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Coupled Continuous Analytical Behavior of High-Rise Structural System Sensitive to Lateral Loads

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Abstract - : It is well known that high-rise buildings act as very important roles in modern cities. First of all, tall buildings can be effectively used to meet the requirements of modern society and solve the problem of limitation of construction site resources. On the other hand, they are the signals of economic properties and civilization. Nowadays high-rise buildings rise higher and higher, with more and more complex and individual plan and elevation, such as, from the point of structural properties, high-rise buildings have the following characteristics,
The height exceeding the limitation of present codes;Extremely irregular shape, including in plan and elevation;The distribution of mass and lateral stiffness is sharply changed along the height;Mega-member with huge space and large span,;Flexible weak connection between towers;New construction materials, methods and details.

***Key Words*:** wall,Structural wall, Connecting jionts.

1.INTRODUCTION *(Size 11, Times New roman)*

The structural type used was the traditional beam-column frame system which made the construction of taller buildings relatively expensive and, therefore, economical point of view it is unfeasible. In the early 1950s, the introduction of shear wall type of construction opened up the possibility of using concrete in apartment and office buildings as high-rise buildings to make a structure economical but Taller buildings still remained economically unattractive, and technically inadequate, because the shear walls which were mostly used in the core and externally/internally of the building were relatively small in dimension compared to the height of such buildings, leading to insufficient stiffness to resist lateral loads and also observe that the shear wall not necessary to provide to whole height of the buildings. Shear wall can curtail up to 50% height of the buildings. It was obvious that the overall dimensions of the interior cores and external and internal shear wall were too small to economically provide the stability and stiffness for high-rise buildings. The natural tendency then was to find new systems that would utilize the perimeter configurations of such buildings rather than to rely on the shear wall alone. The development of the high-rise building system was, therefore, a logical outcome of this challenge. To overcome this challenge introduced new concept of infill wall, here a large number of reinforced concrete and steel buildings are constructed with masonry infill but it is not considered as a structural element. Nowadays infill wall considered as a structural element and it responsible for enhances considerably the strength and stiffness of the structure. Here the structure can improve their strength and stiffness by using infill wall with shear wall and also shear wall can curtail up to certain height which gives better result, which is comparatively very effective than the bare frame.

2. RELATED WORK

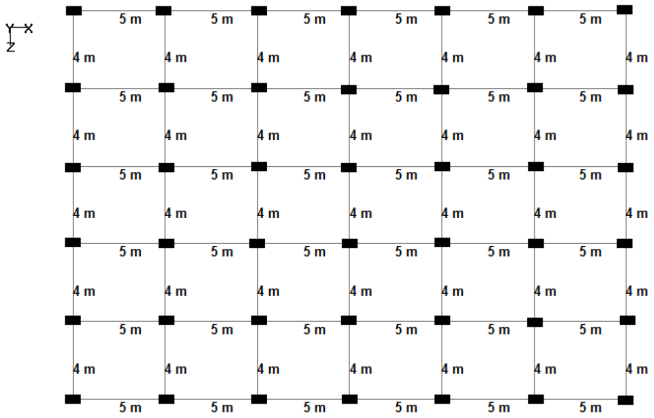
[1]P.PChandurkar and Dr. P. S. Pajgade (2017) did a detail study to determine the solution for shear wall location in multi-storey building with the help of four different models. The buildings were modeled using software ETAB Nonlinear v 9.5.0.After analyzing ten storey building for earthquake located in zone II,zone III,zoneIV and zoneV essential parameters like lateral displacement,story drift and total cost required for ground floorwere found in both the cases by replacing column with shear wall and conclusion was drawn that shear wall in short span at corner (model 4) is economical as compared with other models.It was observed that shear wall is economical and effective in high rise buildings and providing shear walls at adequate locations substantially reduces the displacement due to earthquake. If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall**.[2] Varsha R. Harne (2017)** analyzed a six storey building subjected to earthquake loading in zone II using STAAD Pro andcalculated earthquake load using seismic coefficient method (IS 1893 Part II). Four different cases were analyzed comprising of a structure without shear wall, structure with L type shear wall, structure with shear wall along periphery, structure with cross type shear wall. The lateral deflection of column for building with shear wall along periphery is reduced as compared to other types of shear walls .It was found that shear wall along periphery is most efficient among all the shear walls considered.

3. METHODOLOGY

Shear walls are not only designed to resist gravity / vertical loads (due to its self-weight and other living / moving loads), but they are also designed for lateral loads of earthquakes / wind. The walls are structurally integrated with roofs / floors (diaphragms) and other lateral walls running across at right angles, thereby giving the three dimensional stability for the building structures. But shear wall in high-rise buildings still remained economically unattractive, and technically inadequate, so here infill wall considered as a structural element in design calculation to make structure economical. Now the objective of this research is that the significant amount of literature survey must be carried out on the consideration of stiffness effect of infill panels with shear walls and its construction details. Analyze the high-rise building structure with considering the shear wall and infill wall also required brief study on behavior of the structure in seismic and wind load condition. This can be done by making some models in the software like STADD ProV8i and ETAB.

4. EXPERIMENTAL RESULTS

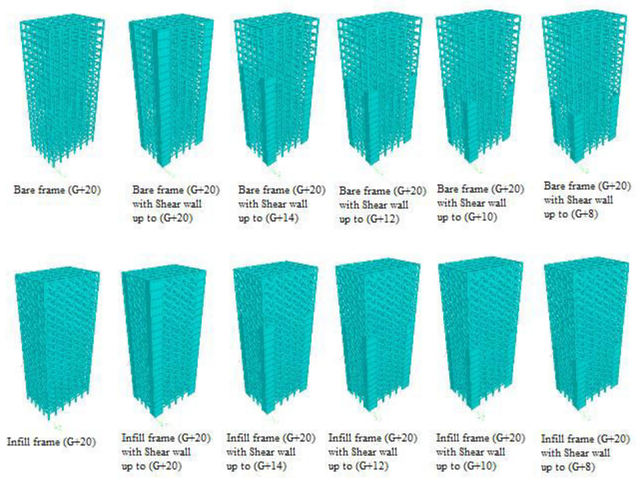
The floor plan of a typical public building is shown in fig. Thus, entire building space frame can be divided into a number of vertical frames with simple symmetrical plan having 6 bays (column to column distance 5m) in X-direction and 5 bays (column to column distance 4m) in Z-direction. The building is G+20 storeys' with ground storey height is 4m and floor to floor height is 3.35 m. The building is assumed to be located in a seismic zone III and ground floor acts as a soft storey or weak storey.



Plan of typical public building

It has total 12 models with different features. As per literature survey, the location of the shear wall affects the result of analysis of the building. The shear wall located in each corner of the building in both directions gives better results. Therefore, in some models shear wall provided at each corner of the building in both directions and also in this analysis in some models, here considered infill wall or masonry wall as a structural element. The geometric and material properties of the equivalent diagonal strut are required for conventional braced frame analysis to determine the increase stiffness of the infill frame. Therefore, by using equivalent diagonal strut method to covert the infill wall (without opening) into equivalent diagonal strut which is provided in both X and Z direction in models.

So here our aim is to find out that infill frame with shear wall in structure can gives better results than the RC frame with shear wall, therefore here we must going to analyze some models on STADD ProV8i or ETAB with different conditions, like bare frame, frame with shear wall and frame with shear wall and infill wall as shown in fig.



By using analysis methods like equivalent static lateral force method, response spectrum method and time history method analyzed these models to understand behavior of the structures from their results.

5. CONCLUSION

Much of a literature review has presented in the form of technical papers till date on the shear wall and infill wall. Different issues and the point are covered in this literature survey. The structural type used was the traditional beam-column frame system which made the construction of taller buildings relatively expensive and unstable in wind seismic loading, therefore, the structure in design, construction and economical point of view it is unfeasible. High-rise structures can be stabilized against the effects of strong horizontal wind loading and seismic loading by introducing shear wall in structure. Shear walls are vertical elements of the horizontal force resisting system, but shear wall with building also have some limitation in construction and design when structure is more slender. It is economically unattractive. So to overcome this problem, structural engineer consider infill wall as a structural element in structure. It is existing element in a structure simply called as a masonry wall or partition wall. Infill wall also provide strength and stiffness to the structure. It can be consider in structure with the shear wall, but in India as per IS code infill wall is not considered as a structural element. For this so much literature survey is carried out in this project to understand the behavior of the shear wall and infill wall. The following conclusions are drawn based on present work which are very use full in future study.

- Shear wall has high in plane stiffness and strength which can be used to simultaneously resist large horizontal loads and support gravity loads.

- The deflection is reduced drastically by introducing shear wall at corner of the structure along both directions.

- Changing the position of shear wall will affect the attraction of forces, so that wall must be in proper position.
- Steel bracing has more margin of safety against collapse as compare with shear wall

- Providing shear walls at adequate locations substantially reduces the displacements due to earthquakes.
- The presence of infill can guarantee higher overall stiffness and strength, reducing the inter-storey drift demand of the structure.
- The opening size of the infill has a significant influence on the fundamental period, inter-storey drift ratios, infill stresses and the structural member force, Generally they increase as the opening size increases, indicating that the decrease in stiffness is more significant than the decrease in mass.
- Deflection in case of centre opening is large compare to corner opening.

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