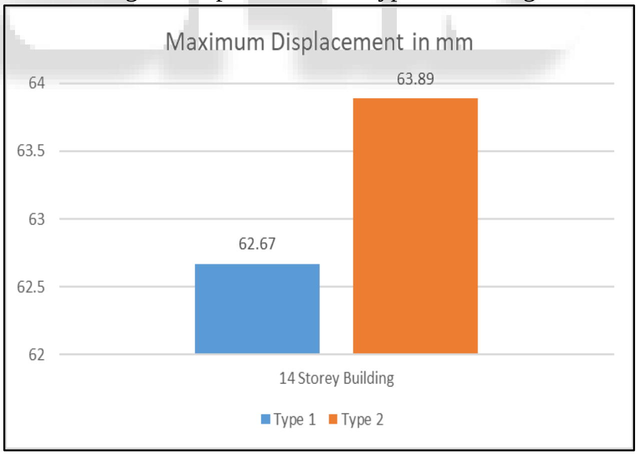

Fig. 10: Graphical Representation of Maximum Displacement of 14 Storey Building.

	Concrete Quantity (m3)	Steel Quantity (Kn)
Type 1	4762.1	2919.75
Type 2	4762.1	2963.63

Table 5: Total Quantity of 14 Storey Building.

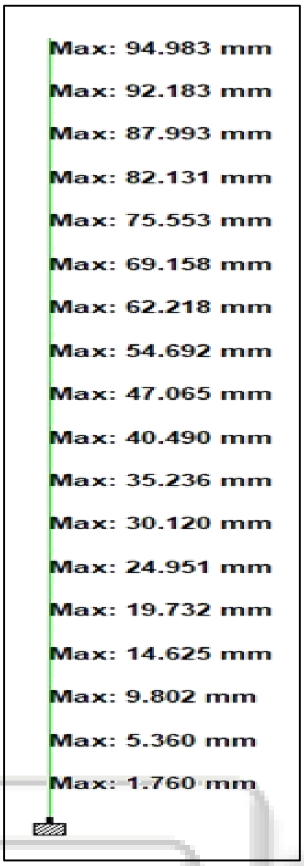

Fig. 11: Displacement of Type 3 Building.

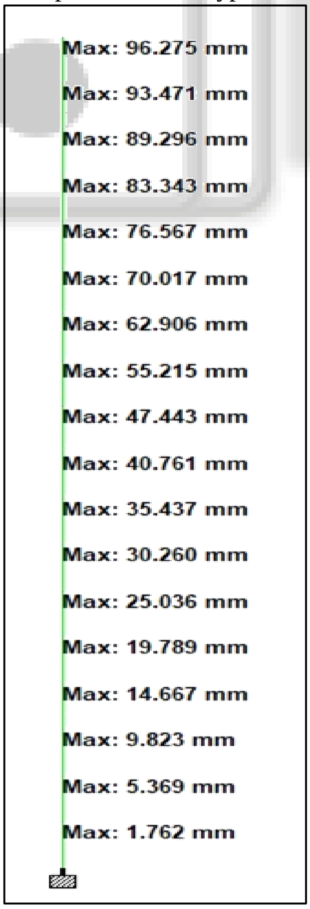

Fig. 12: Displacement of Type 4 Building.

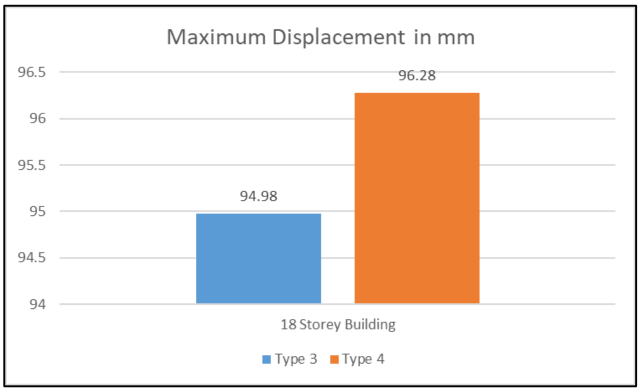

Fig. 13: Graphical Representation of Maximum Displacement of 18 Storey Building.

	Concrete Quantity (m3)	Steel Quantity (Kn)
Type 3	6829	4310.47
Type 4	6829	4373.73

Table 6: Total Quantity of 18 Storey Building.

IV. CONCLUSION

The final conclusions drawn for the present study are:

- With the introduction of heavy mass in 14 storey building at 5th floor and 11th floor, bending moment increases 8% and 15% respectively. Whereas, shear force increases 13% and 18% respectively.
- When the heavy mass was placed at 5th floor in 14 storey building, maximum displacement comes out to be 62.67 mm and when this heavy mass was shifted to 11th floor, then the maximum displacement increases 2% and the value comes out to be 64.90 mm.
- Type 2 building uses slightly more material quantity than type 1 building.
- With the introduction of heavy mass in 18 storey building at 6th floor and 16th floor, bending moment increases 7% and 15% respectively. Whereas, shear force increases 12% and 18% respectively.
- When the heavy mass was placed at 6th floor in 18 storey building, maximum displacement comes out to be 94.98 mm and when this heavy mass was shifted to 16th floor, then the maximum displacement increases 1% and the value comes out to be 96.28 mm.
- Type 4 building uses slightly more material quantity than type 3 building.

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