

Comparative Study of Multi Storey Monolithic Structural With and Without Opening

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Abstract- The present thesis is a comparative study of multi-story monolithic structure with and without opening will be carried out (reinforced concrete wall structure). In India, monolithic construction system carried out only for lower rise structure; if we consider this structural system mid to high rise structure then it may more feasible, adoptable and economic comparing conventional structural system. In this system all slabs, stairs, wall with opening or without opening cast together in one operation. Etabs software is used for analysis (dynamic analysis) of both structural systems. Analysis will be carried out for G+10 story building. For structural safety and sustainability parameters like story shear, story displacement, story drift, lateral load to be compared for both structural system.

Keywords- Monolithic structure, Opening, E-TABS, Different seismic zone, Response spectrum method, Shear wall.

I. INTRODUCTION

During construction, walls and slabs having almost the same thickness are cast in a single operation. This process reduces not only the number of cold-formed joints but also the assembly time. The simultaneous casting of walls and slabs results in monolithic structures unlike any other frame-type RC buildings.

The Monolithic Concrete Construction is considered as shear wall type construction. Walls are designed for vertical loading, in plane shear loading and out of plane loading due to wind load and earthquake force as per relevant Indian standard code IS 875(part-3):1987 and IS 1893(part-1):2002 respectively. For out of plane loading the plate can be assumed to be supported by floor slabs/diaphragm and cross walls and continuity can be assumed, wherever applicable. The detailing requirement is as per IS 456:2000 code of practice for plane and Reinforced Concrete and IS 13920:1993 Code of Practice for ductile detailing of reinforced concrete structure. A Guideline on Monolithic Concrete Construction with material requirements and design aspects has been prepared and circulated to manufacturer and user agencies by BMTPC (building material and promotion council).

Durability of concrete structure can be achieved by using proper ingredient, grade of concrete and mix designed as per IS 456:2000. Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore adequate cover is likely to be maintained.

Wall sizes of 160mm were considered. The height of each story is 3m. As compared to the building without opening 20 to 25% opening was provided. Thus, the dead load acting on this building increases special confining surrounding the opening area can be provided, if needed, as per IS:13920. Analysis is carried out using ETAB software. Shear wall have been provided throughout the building. Foundation has been provided with pin joint. After this, all the elements are meshed up (FEM modeling). Later, the analysis is carried out for 4 different seismic zones with the help of response spectrum method.

R. Jünemann [1] during the earthquake Geometry related characteristics, material properties, dynamic and wall-related parameters and irregularity indices are all defined and computed for the inventory of damaged buildings. Finally they concluded reasons of building damages, In this (i) smaller wall thickness, (ii) larger axial loads, and (iii) significantly larger vertical irregularities, especially in the lower levels. Although statistical analysis is unable to capture more specific effects, field observations and experimental results have shown that high ALR reduce ductility capacity of RC walls and make them more prone to brittle failures.

Marius Mosoarca [2] Reinforced concrete shear walls are used to design buildings located in seismic areas, because of their rigidity, bearing capacity and high ductility. Until now many theoretical and experimental tests on shear walls with or without openings have been made, therefore their failure modes have been analyzed and are rather very well-known; the research results being confirmed by real failure modes of RC walls after earthquakes. A special case is the failure mode of the reinforced concrete shear walls with vertical staggered openings. If at coupled walls the elements must be designed so that the plastic hinges appear at the ends of the coupled beams and then in the pier, this thing is more difficult at shear walls

with staggered openings. Walls with staggered opening were more rigid and failed at higher seismic forces and horizontal displacements. Shear wall with staggered openings are more effective than walls with regular openings due to their increase ductility. ALR ratio has adverse influence on seismic performance of shear wall.

1.1 Methodology

Data:

Type of building: Residential building

Height of building: 45m

Thickness of slab: 150mm

Grade of concrete: M20, M25

Grade of steel: Fe415

Seismic zone: 5

Unit weight of RCC: 25kN/m³

Type of soil: Medium

Software used: ETAB

Thickness of shear wall: 160mm

By using the above data two different models one for with opening and other for without opening monolithic structural system are carried out. After performing the analysis various parameters like story drift, story shear, displacement and lateral load are obtained from software and comparative study is carried out.

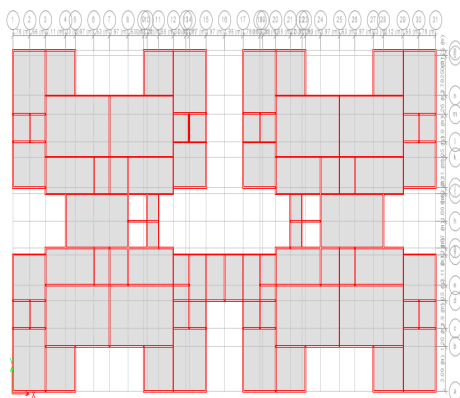


Fig-1 Plan

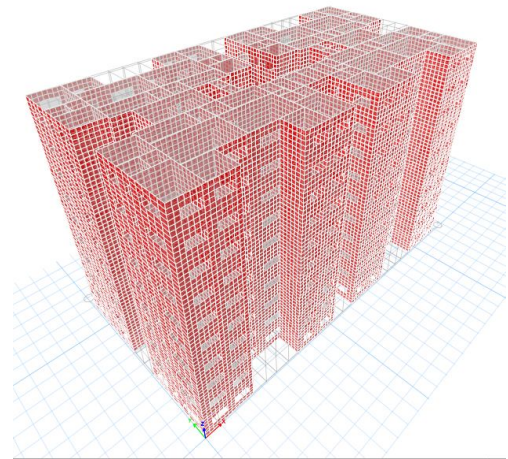


Fig-2 With Opening 3D View

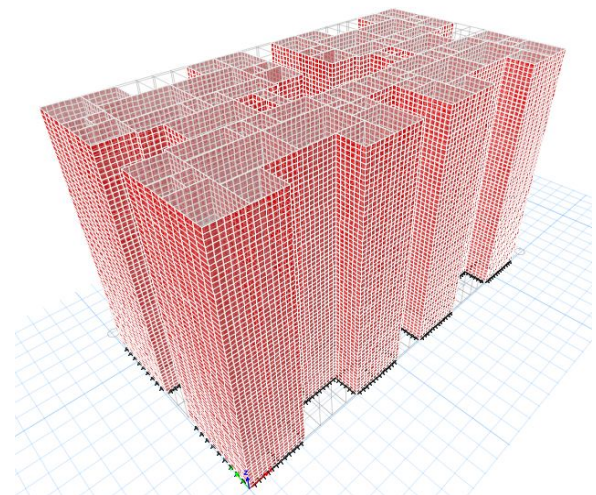


Fig-3 Without Opening 3D View

II. MODELING AND ANALYSIS

2.1 Results

This result shows different parameters for seismic zone-5. Comparison between with opening and without opening structure.

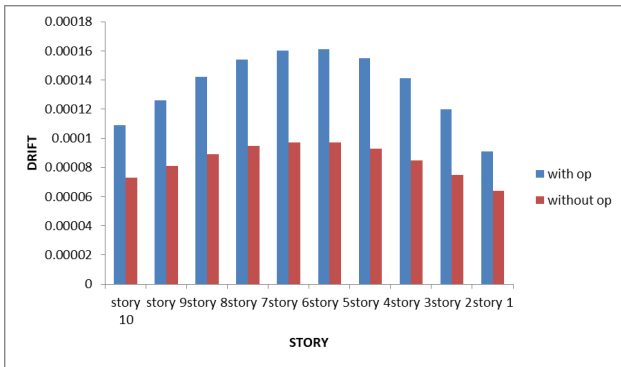


Fig: 4 Zone5 Story Drift In X Direction

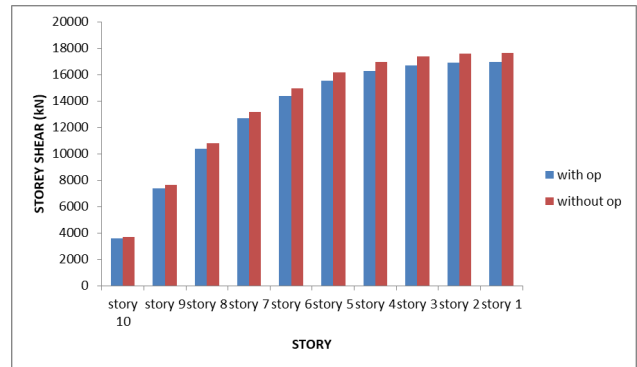


Fig: 8 Zone5 Story Shear

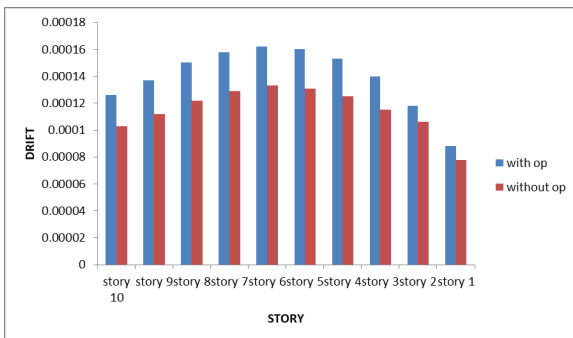


Fig: 5 Zone5 Story Drift In Y Direction

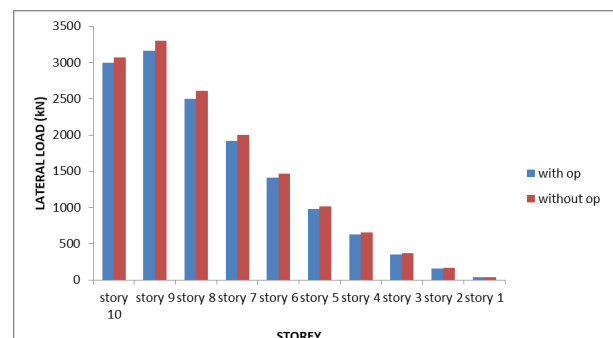


Fig: 9 Zone5 Lateral Load

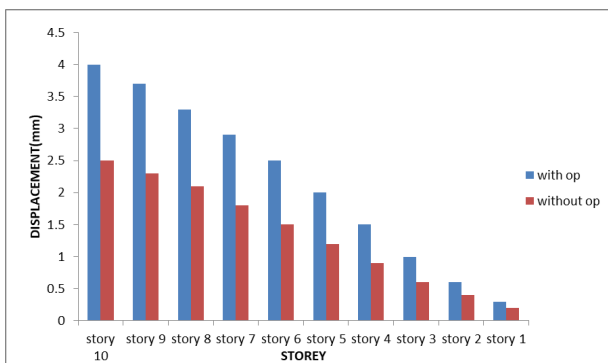


Fig: 6 Zone5 Story Displacement In X Direction

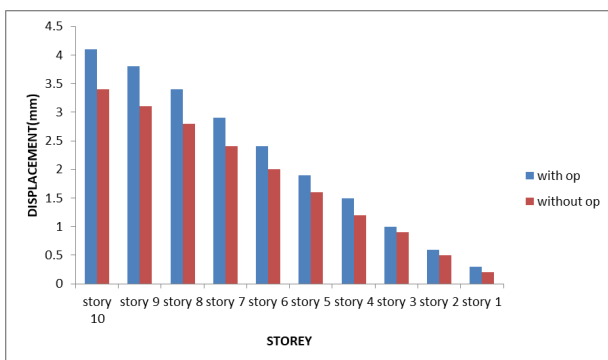


Fig: 7 Zone5 Story Displacements In Y Direction

III. CONCLUSION

- When structure is constructed with opening monolithic structure than the displacement is more as compared to structure constructed without opening monolithic structure in X-direction and Y-direction. The increase in displacement is due to decrease in stiffness.
- There is not abrupt change in the stiffness at various storeys and the storey drift is very less. For G+10 storey structure story drift is less in both directions for without opening monolithic structure as compared to with opening monolithic structure.
- Even though lateral loads are higher in case of without opening monolithic structure there is decrease in displacement in both directions.
- Storey shear is increase for without opening monolithic structure as compare to with opening increase story shear is depends on dead load of the structure. Thus, at the base of building storey shear is maximum.
- Analysis was carried out for 160mm size wall. It can be interpreted that if the section size is reduced, the structure may fail. In order to prevent this situation of cracking and failure of structure, special confining steel should be provided around the opening.

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