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Design And Analysis of High Rise Building Under Different Type of Soil Condition with and Without Shear Wall Using ETAB Software

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Abstract - The structural system of a high-rise building with Shear walls are lateral load resisting structural systems which provide stability to structures from lateral loads like wind and seismic Loads. The design of multi-storey building it is generally constructed on assumed that underlying soil are Hard, Medium and Soft. A Multi-storey building with RC-Shear wall is to have good lateral load resisting System along with gravity load system for safety of occupant and for better performance of structure even in most adverse condition. As a result, the accuracy in assessing structural safely during earthquake cannot be accounted accurately. So investigation of energy transfer mechanism from soils to buildings during earthquake is vital for the design of earthquake resistant structures and for retrofitting existing structures. Hence the soil -structure interaction analysis of framed structures is the main focus of this study. The effects of soil-structure interaction are analyzed for typical multi- storey building resting on different soils. In Our Project contains a brief description and analysis of Symmetrical frame having 30 storey building with shear wall and without shear wall with different types of soil condition for highly seismic area i.e. zone-5, thoroughly discussed structural analysis of a building to explain the application of shear wall. The design analysis of the multi storied building in our project is done through software ETABs.

Key Words: Story displacement, story shear, Seismic analysis and Comparison, ETABS, Base Shear.

1.INTRODUCTION

Reinforced concrete framed buildings are adequate for resisting both vertical and the horizontal loads acting on them. When the buildings are tall say more than 10 storey's or so, beam and column sizes work out large reinforcement at beam-column junctions works out quite heavy, so that there is a lot of congestion at these joints and it is difficult to place and vibrate concrete at these places, which fact, does not contribute to the safety of buildings. These practical difficulties call for introduction of shear wall in multi-story buildings. A shear wall is a structural element used to resist lateral/horizontal/shear force parallel to the plane of wall is called shear wall.

- Shear wall resist the lateral or horizontal force by cantilever action for slender wall where bending deformation is dominant.
- Shear wall resist the lateral or horizontal force by truss action for short wall where shear deformation is dominant.

In India most of the structures are low rise buildings. Now a days due to greater migration towards cities, results in increase in the population in most of the major cities. In order to fulfill the requirement of this increased population in limited land the height of building becomes medium to have high rise buildings. The improper design and construction of building may cause great destruction of structures all over the world. Hence, we have to be concerned about the safety against the earthquake forces that are affecting the structures. The major factor is the asymmetry of the building the asymmetry contributes significantly for translational torsional coupling in the seismic responses which can lead to lateral deformation of the building. Buildings with asymmetric distribution of stiffness and strength in plan undergo coupled lateral and torsional motions during earthquake. . High-rise buildings were made practicable by the use of steel structural frames and glass exterior sheathing. By the mid-20th century, such buildings had become a standard feature of the architectural landscape in most countries in the world. The foundations of high-rise buildings must sometimes support very heavy gravity loads, and they usually consist of concrete piers, piles, or caissons that are sunk into the ground. Beds of solid rock are the most desirable base, but ways have been found to distribute loads evenly even on relatively soft ground. The most important factor in the design of high-rise buildings, however, is the building's need to withstand the lateral forces imposed by winds and potential earthquake. Most high-rises have frames made of steel or steel and concrete. Their frames are constructed of columns (vertical-support members) and beams (horizontal-support members). Cross-bracing or shear walls may be used to provide a structural frame with greater lateral rigidity in order to withstand wind stresses. Even more stable frames use closely spaced columns at the building's perimeter, or they use the bundled-tube system, in which a number of framing tubes are bundled together to form exceptionally rigid columns.

2. Body of Paper

The building considered here is a residential building Having G + 24 storied located in seismic zone V and for earthquake loading, the provisions of the IS:1893(Part1)- 2002 is considered. The plan dimension of the building is 20 m X 30 m. Height of each storey is 3m. The floor plans were divided into four by six bays in such a way that center to center distance between two grids is 5 m by 5 m respectively.

Table -1: Comparison of seismic weights

Description	Manual Calculation	ETABS Software
Time Period	1.85 sec	2.0 sec
Sa/g	1.5	1.506
Seismic Weight	124117.55 KN	130446.55 KN
Base Shear	6714 KN	6719 KN

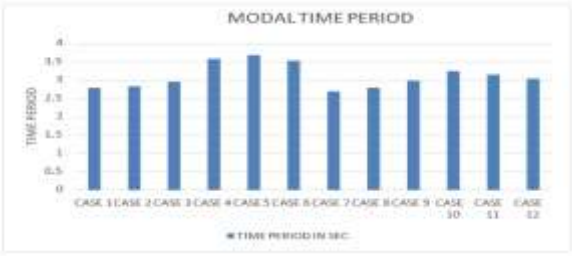

Fig. 1: Modal Time Period

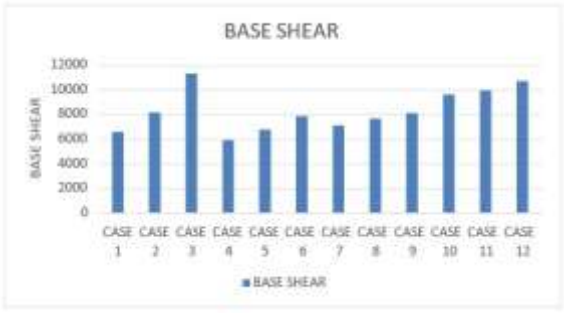

Fig. 2: Base Shear

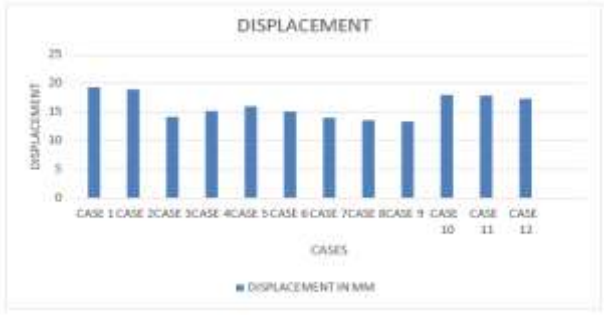

Fig. 3: Displacement

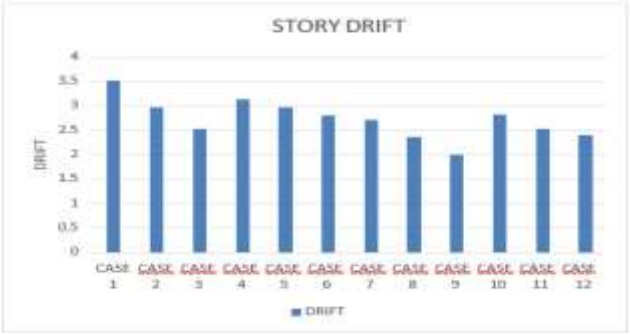

Fig. 4: Story Drift

3. CONCLUSIONS

Detailed structural design of building is important aspect of construction procedure. Practically an engineer employed must have knowledge on designs, construction procedures, site study etc. The project work was only related with the practical application of the studied courses in the field. Finally, I hope that efforts and coordination for the project work will prove much useful in our career and project will be helpful in providing information on the earthquake resistant design and its safe practice.

Design Base Shear (Manually) = **6714 KN**

Design Base Shear (ETABS) = **6719 KN**

- The G+24 residential building has been analyzed and deigned using ETABS
- Designing using software's like ETABS reduces the man power and saves time in design work.
- Details of each and every member and component can be obtained from ETABS.
- Seismic forces have been considered and the structure is designed as an earthquake resistant structure.
- To conclude, ETABS is versatile software having the ability to determine the reinforcement required for any concrete section based on its loading and determine the nodal deflection against lateral forces.
- It experiences static as well as dynamic analysis of the structure and gives accurate results which are required. The following points have been obtained at the end of the design.
- The values of bending moment and shear force for every individual member have been studied.
- The short-term deflection for all horizontal members is within safe limits.
- The Value of Base shear obtained from ETABS is quite more than the manual Calculations.

Always better to know two or more than a single software so that a counter check can be made especially for a large and mega project to avoid suspicious results and to continue his design with peace of mind. In building having no shear wall drift increases in initial 4 or 5 stories there after it remain constant about 2/3 of total height and then it decreases. A kink is observed where column sections are changed.

- Irrespective of type of provision of shear wall. In case of 70m height building drift increases gradually up to ½ of total height and there after it is almost constant in all the cases. In all the cases it is well within permissible limit.
- In case where full shear wall and Stepped shear wall show proper drift reduction factor upto 3/4 of total height.
- Gradual reduction in thickness of shear wall has better drift control.
- For soil condition hard and medium the drift reduction factor decrease drastically in above storey due to which shear wall acts negatively in drift control as compare to frame structure.
- For soil condition soft stepped shear wall show proper drift control.
- Gradual reduction shear wall maybe saved in investment without impairing structural strength.
- For Different cases of 70m heighted building for different

condition of soil in which the permissible drift exceed for soft soil condition especially where column section and Shear wall section are changes up kink sudden change observed.

- As we seen in results base of shear wall is increasing in large scale compare to column base reaction
- Also the time period is also more for the column compare to the shear wall design
- As we get values of percentage reinforcement of the building which is required for the construction for shear wall and column, in that case shear wall requires more percentage reinforcement in building whivh is also not economical
- But after seeing all results coming from the project we conclude that shear wall is better to oppose the lateral forces as compare to the column
- And column are better to maintain base reactions for footings of building

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