Response of A G+20 Residential Building with Varying Shear Wall Positions by Using Etabs

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ABSTRACT
In the modern world house is mandatory for every human being. As the availability of land is decreasing, it is difficult to construct an individual house for everyone. To enhance this problem mankind as decided to build a residential building with 'N' number of floors. By constructing tall buildings, it may be subjected to live load, dead load, earthquake load, wind load etc. Due to these loads collapse of buildings, property and loss of human being's lives may occur. In this mini project a G+20 building is considered and analyzing with varying shear wall positions by using ETABS software. The shear wall will resist lateral loads.

Keywords: Shear Wall, Earthquake

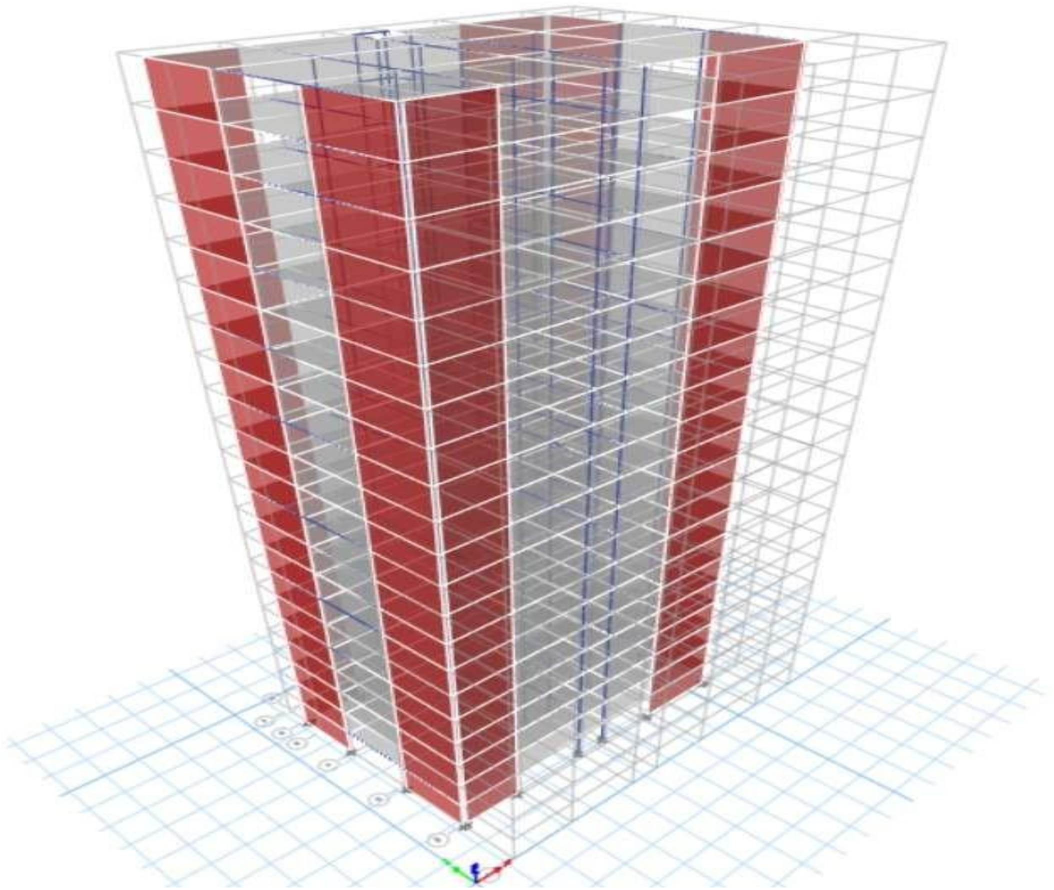
1. INTRODUCTION: -

Adequate stiffness is to be ensured in high rise buildings for resistance to lateral loads induced by wind or seismic events. Reinforced concrete shear walls are designed for Buildings located in seismic areas, because of their high bearing capacity, high ductility and rigidity. In high rise buildings, beam and column sizes work out large and reinforcement at the beam column junctions are quite heavy, so that, there is a lot of clogging. at these joints and it is a lot of clogging at these joints and it is difficult to place and vibrate concrete at these places which does not contribute to the safety of buildings. These practical difficulties call for introduction of shear walls in high rise buildings.

In a shear wall structure, shear walls are entirely responsible for the lateral load resistance of the building due to seismic and wind loadings. These shear walls act as vertical cantilevers in the form of separate planar walls around stair case, elevators and service shafts. Shear walls are much stiffer horizontally than rigid frames. Shear walls are much economical up to about 35 stories. In contrast to the rigid frames, the shear walls solid form tends to restrict open internal spaces where required. However, they are well suited to hotels and residential building where the floor-by-floor repetitive planning allows the shear walls to be vertically continuous. They also serve excellent acoustic and fire insulators between rooms and apartments.n a shear wall structure, shear walls are entirely responsible for the lateral load resistance of the building due to seismic and wind loadings. These shear walls act as vertical cantilevers in the form of separate planar walls around stair case, elevators and service shafts. Shear walls are much stiffer horizontally than rigid frames. Shear walls are much economical up to about 35 stories. In contrast to the rigid frames, the shear walls solid form tends to restrict open internal spaces where required. However, they are well suited to hotels and residential building where the floor-by-floor repetitive planning allows the shear walls to be vertically continuous. They also serve excellent acoustic and fire insulators between rooms and apartments.

STRUCTURAL FORMS

Lateral loads can develop high stresses, produce sway movement or cause vibration. Therefore, it



is very important to have sufficient strength for the structure against vertical loads. Earthquake and wind forces are the only major lateral forces that effect the buildings. The function of lateral load resisting systems or structure form is to absorb the energy induced by these lateral forces by moving or deforming without collapse. The determination of structural form of a tall building or high rise building would perfectly involve only the arrangement of the major structural elements to resist most efficiently the various combinations of lateral loads and gravity loads. The structural consideration. strongly influence the selection of structural form. The ability of the structural system and material to deform and absorb energy without collapse or fracture is termed as ductility. All these structural forms in three basic ways: bending or flexure, shear and axial tension or compression. The selection of structural forms is strongly influenced by the following range of factors has to be taken in to account.

1. The internal planning
2. The material and the method of construction
3. The nature and magnitude of the horizontal loading
4. The external architectural treatment.

5. The height and proportions of the building
6. The planned location and routing of the service systems

2. LITERATURE REVIEW: -

2.1 Saurabh Mishra, V.k. Singh et.al. (2018) conducted time history analysis of frames to identify effective position of shear wall in multi storey building. An earthquake load was applied to H-shaped twenty-one storey structure of four models with shear wall at different location in all seismic zones IV in ETABS 2016 software. Displacement, story drift, torsion results were developed for all four models and compare them and get the most effective location of shear wall in square shaped six storey building.
M.K. Akhil Krishnan et.al. (2016) conducted non-linear static analysis of frames to identify effective position of shear wall in multi storey building. An earthquake load was applied to a square shaped six storey structure of four models with shear wall at different location in all seismic zones IV in SAP2000 software. Displacement, story drift, ductility results were developed for all four models and compare them and get the most effective location of shear wall in square shaped six storey building. Umamaheshwara.
B, Nagarajan. P (2016) analyzed 15 storey irregular shaped building four model with different location of shear wall located in zone V by performing Seismic Coefficient Method (static method) and Response Spectrum Method on ETABS to calculate and compare base shear of all four models. From the analysis, it is concluded that the most effective location of shear wall for 15 storey RC irregular shaped building.

3. NUMERICAL MODELLING AND ANALYSIS: -

Geometrical properties
1. Height of typical storey = 3.5m
2. Height of ground storey = 3.5m
3. Length of building = 23.1m
4. Width of building = 9m
5. Height of the building = 21m
6. Number of stores 6 stories
7. Wall thickness = 230mm
8. Slab thickness = 150mm
9. Grade of the concrete = M 25 & M30.
10. Grade of the steel = Fe415
11. Thickness of shear wall = 230mm.
12. Support fixed
13. Column size 450X450mm
14. Beam size 450X600mm

DEAD LOAD

Dead load is taken as prescribe by the IS:875-1987 (Part-1) Code of practice design loads (other than earthquake) for buildings and structure. Unit weight of RCC 25 KN/m3 Unit weight of brick masonry 20 KN/m3 Floor finish 1.5 KN/m2 Water proofing 2 KN/m2 on terrace roof Wall load 13.8 KN/m on all floors expect terrace roof 6.9 KN/m on terrace roof

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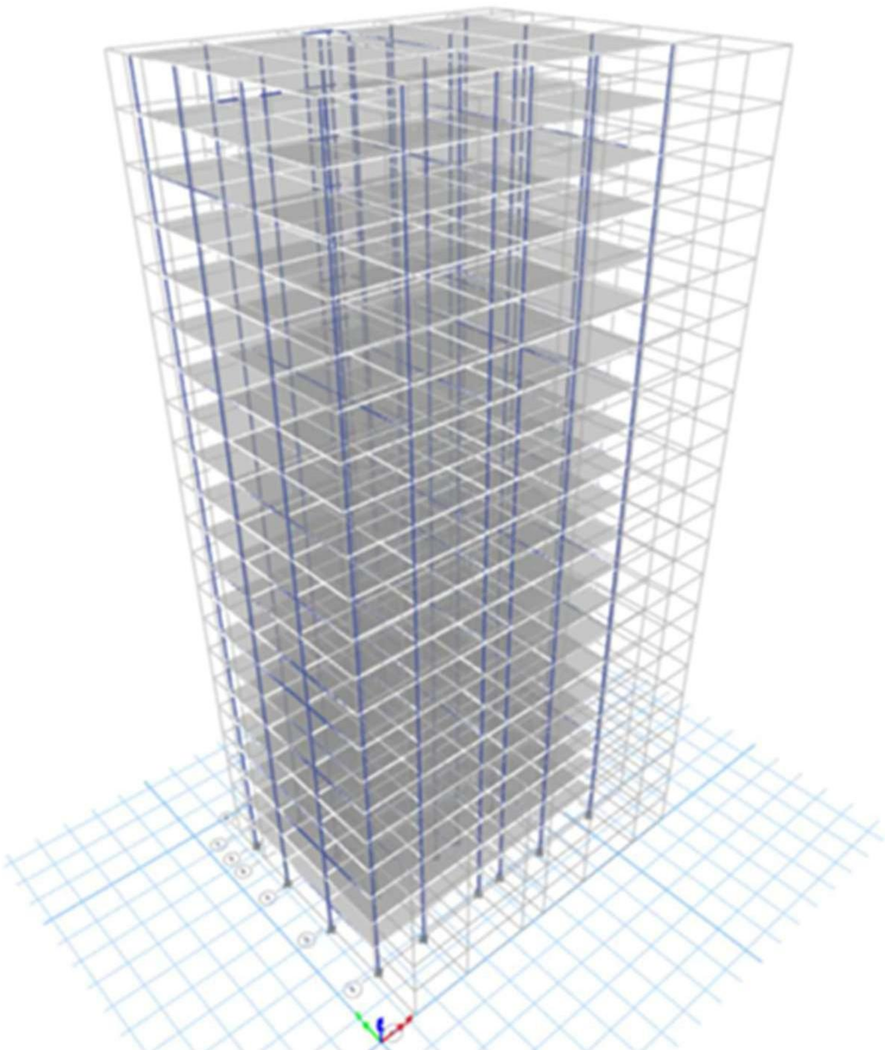
SEISMIC LOADING

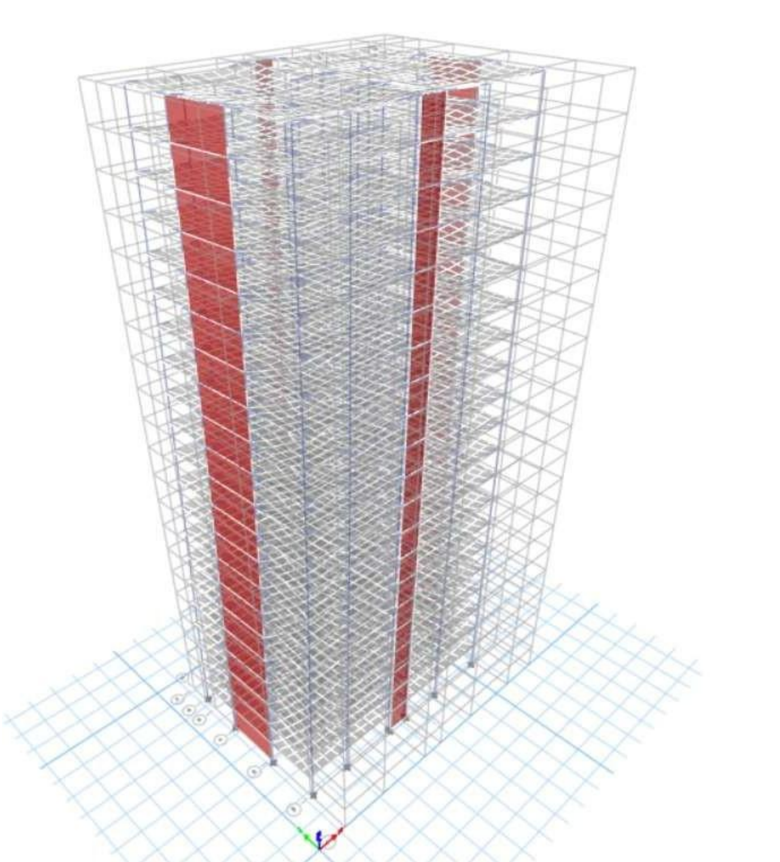
In the present work the building located in Hyderabad which comes under zone-II using the IS 1893-PART-1 2002 (1) the following are the various values for the building considered as per the Geometric properties.

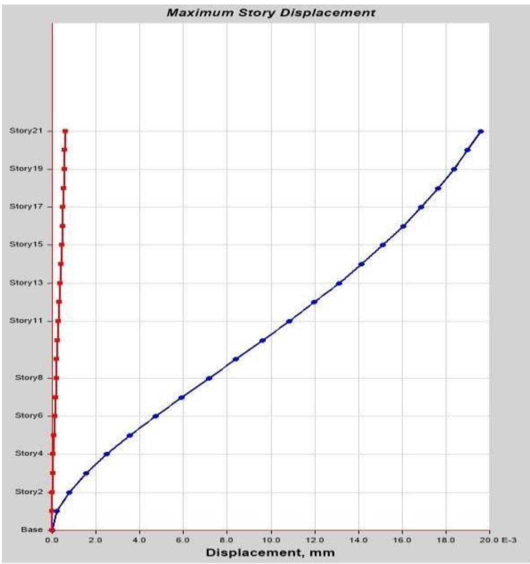
LOAD COMBINATIONS

As per IS 875: 1987 (part-5)

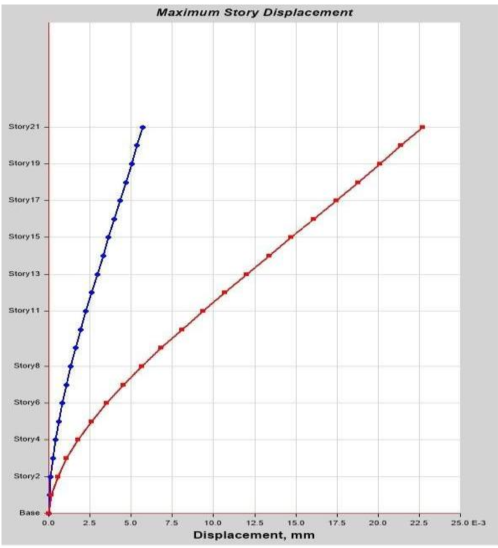
1. 1.5(DL+LL)
2. 1.5(DL+WL)
3. 1.5(DL+EQL)
4. 1.2(DL+LL+EQL)
5. 1.2(DL+LL+WL)





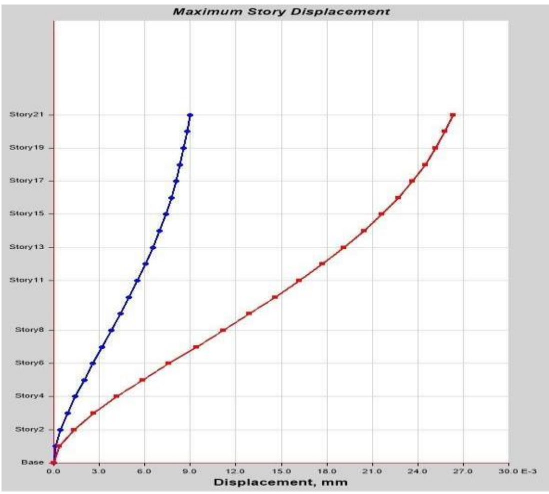


CENTRE SHEAR WALL GRAPH



CORNER SHEAR WALL GRAPH

Case	Mode	Period sec
Modal	1	1.631
Modal	2	1.61
Modal	3	0.971
Modal	4	0.361
Modal	5	0.342
Modal	6	0.213
Modal	7	0.16
Modal	8	0.147
Modal	9	0.099
Modal	10	0.095
Modal	11	0.089
Modal	12	0.073



WITHOUT SHEAR WALL GRAPH

Case	Mode	Period sec
Modal	1	2.705
Modal	2	2.322
Modal	3	1.714
Modal	4	0.773
Modal	5	0.517
Modal	6	0.387
Modal	7	0.372
Modal	8	0.22
Modal	9	0.219
Modal	10	0.163
Modal	11	0.147
Modal	12	0.129

Case	Mode	Period sec
Modal	1	4.332
Modal	2	3.507
Modal	3	2.966
Modal	4	1.319
Modal	5	1.069
Modal	6	0.897
Modal	7	0.683
Modal	8	0.556
Modal	9	0.462
Modal	10	0.418
Modal	11	0.341
Modal	12	0.285

CONCLUSION:

- Based on the study, it has been observed that providing of shear wall to the structures can contribute in increase in stiffness of the structure.
- The displacement is reduced in buckling with shear wall compared to the building without shear wall.
- The building with shear wall has more earthquake resistance compared to the building without shear wall.
- The time period decreases in the building with shear wall when compared to the building without shear wall.

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