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ANALYSIS AND DESIGN OF G+3 BUILDING IN DIFFERENT SEISMIC ZONES USING E-TABS

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Abstract
As a structure is subjected to the earthquake, it results vibrating. The earthquake force subjected to structure will be resolved into three mutually perpendicular directions-the two horizontal directions (x and y) and therefore the vertical direction (z). This motion causes the structure to vibrate or shake altogether three directions; the predominant direction of shaking is horizontal. Here the most essential thing is to consider the results of lateral loads induced from wind and earthquakes within the analysis of reinforced concrete structures, especially for high- rise buildings. Here the basic intent of analysis for the earthquake resistant structures is that buildings should be able to resist minor earthquakes without damage[5,6]. It also can resists moderate earthquakes without any structural damage but sometimes non-structural damage will resist major earthquakes without collapse the major structure. To avoid the collapse during a major earthquake, the members are must have to be ductile enough to absorb and dissipate energy by post-elastic deformation. So redundancy within the structural system which permits redistribution of internal forces within the failure of key elements. When the primary element or system yields or fails, the lateral force certainly redistributed to a secondary system to stop progressive failure[7,8]. The objectives of the current work is to study the behavior of a multi storied building subjected to earth quake load by adopting Response spectrum analysis.

Introduction
The successful plan and development of seismic tremor safe structures have a lot more prominent significance in everywhere throughout the globe during this way designs are trying to utilize various materials to further their best potential benefit keeping in see the exceptional properties of each material basically powerful and stylishly satisfying structure are being built by joining the most effective properties at singular material and simultaneously meeting the actual prerequisites of huge length, building load, soil condition, time, adaptability and economy tall structures are most appropriate arrangement.[2,3]
The Design of buildings wherein there's no damage during the strong but rare earthquake is named earthquake-proof design. The engineers don't attempt to make earthquake proof buildings which will not get damaged even during the rare but strong earthquake. Such buildings are going to be too robust and also too expensive.[9] The aim of the earthquake resistant design is to have structures which will behave elastically and survive without collapse under major earthquakes which may occur during the lifetime of the structure. So here is to avoid the collapse during any major earthquake, the structural members must have to be ductile enough to absorb and dissipate energy by post-elastic deformation.[10,11]

Many researchers are conducted on this topic and still, it's continuing because more we attempt to learn more we are able to minimize the damages and save the lives. As per studies that are made on the seismology about 90% earthquake happens because of tectonics.[12,13] If we come to civil engineering, an engineer's job is to produce maximum safety within the structures designed and maintain the economy.
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Prior to the analysis and design of any structure, necessary information regarding supporting soil should be collected by means of geotechnical investigation. Also a geotechnical site investigation may be a process of collecting information and evaluating the conditions of the location for the purpose of designing and constructing the foundation for a structure. Structural engineers face the challenges of striving for many efficient and economical design with accuracy in solution while ensuring that the ultimate design of a building and also the building. [15,16]

Introduction of Software

ETABS is a software which stands for the Extended Three Dimensional Analysis of Building System. It's a building software product that takes under consideration multi-story building examination and plan. Demonstrating devices and formats, code-based burden remedies, examination strategies and arrangement methods, all organize with the network like geometry remarkable to the present class of structure.[17]
ETABS is that the present day driving structure programming within the market. Many configuration organization's utilization this product for their task configuration reason. Along these lines, this paper for the foremost part manages the near examination of the outcomes got from the investigation of a multi celebrated structure when dissected physically and utilizing ETABS programming.[18,19]
Basic reaction to tremor relies upon Dynamic qualities of the structures and power, length and recurrence substance of existing ground movement. Auxiliary investigation implies assurance of the general shape and all the particular elements of a specific structure in order that it play out the capacity for which it's made and will securely withstand the impacts which will follow up on it during its valuable life.

Scope of Work

1. Based on project, study was undertaken with a view to determine the extent of possible changes within the seismic behavior of RC Building Models.
2. The RC framed buildings are firstly designed for the gravity loads and then for the seismic loads.
3. The study introduced the symmetrical bare frame building models on different Zones

using equivalent static method and Response spectrum analysis.

4. The study highlights the effect of seismic zone factor in different Zones that's in Zone II, Zone III, Zone IV and Zone V which is taken into account within the seismic performance evaluation of buildings.
5. The study emphasis and discusses the effect of seismic zone factor on the seismic performance of G+3 building structure.
6. The whole process of modeling, analysis and design of all the primary elements for all the models are carried by using ETABS Ultimate 18.1.1 version software.

Experimental Work

As discussed within the previous chapters, a structure must be analyzed and designed to resist the lateral earthquake forces. In this chapter here, the analysis and design procedure of the G+3 storey building is discussed with the assistance of ETABS Software by response spectrum method. Here in this process, computational advantages found in using the response spectrum method of seismic analysis for the prediction of displacements and member forces in structural systems. This kind of tactic involves the calculation of the only utmost values of the displacements and member forces in each mode using smooth design spectra that's the typical of several earthquake motions. In these different seismic Zones are taken to induce the results of building, how it reacts to different Zones.

Seismic analysis as per IS Code

At the purpose when a structure is exposed to seismic tremor, it reacts by vibrating. A seismic tremor power is often settled into three commonly opposite bearings the 2 even headings (x and y) and therefore the vertical course (z). This movement makes the structure vibrate or shake in all of the three bearings; the overwhelming heading of shaking is even. All of the structures is essentially intended for gravity loads-power like mass time's gravity within the vertical heading. In light of the natural factor of wellbeing utilized within the plan particulars, most structures will generally be enough secured against vertical shaking. Vertical increasing speed need to likewise be considered in structures with huge ranges, those during which dependability for plan, or for generally speaking strength examination of structures.[20,21]

Wind Analysis

Basic wind speed in the India map, applicable at 10 m height above mean ground level for various Zones of the country selected from the code taken into consideration.

$Vz = Vb\ k1k2\ k3$

Where, Vz = at any height, the design wind speed ‘z’ in m/s, Vb = Basic wind speed in m/s,
k1 = probability factor (risk coefficient),
k2 = the terrain roughness and the height factor, and k3 = topography factor.
NB: The designe wind pressure at any height above mean ground level shall be obtained by the subsequent relationship between wind pressure and wind velocity.[22]

Software Analysis

Step 1. New model - Use built in setting a dialogue box will appear where we entered thedetails of grid dimensions and story dimension of our building.

- **Start Etabs 18 - New model (Ctrl+N) - dialogue box appear - Model Intialization - usebuilt-in setting with – ok**

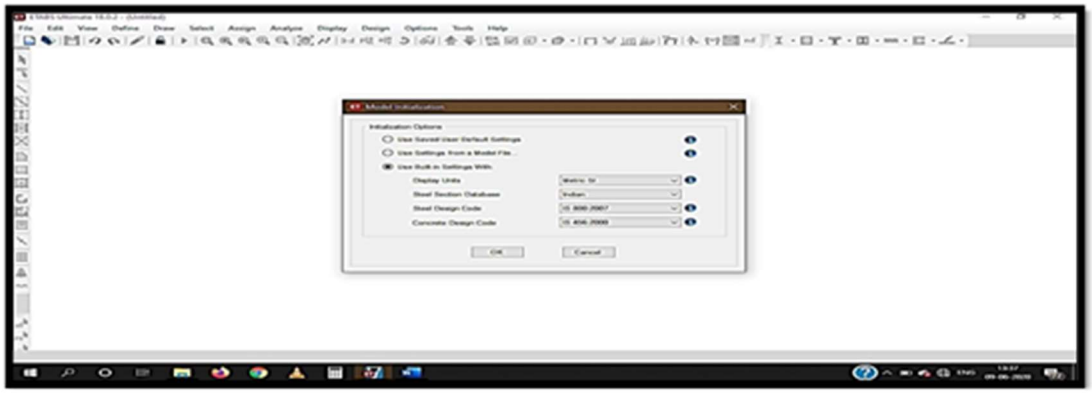

Fig. 1 - Step 1. New model

Results

1. Result Analysis of - Zone V

Result Analysis and story response for Zone 5 shown below.

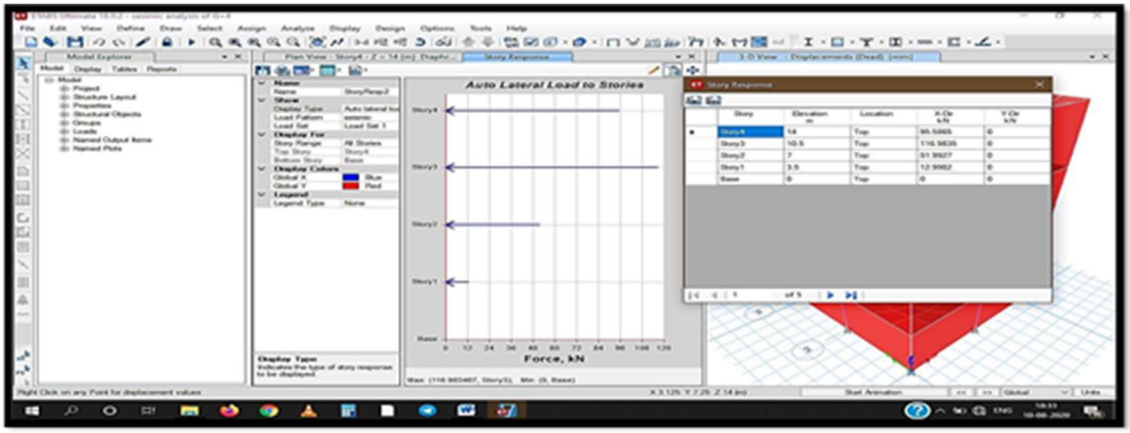

Fig. 2- Deformed shape - Dead Load – Zone V

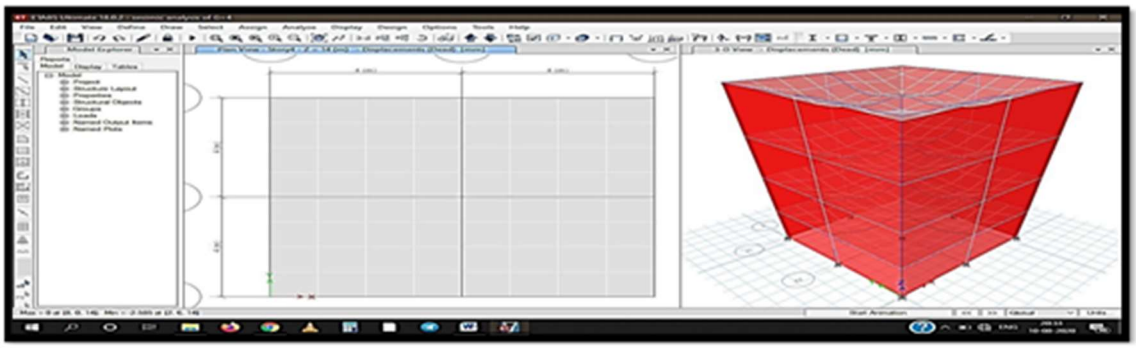

Fig. 3- Story response for zone – V

2. Result Analysis of - Zone IV

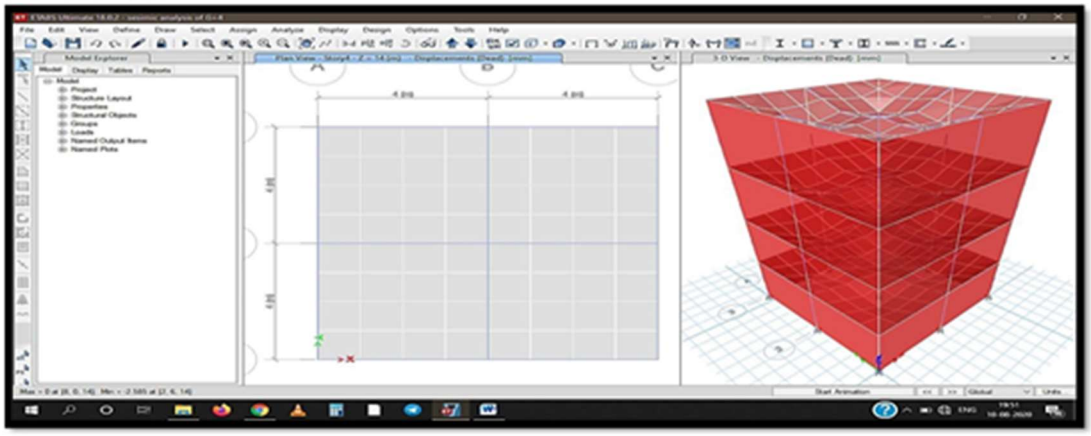

Fig. 4- Deformed shape - Dead Load – Zone IV

Result Analysis and story response for Zone 4 shown below.

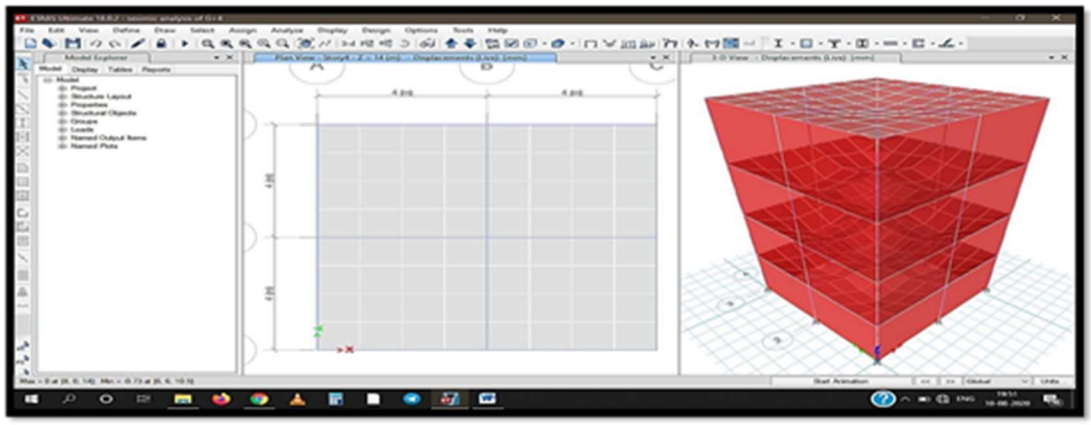

Fig. 5- Deformed shape - Live Load – Zone IV

Conclusion

1. The Structure analyzed in several seismic Zones of India, than we discover out the leads to base shear of the building is more in seismic Zone-V has compare to Zone-II, Zone-III and Zone-IV.
2. Base shear of seismic Zone-V is more than 72.2%, 55.56% and 33.33% as compared to Zone-II, Zone-III, and Zone-IV respectively.
3. Now for the Floor Displacements, Zone-V has higher displacement value than compared to Zone-II, Zone-III and Zone-IV.
4. In Maximum Floor Displacements seismic Zone-V is more than 39.79 mm, 30.77 mm, and 18.52 mm as compared to Zone-II, Zone-III, and Zone-IV respectively.
5. Support reactions Zone-V as higher value as compare to Zone-II, Zone-III, and Zone-IV.
6. Steel quantity of seismic Zone-V is more than 53.84%, 13.89% and 8.31% as compared to Zone-II, Zone-III and Zone-IV.
7. From the above results Zone-V is critical for the G+3 structure.
8. Seismic force acts on the structure it reflects additional force working on the structure, due to these addition forces structure behave different way than normal condition.

9. Involves seismic zones Zone-V has higher zone factor than other zones. So Zone-V values are over then compare other zones.
10. As the factors like Displacements, support reactions, Base shear, and steel quantity all these are Depends on zone factor, so as a result these values are more in Zone-V.

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