Earthquake Analysis of G+5 Institutional Building in Zone 2 & Zone 5

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ABSTRACT

A great destruction by the sudden violent shaking of the ground,as a result of movements within the earth's crust or volcanic An earthquake is the shaking of an earth surface resulting from a sudden release of energy in the Earth's lithosphere that creates seismic waves. The seismic activity, of an area is the frequency, type, and size of earthquakes experienced over a particular time period.

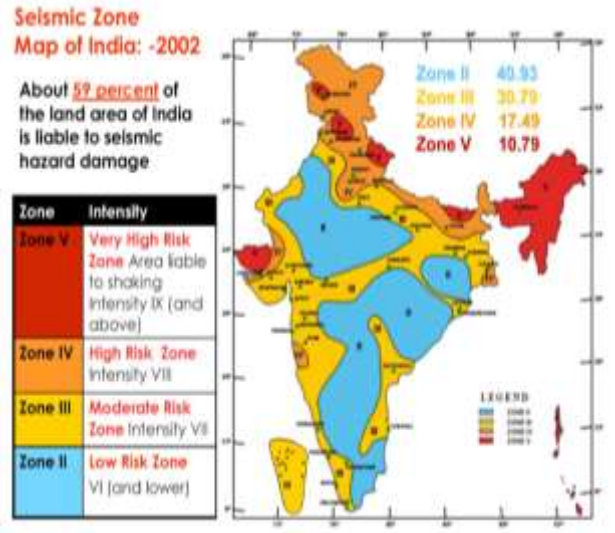
The project report comprises seismic analysis and design of the G+5 RCC building. A G+5 storey structure for the seismic investigation is situated in Zone-II and Zone-V districts in India. The dead and live loads are applied and analyses for Beam, column, slab, and footing are carried out.Various software nowadays is available & STAAD-PRO is the most commonly used for analysis and designing of a building. G+5 RCC building is analyzed for Zone-II and Zone-V by Staad pro software. A comparative study has been carried out.

Key-words :- STAAD-Pro, Seismic Analysis, Design, Earthquake Behavior, Seismic Resistance

INTRODUCTION:

Earthquake :-

Earthquake is the process of shaking of earth which causes more or less destruction to the life of human being, earthquake is a disturbance which is occurred naturally. It occurs due to the release of elastic energy which causes sudden movement of the earth i.e., ground in a few seconds. It is an unpredictable activity that affects a large area. It causes large destruction of transport, cities, villages, and owns and causes loss of life. Earthquake engineering is the branch of engineering in which we are studying the harmful effects of the earthquake and how we reduce the damages which are caused by the earthquake. To minimize the damages of earthquakes it is necessary to investigate the solutions and apply them in practical operations i.e., Planning, designing, constructing, etc.



Physical Damage :-

Physical damage includes damage to the physical quantities i.e., structure, railway, road, pipelines, infrastructure, bridges, towers, buildings, human life, etc. Aftershocks also cause major damage to those structures which are already weakened due to the earthquake. Aftershocks may be defined as the small vibrations that occur after a major earthquake. Some major effects of the earthquake are landslides, fire, and dam failure which causes flooding in the neighboring area. Due to the earthquake, many people lost their shelter which affects the local population of that area and also affects their standard of living, it also causes blockages of the communication system.

Earthquake Zones:-

In India earthquake occurs at different locations and shows different behavior in that particular area. So, to construct a building in different locations or zones, a seismic map is required to know the properties of that area. In India, there are four seismic zones: zone II, zone III, zone IV, and zone V.

Seismic Design Approach- For tall buildings, lateral forces are the major factors. In tall building lateral forces causes sway of the structure which produces undesirable vibrations and creates undesirable stresses producing critical stresses in the structure. The sway of a structure is defined as the displacement of its top surface concerning its base. According to the scenario of seismic design, people should live in a building that would not cause any type of damage in small and frequent shaking intensity and provide proper service after the earthquake. The structure should be able to withstand a moderate earthquake without causing any structural and non-structural damage. While designing by limit state method the earthquake forces taken for calculation is equal to stronger than in past earthquake.

LITERATURE REVIEW :

[1] Keerthi Gowda B. S. (May 2014) suggested that earthquakes in numerous parts of the planet demonstrated the hazardous consequences and vulnerability of inadequate structures. The buildings with floating columns have a typical feature within the modern multistory construction in urban India. The column also called vertical element which rest at lower level of beam. The seismic forces generated at the ground levels during a building have to be bring down along the peak to the bottom and any discontinuity during this load transfer path leads to poor performance. Thus, features like floating columns were highly undesirable within the building in-built seismically active areas. the present study examines the adverse effect of floating columns in a very building.

[2] Ms. Priyanka D. Motghare (2016) this paper pertains to analytical studies distributed to judge the performance of RCC frames under different positions of floating columns. Buildings with a column that Supports and Float on beams at an lower level storey and it doesn't go all the thanks to the muse which has lack of coherence within the load transfer. This analysis was dispensed by considering different floating columns with using STAAD Pro.

[3] Bruce R. Ellingwood (2001) studied the prospect and future improvement in earthquake resistant and style procedure supported the more rational probability-based treatment of uncertainty are examined.

[4] S. K. Airward, S. K. Jain and M. M. Pande (2008): Estimated earthquake loads on multi-story R.C. Framed buildings as per IS:1893-1984 and IS:1893-2002 recommendations. They considered three and five storey buildings and each was analyzed individually. for every building, a gaggle of 5 individual sequences was decided within the testing. The methods of study adopted were the Response Spectrum method, Modal Analysis method and Seismic Coefficient method. Seismic responses viz. storey shear, base shear.

[5] Anil K. Chopra (2015) this book includes about the speculation of structural dynamics and This book concerned with the look of the multi-story building and earthquake response with dynamic analysis.

METHODOLOGY:
A G+5 storey RC commercial building has been designed as an RCC framed structure with a ferroconcrete slab. This building is analyzed by using STAAD PRO Software and also the analysis part is finished for the varied zones of India and different soil types. IS code 456-2000: Plain and ferroconcrete, IS code 875-1987(part 2): load, and IS code 1893-2002: Criteria for earthquake resistant design of structures are taken into consideration.

Modeling: -
Concerning the consideration of the kind of structure, modeling has been done using the Geometry and Structural Wizard tool.

Generation of Nodal Point:
As per the planning concerning the positioning of the column within the building, their respective nodal point has been created thereon model.

Property Definition:
Using the General-Property command define the property as per the scale requirement for the respective building on STAAD-Pro. So, the beam and columns are generated after assigning to the chosen beam and columns.

Create and Assign Support & Member Property:
After column definition at supports are provided as fixed below each column by selecting columns using Node Curser and its cross-section assigning supported load calculations and property definition.

3-D Rendering:
After assigning the member property to the structure the 3-D view of the structure are going to be shown using the #- D Rendering command.

Dead load:
The burden contains the load of walls, partitions floor finishes, false ceilings, floors, and so the other permanent standing construction within the buildings. The load loads are estimated from the scale of various members of the building and their unit weights. The unit weights of plain concrete and concrete were taken as 25kN/m3. The unit weight of masonry was taken as 19kN/m3. As per IS:875 (Part 2)-2016, the burden has been assigned supported member load, floor load, and self-weight of the definition of the beam.

Live Load:
As per IS:875 (part 2)-1987, burden 2kN/m has been assigned to the members.

Seismic Load:
After defining the seismic load as per the requirement of IS: 1893 (Part 1): 2016, the seismic load has been assigned concerning +X, -X, +Z, and –Z directions with their respective appropriate seismic factor.

Load combination:
Required load combination cases for seismic analysis are assigned to the model supported specified loading combinations provided within the Indian standard CODES that are available in STADD-Pro.

Output Generation:

After that file is generated which contains the structural design of every beam and column member of a structure.

CONCLUSION:

The following conclusions are made from the present study:

1. The base reaction forces in the global x-direction are increasing from zone- II to zone- V, in Zone-II the value is 723.5497 and in zone-V, the value is 3727.7996 means as the zone is increased the values also get increased.
2. As the zone is modified the zone factors are changed and because of this, the structure act's differently in numerous zones. As Zone-II could be low earthquake-prone zone so in this the bottom reactions are low and as zone-V is a high earthquake-prone zone so in this the bottom reactions are high.
3. The storey drift values increase with the increase of seismic zone factor, so the zone is increased from Zone-II to zone-V the values for Zone-II storey 4^{th} is 0.000709 and for zone-V, the value is 0.001442, therefore the the storey drift values increased as the zone is increased.

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[7] IS 1893 (part 1): 2002