A Comparative Study on RCC Structure with and without Shear Wall

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Abstract---Now days tall buildings are provided with shear walls to improve the lateral load resistance. In the present paper we are study the solution for shear wall location and type of shear wall in seismic prone areas. The effectiveness of RCC shear wall building is studied with help of four different models. Model one is bare frame system and remaining three types are different shear wall buildings. An earthquake load is applied to 8 storey building located in different zones. The performance of building is evaluated in terms of lateral displacements of each storey. The analysis is done by using structural finite element analysis (SAP2000) software.

Keywords: building, finite element analysis,model, SAP2000, seismic, shear wall.

I. INTRODUCTION

Reinforced concrete shear wall structures wide space in many earthquake regions, Such as India, Canada, Turkey and Chile. Shear walls are vertical elements of horizontal force resisting system. They are usually provided in tall buildings to avoid collapse of buildings under seismic forces. Shear wall buildings are usually regular in plan and elevation. Shear walls are usually provided between columns, stairwells, lift wells, toilets, and utility shafts.

When walls are situated in advantageous positions in a building, they can be very efficient in restating lateral loads originating from wind or earthquakes .large portion of the lateral loads on the buildings and horizontal shear force resulting from the load are often assigned to structural elements they have been called shear wall. RC buildings with shear wall also have columns; these columns primarily carry gravity loads. Reinforced concrete shear walls classifications (Fig.1) are bar bell type shear wall, coupled shear wall, rigid frame shear wall, and framed shear wall with in filled frames, column supported shear walls and core type shear wall. Out of this shear walls rectangle type shear wall, core type shear wall, and coupled type shear walls are used for analysis. Rectangular type shear wall are formed by columns and walls in between. Core type shear walls have good resistance to torsion. In this present paper one model for without shear wall Rcc (G+7) building and three models are different types of shear wall buildings are generated in SAP 2000 software.

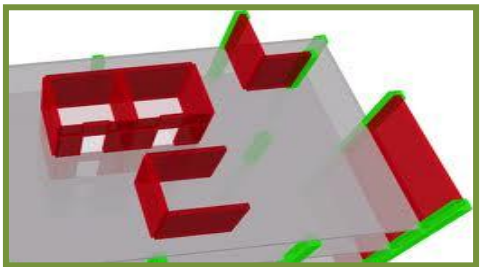

Fig. 1: types of shear wall

So many Literatures are available for design of RCC shear walls. However less discussion about the location of shear wall and suitable type of shear wall for RCC buildings. More shear walls are uneconomical in low earthquake intensity areas. Shear wall should provided suitable position to resist the lateral forces. Some times more number of shear walls is not economic. Shear walls are provided proper location in the building and reduce the collapse of structure.

II. LITERATURE REVIEW

M. D. Kevadkar and P. B. Kodag have done lateral load analysis of R.C.C. Building (G+12) by considering 3 models. Out of this 1st model is without bracing and shear wall, 2nd model with different shear wall system and 3rd Model with Different bracing system the computer aided analysis is done by using E-TABS to find out the effective lateral load system during earthquake in high seismic areas. The performance of the building is evaluated in terms of Lateral Displacement, Storey Shear and Storey Drifts, Base shear and Demand Capacity (Performance point).

Anshuman.S et al. determined the solution for shear wall location in multistory building based on its both elastic and elastoplastic behaviors. An earthquake load is calculated and applied to a building of fifteen stories located in zone IV. Elastic and elastoplastic analyses were performed using both STAAD Pro 2004 and SAP (2000) software packages. Shear forces, bending moment and story drift were computed in both cases and location of shear wall was established based upon the results.

Romy Mohan and C Prabha are presented Dynamic Analysis of RCC buildings with Shear Wall. for analysis consider the two multi storey buildings, one of six and other of eleven storeys have been modeled using software package SAP 2000 for earthquake zone V in India. Six different types of shear walls with its variation in shape are considered for studying their effectiveness in resisting lateral forces. This paper also deals with the effect of the variation of the building height on the structural response of the shear wall.

O.Esmaili et al. study on structural RC shear wall system in a 56-Story Rcc tall building. In this tower shear wall system with irregular openings are utilized under both lateral and gravity loads. To have a seismic evaluation of the tower, a lot of non-linear analyses were performed to verify its behavior with the most prevalent retrofitting guidelines like FEMA 356. In this paper some especial aspects of the tower and the assessment of its seismic load bearing system with considering some important factors will be discussed.

III. MODELING

For this modeling, an 8-storey building with 3m height for each storey, 40m in X direction and 24m in Y direction. Regular in plan is modeled as shown in Fig.2. These buildings assumed to be fixed at the base and floor is acts as diaphragm. The story height of building is constant including ground story. the building are modeled using software SAP 2000.four different types of models were studied with different types of shear walls and different positioning of shear wall in building. Models are studied in four zones.

A. The plan of the building models are given below

- Model 1- Floor plan of the bare framed structure as shown in Fig.3.
- Model 2 - Floor plan of the core type at lift wells and rectangle type shear wall frame structure as shown in Fig.4.
- Model 3- Floor plan of the coupled type with openings and core type shear walls at lift wells of frame structure shown in Fig.5.
- Model 4 - Floor plan of core type shear walls at the lift wells and four corners of framed type structure as shown in Fig.6.

Dead load and live load have been taken as IS 875 (part-1) and IS 875(part-2) respectively.

B. Preliminary data

No of stories	G+7
Floor to Floor height	3m
Beam size	300 x 450 mm
Column size	450 x 600 mm
Thickness of shear wall	250 mm
Thickness of slab	125 mm
Grade of concrete	M30
Grade of steel	Fe 415

Table. 1: Modeling Details

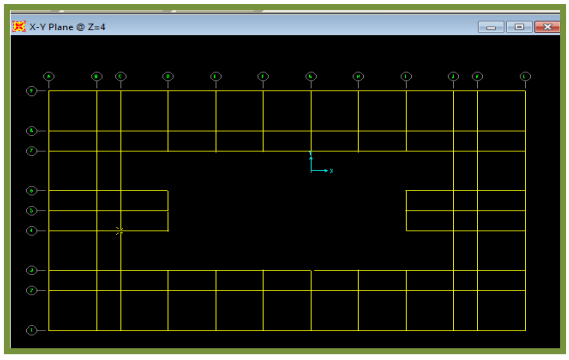

Fig. 2: Floor Plan of the building

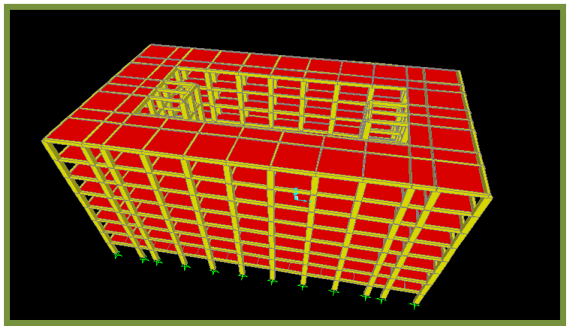

Fig. 3: 3D Model-1

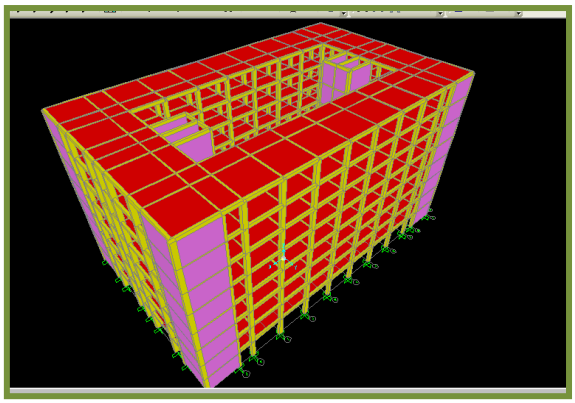

Fig. 4: 3D Model-2

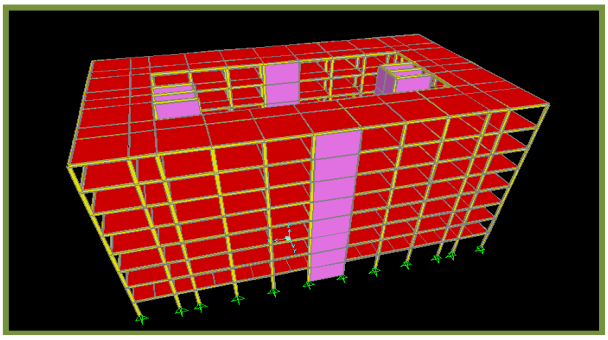

Fig. 5: 3D Model-3

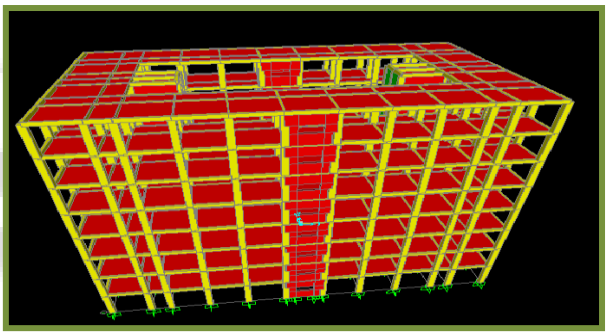

Fig. 6: 3D Model-4

IV. RESULTS AND DISCUSSIONS

Analysis of G+7 storied bare frame models and different types shear wall model is done using sap 2000 software, from the response spectrum analysis results obtained, four model results are compared.

A. Lateral displacement

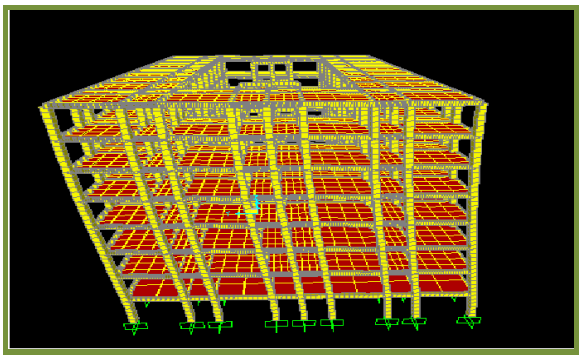

Fig. 7: Deformed shape of bare frame model.

Lateral displacements for all four zones are shown in below graphs.

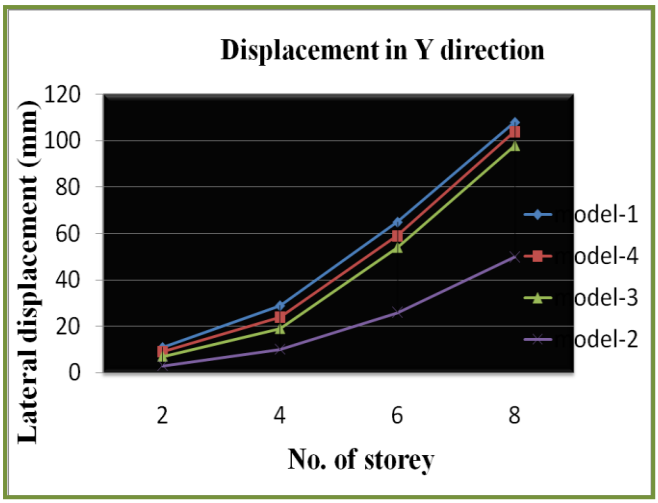

Fig. 8: Model displacement in zone V

The lateral displacement of bare frame model is 84mm in X direction and 108mm in Y direction in zone V. Corner type shear wall reduce by 50% displacement in Y direction. Rectangle type shear wall controls the 15% in Y direction.

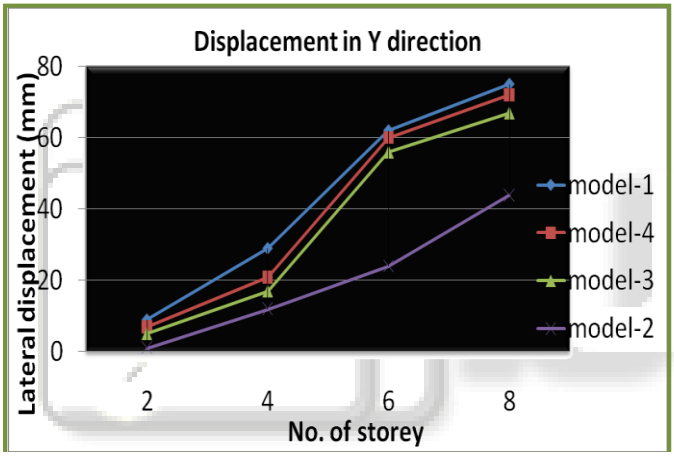

Fig. 9: Model Displacements in zone IV

In this zone rectangle shear wall model controls the 25% of bare frame displacement in Y direction and 50% reduce in X direction.

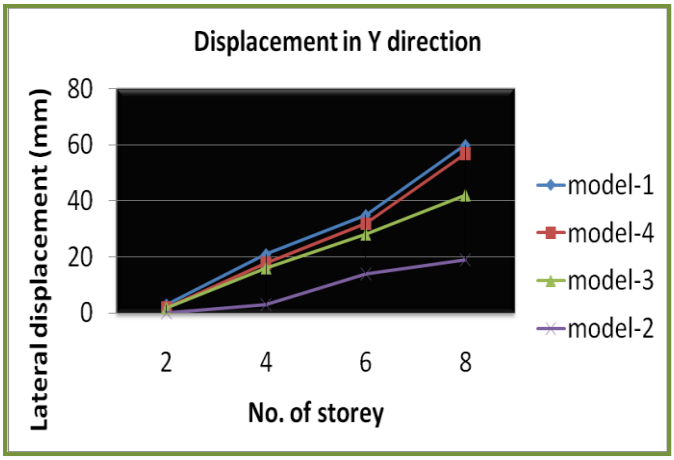

Fig. 10: Model Displacements in zone III

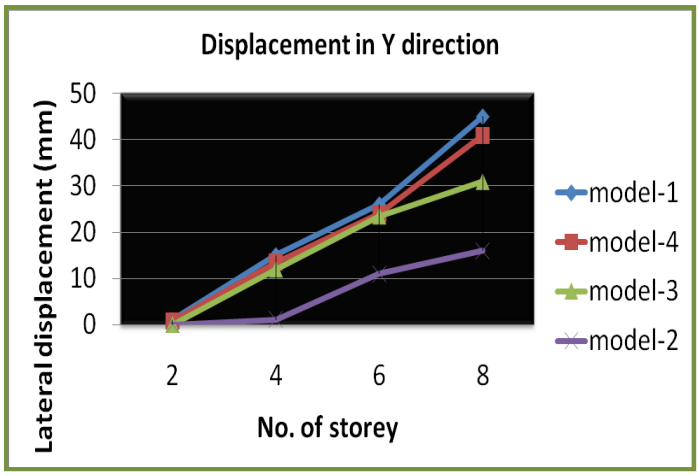

Fig. 11: Model Displacements in zone II

B. Bending moment and sheer force variation of corner type shear wall

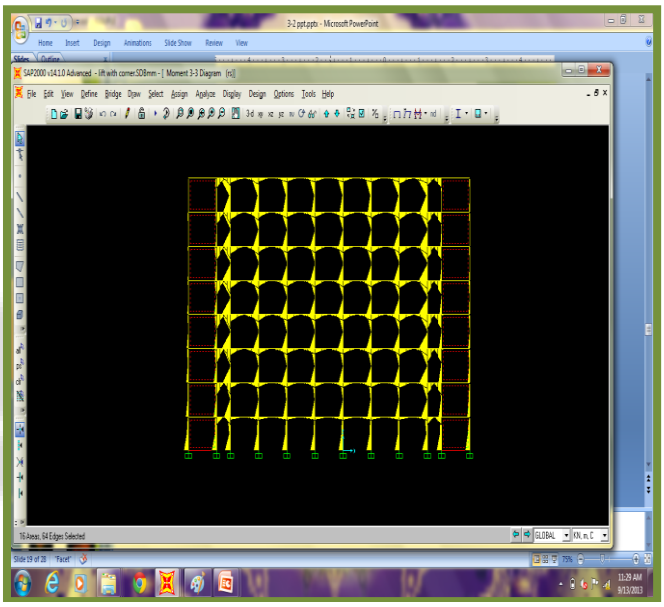

Fig. 12: bending moment diagram

Corner type shear wall reduce the bending moment in the corners of the building. So it will be reduce the twisting effect of building.

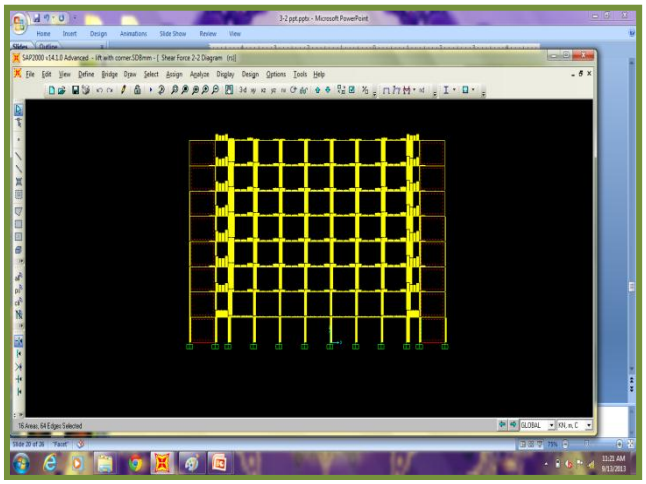

Fig. 13: Shear force diagram.

V. CONCLUSION

- From the above response spectrum analysis it is observed that the corner type shear wall (model 2) is less deflection and compared to all other models.
- In zone V and IV like high earthquake intensity areas provide shear walls on all four corners and centroid of the building to reduce deflection in X and Y direction.
- Corner core type shear wall reduce shear force and bending moment of building.
- React angle type shear wall (model 3) is suitable for zone III. The deflection of this model is allowable range of X and Y direction of building in zone III.
- Coupled type shear wall with openings (model 4) is allowable deflection in zone II.

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