International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 05, May 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

COMPARATIVE ANALYSIS OF LATERAL LOAD RESISTING SYSTEM WITH PLAN IRREGULARITY

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ABSTRACT

The case study in this paper mainly emphasizes on structural behavior of multi-storey building for different plan configurations like rectangular, C, L and T -shape. Modeling of 20- storeys R.C.C. framed building is done on the ETABS software for analysis. Post analysis of the structure, maximum shear forces, storey Drift, and maximum storey displacement are computed and then compared for all the analyzed cases.

Index Terms - Dynamic analysis, ETABS, plan Irregular structure, response spectrum analysis, and seismic forces.

I. INTRODUCTION

Tall buildings are the most complex built structures since there are many conflicting requirements and complex building systems to integrate. Today's tall buildings are becoming more and more slender, leading to the possibility of more sway in comparison with earlier high-rise buildings. Thus the impact of wind and seismic forces acting on them becomes an important aspect of the design. Improving the structural systems of tall buildings can control their dynamic response.

With more appropriate structural forms such as shear walls braced frame, diagrid and improved material properties, the maximum height of concrete buildings has soared in recent decades. Therefore; the time dependency of concrete has become another important factor that should be considered in analyses to have a more reasonable and economical design.

II. OBJECTIVE

i) To study the seismic performance of typical RC buildings

ii) To analyse the building under the influence of plan irregularity on the different type of structures.

iii) To study Design and Analysis software ETAB- 2015

iv)\compare the results after response spectra analysis in ETAB software

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III. REINFORCED CONCRETE SHEAR WALL

For the evaluation purpose a normal building with 20 Storey is considered. In order to make building more sustainable shear wall having 125 mm thickness is taken.

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ISSN (O) 2319 - 8354
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Location of Shear Wall is an important part which affects the response of a structure. In case of irregular structure, shear walls at end side perform better in major number of cases.

Three irregular structures having plan irregularities. (T L C.) And two systems i.e. moment resisting frame and shear wall system (dual system) for zone IV are considered. For irregular structural in x-direction there are 6 bays, each of 3 m width and in z-direction also there are 6 bays, each of 3 m width.

Reinforced concrete walls, which include lift walls or shear walls, are usual requirement of reinforced concrete multistory buildings. Constructing the shear wall in tall, medium and even short buildings will effect and intern reinforce the significantly and either more economical than the bending frames. By the shear, we can control the side bending of structure, much better than other elements like closed frames and certainly the shear walls are more flexible than them. However, in many occasions the design has to be based on the position of the lift and stair case walls with respect to the center of mass.

Twisting moments in the members are observed to be having increasing trend with enhancement in the eccentrically between geometrical centroid of the building and shear wall position. They concluded that shear wall should be placed at a point by coinciding center of gravity of the building. But the nature of stresses generated in the shear wall according to its position is also different. The shear wall kept at very near to the center of stiffness act as a vertical bending element and the shear wall kept at corner of the building are may be compression or in axial tension according to the direction of the lateral force.

IV. BRACED FRAMES

Braced Frames are usually designed with simple beam to- column connections where only shear transfer takes place but may occasionally be combined with moment resisting frames. In braced frames, the beam and column system takes In the analysis, only the tension brace is considered effective. Braced frames are quite stiff and have been used in very tall buildings. Trussing, or triangulation, is formed by inserting diagonal structural members into rectangular areas of a structural frame. It helps stabilize the frame against sideways forces from earthquakes and strong winds.

4.1 Modelling Details

Building description	
Length x Width	18m x 18m
No. of storey	20
Storey height	3.65
Beam dimensions	500x700
Column dimensions	700x700
Slab thickness	125
Thickness of main wall	230
Height of parapet wall	.90
Thickness of parapet wall	115
Support conditions	fixed
Brace dimension	300 x 300

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ISSN (O) 2319 - 8354
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Material Description	
Grade of Concrete	fck= 30N/mm2
Grade of Steel	fy= 500N/mm3
Density of Concrete	Ɣc= 25kN/mm3
Density of Brick walls considered	brick= 20kN/m3

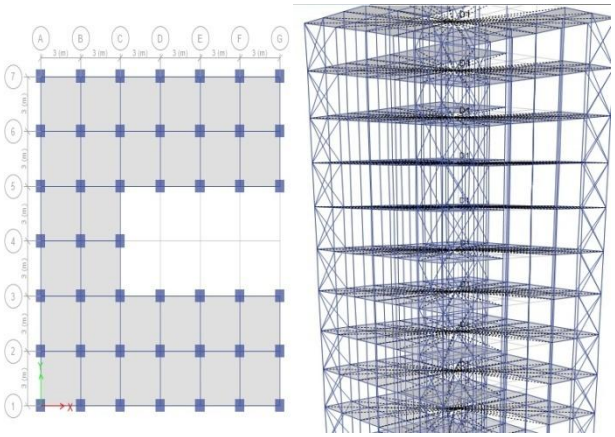
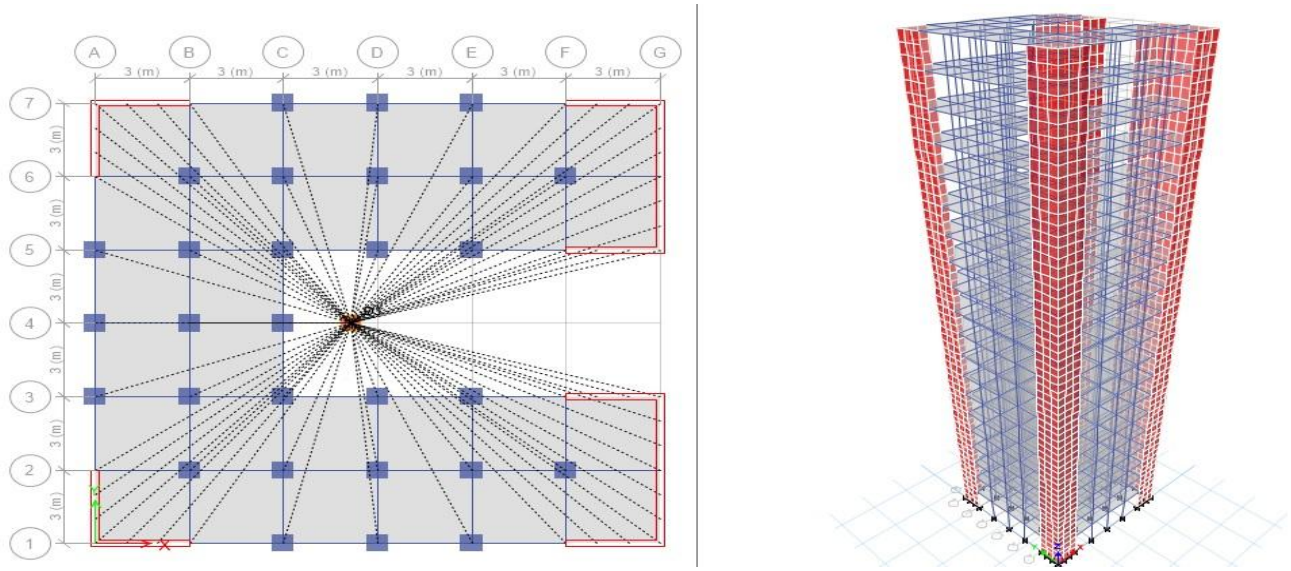


Fig. 1. a)Plan of Moment Resisting Frame C-Section building

b)Plan of Braced frame system

Plan bracing takes the form of diagonal members, usually angle sections, connecting the compression flanges of the main beams, to form a truss when viewed in plan. This makes a structure that is very stiff in response to lateral movement. With lateral movement of the compression flanges thus resisted, the half wave length for buckling is reduced to the length between bracings.



c) Plan of shear wall system

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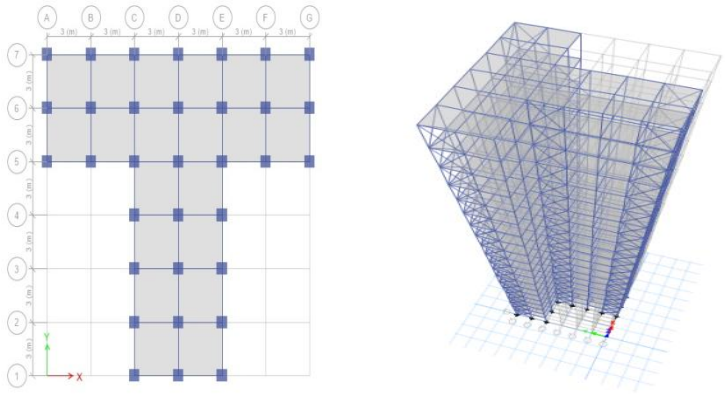


Fig. 1. a)Plan of Moment Resisting Frame C-Section building
b)Plan of Braced frame system

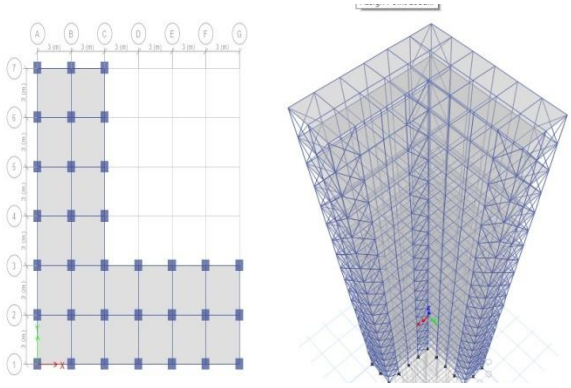
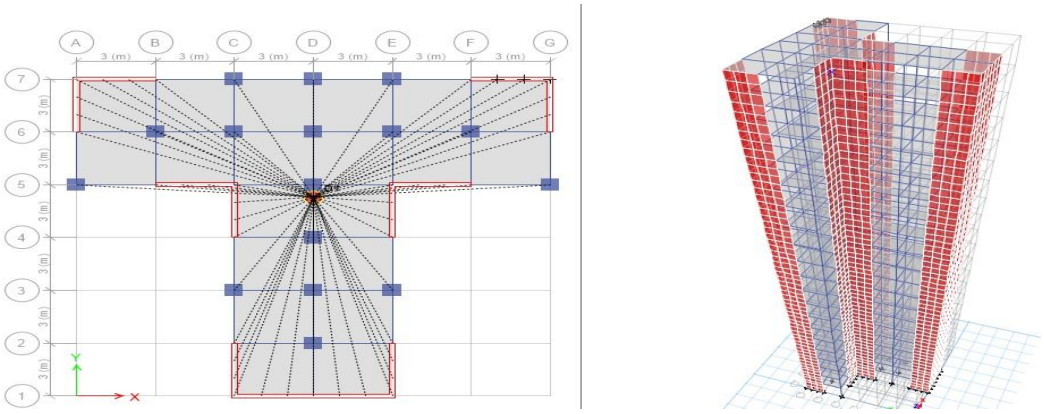


Fig. 1. a)Plan of Moment Resisting Frame L-Section building
b)Plan of Braced frame system

V. RESULTS AND DISCUSSIONS

The 3-D models discussed in the above section are modeled in ETABs software and is analyzed by Response Spectrum Method. The structural responses like lateral displacements, storey shears, storey drifts are compared and presented.



c) Plan of shear wall system

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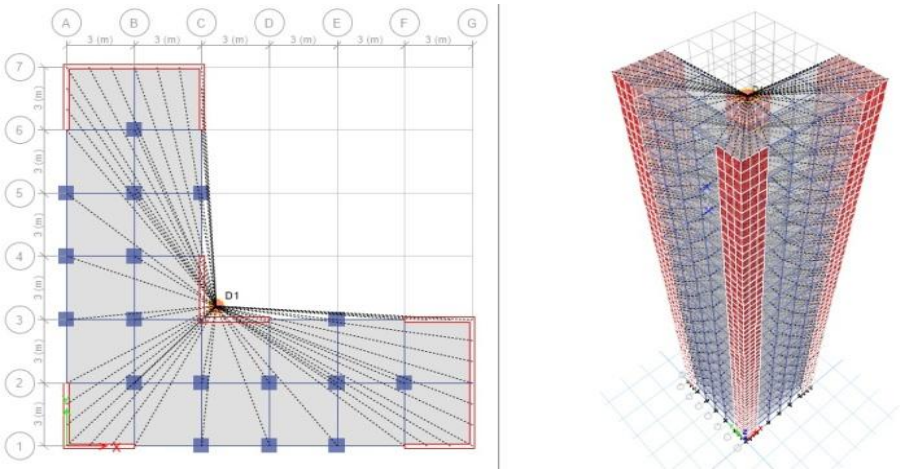

c) Plan of shear wall system

1. Lateral Displacement in X- direction

The comparative study of Lateral Displacements in structures with increasing Height is shown in graph below.

a) 20 m height: a) For C- Section

b) **For L- Section**

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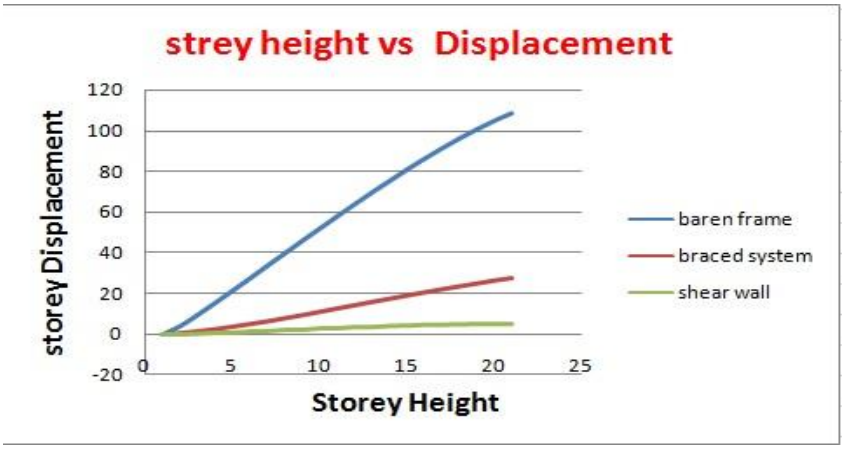
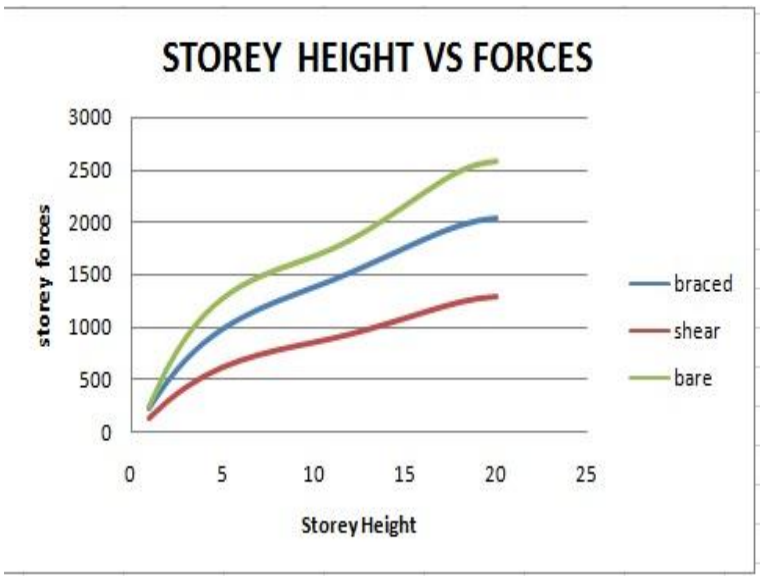
c) **For T- Section**



ii) Maximum storey Forces in X-direction:

a) For C- Section

b) For L- Section:-



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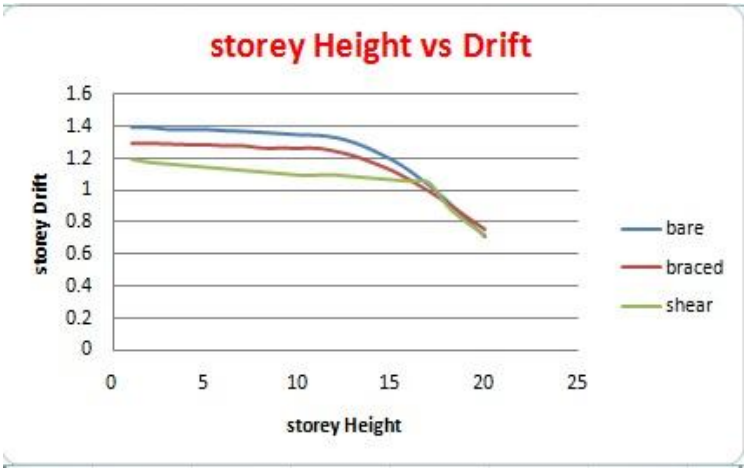
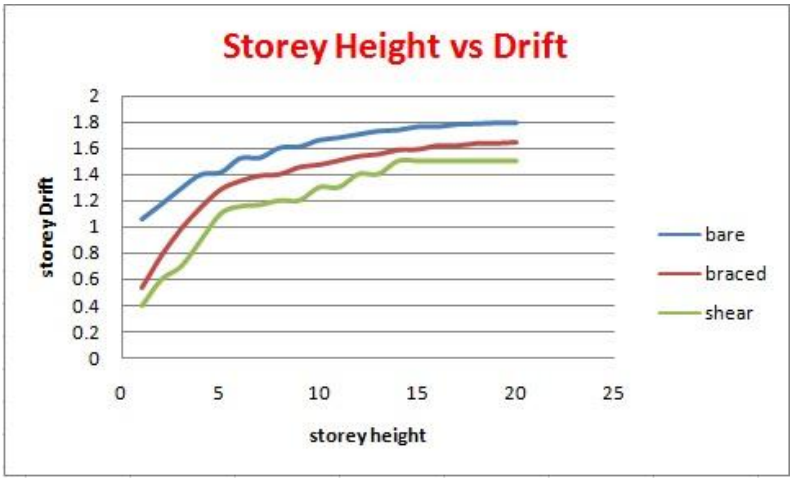
c) For T- Section:-

iii) Maximum storey Drift in X-direction:

a) For C- Section



b) For L- Section :-



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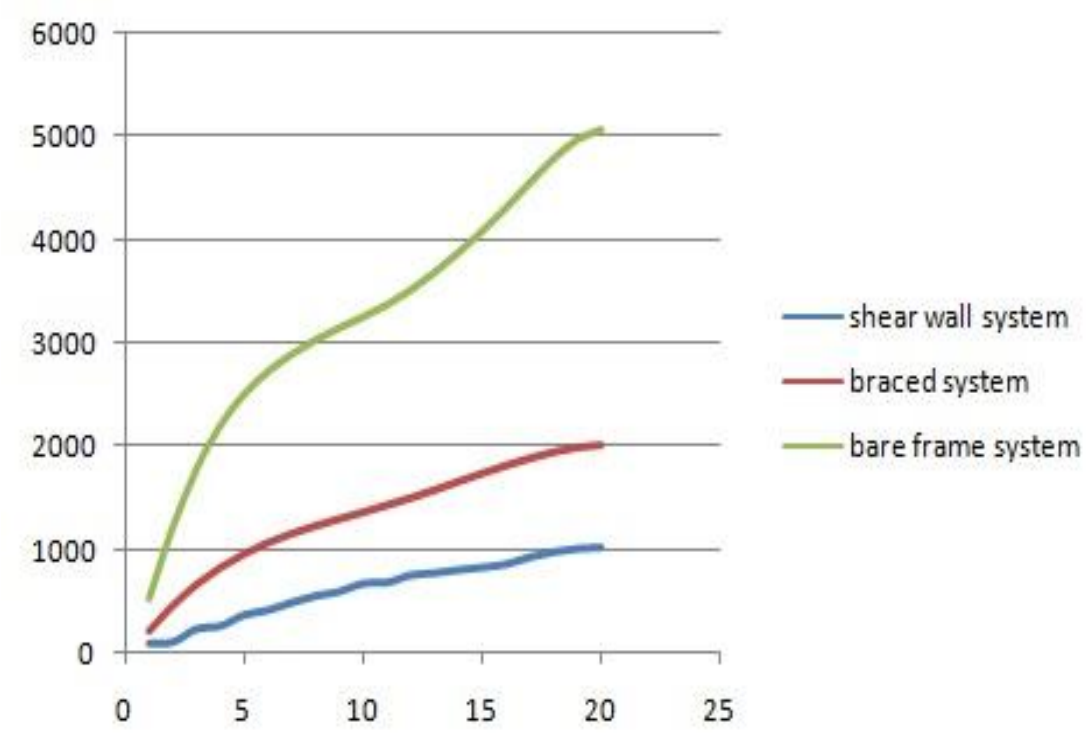
c) For T- Section:-



VI. CONCLUSION

On the basis of analysis and results, the following conclusion has been made:-

1) With the introduction of shear wall, storey displacement and storey drift decreases compared to moment resisting system and bracing system.

2) Storey forces are greater in moment resisting frame than shear wall system nearly by 37 % and bracing system by 16 %.

3) Time period is also less in shear wall system as compared to moment resistant frame and bracing system as well.

4) Response spectrum analysis results provides a more realistic behavior of structure response and hence it can be seen that the displacement values in both X and Y directions are least in model with shear wall

5) Shear wall system is more economical by 26 % than moment resisting system for given data. But same for bracing system

VII. SCOPE FOR FUTURE RESEARCH

The volume of work undertaken in this study is limited to comparison of seismic response parameters in a building with shear wall in different shapes using linear. The study could be extended by including various other parameters such as torsional effects and soft storey effects in a building .Non linear dynamic analysis may be carried out for further study for better and realistic evaluation of structural response under seismic forces.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

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