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"SEISMIC DESIGN OF MULTISTORY BUILDING WITH DIFFERENT SOIL CONDITION"

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Abstract: The current version of the IS: 1893-2002 requires that practically all multi storied buildings be analyzed as three-dimensional systems. Buildings may be considered as symmetric in plan, in mass and stiffness along storey, of the buildings. By using the latest software STAAD Pro, the study will analyze and compare the seismic response of a G+15 storey RCC frame structure with variable soil conditions (Hard, Medium and Soft soil) for seismic Zone IV.

The structural & seismic parameters are kept same for Model M1, M2 & M3 except the soil type. All models are analyzed in STAAD Pro V8i software using the Equivalent Static method of seismic analysis. The response of the model is examined in terms of the maximum storey displacement, base shear and story drift. The objective of the study is checking the stability of the three models in different soil type conditions.

The objective of the project is to carry out Response spectrum analysis (RSA) of regular RC building frames with different types of soil. Comparison of the results of analysis with and without seismic effect regular structure will be done.

Keywords: *Story drift, seismic analysis, story displacement, seismic zone, bending moment and base shear*

I.INTRODUCTION:

Tall structures are colossal undertakings requesting unimaginable coordinated factors and the board, and require gigantic monetary venture. A cautious coordination of the underlying components and the state of a structure which limit the sidelong dislodging, may offer impressive reserve funds. These days, the test of planning an effective tall structure has significant changed. The traditional way to deal with tall structure plan in the past was to restrict the types of the structure to a rectangular shape for the most part, however today; significantly more convoluted building calculations could be used.

To reduce excitations and work on the presentation of tall structures against wind loads and seismic tremor loads, numerous investigations and research have been completed. Among these tactics, streamlined modifications, such as changes to a structure's corner geometry and its cross-sectional shape, are a crucial and effective plan strategy.

A structure ought to have four primary credits, fundamentally having straightforward and normal setup, sufficient parallel strength, firmness and pliability. Structures having basic standard calculation in plan as well as in rise, experience considerably less harm than the sporadic design.

The novel idea utilized in seismic tremor designing is the same parallel power .In structures most extreme removal or part not set in stone by the elements examination which further changes to part of the way unique and somewhat static investigation.

In structures, sidelong loads come in many different forms, such as seismic tremor loads and breeze loads, and how they behave varies depending on the kind of soil. When a building shows signs of shaking, the establishment and soil mass are both impacted modifies the earth's development as a result.

Soil Condition

As per IS 1893 2002 code (article 6.3.5.3), soil conditions are categorized into the three following groups:

I- Hard Soil: Clayey sands or sand earth combinations that have a value of N over 30, where N represents the: typical entrance esteem; sand rock and generally evaluated rock and sand rock blends without or with soil folio.

II- Medium Soils: All types of soils with N vary from 10 and 30

III- Soft Soil: All types of soils other than N and SP fall under these

Behaviour of RCC Structures

Primary examination is basically worried about figuring out the way of behaving of a construction when exposed to some activity. The powerful loads incorporate breeze.

Primary evenness can be a significant justification for structures lackluster showing under extreme seismic stacking, unevenness contributes essentially to expanded horizontal diversions, expanded part powers and eventually the structures breakdown.

A structure a collection of pieces and foundations joined together as a whole. In such a building, the pile is moved from the pieces to the pillars, from the shafts to the segments, then to the lower parts, and finally to the establishment, which moves it to the soil. A R.C.C. outlined structure building has a floor area that is 10–12% larger than a heap bearing walled fabrication.

R.C.C. defined designs make solid construction possible and are more effective at withstanding shocks, vibrations, and quakes than load bearing walled structures. For RCC defined structures, development speed is quicker.

Table 1-1 Importance Factor, I (Reference IS code 1893)

Sr. No.	Structure	I
1	Significant help and local area structures or designs (for instance basic administration structures, schools), signature structures, landmark structures, life saver and crisis structures (for instance medical clinic structures, phone trade structures, TV slots structures, radio broadcast structures; bus stop structures and metro rail structures), rail route stations, air terminals, food capacity structures (like distribution centers), fuel station structures, electric power station structures and fire station structures), and huge local area lobby structures (for instance film corridors, shopping centers, gathering lobbies and tram stations) and power station structures	1.5
2	Private or business structures (other than those recorded in Sl. No. 1 with inhabitance in excess of 200 people	1.2
3	All others	1.0

II.LITERATURE REVIEW

Abhishek Mishra et al. (2022), using the most modern software STAAD Expert. Aside from the soil type, the primary and seismic boundaries are maintained as-is for Models M1 and M2.In STAAD Genius V8i programming, the two models are separated using the Same Static seismic analysis method. The biggest story removal, base shear, and story float are considered when analysing the model's response. The goal of the evaluation is to evaluate the two models' stability under diverse soil type situations.

Vishwakarma Arvind et. al (2020) Multi cumulative Stability Improvements, Volume 7, Issue 7, of IJIRS. Multi-story structures with soft, medium, and hard floors. This initiative aims to analyses different research articles written by different researchers using different soil conditions. Several researches used varied building constructions depending on the hard, medium, and soft soils to adapt to lateral stresses. Extensive study has revealed that the majority of excavators work on medium soils likes: A warning, please. The majority of studies, few of which particularly address wind, are based on seismic data. The concrete plan is given a minor focus in the structure's design

Awanti Lodhi, Satyendra Dubey, Vedant Shrivastava (2020) In "The Influence of Hard and Soft the effects of seismic zones, hard and soft soils, and height change are explored. This article looks at how affect structures at different distances from them. Ascertain the effect of challenging and delicate soils on the offset height of the SMRF frame structure. gentle, hard, and medium. There are three different types of apartments. Floors G+4, G+5, which are obtained from heights of 15 m and 18 m, are individually considered and decomposed for seismic zones II and III. The STAD PRO.

III.METHODOLOGY

Earthquakes may seriously damage a building if it is not properly planned and constructed with the required quality. Response spectrum analysis is an important technique for seismic analysis when a structure displays a linear reaction.

This method entails examining a structure's seismic response to a certain loading that might change over time step-by-step.

The next method was created to achieve the aforementioned objectives:

1)To understand the basics of the subject, a thorough examination of the literature utilising books and technical papers was undertaken.

2)The structural type selection.

3) Modelling the selected structures

4)You must conduct some research and analysis.

5)Interpretation of the conclusion and results.

In the current research, it is recommended that seismic analysis be carried out on G+15 story RCC structures using the Response Spectrum Analysis technique in accordance with IS 1893-2002, with the use of the STAAD PRO programme.

Response Spectrum Analysis Method

The several response modes of a structure may be taken into account using this technique. Computer analysis may be used to discover these modes for a structure. The response for each mode—corresponding to the modal frequency and the modal mass—is taken from the design spectrum to estimate the structure's overall response. maximum response during ground movements of the idealised single-degree freedom system, with a fixed period and damping. Plotted against the undamaged natural time and for various damping levels, the maximum response can be expressed as the maximum absolute acceleration, maximum relative velocity, or maximum relative displacement. For this, case studies involving the response spectrum have been investigated.

IV.SOFTWARE ANALYSIS

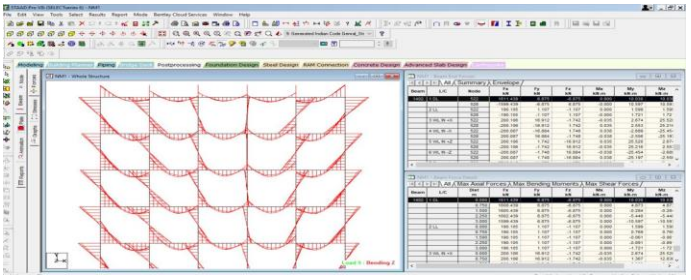


Figure 1 : Shear and Bending Moment

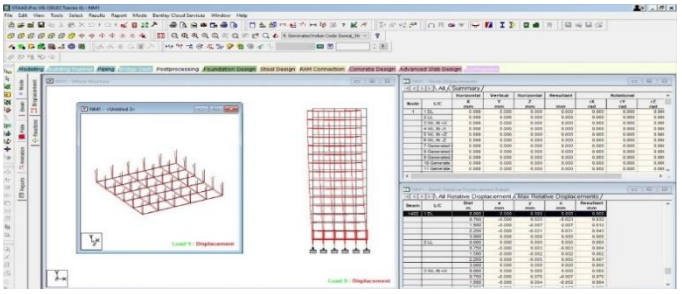


Figure 2: Displacement

Seismic Analysis with Soft Soil

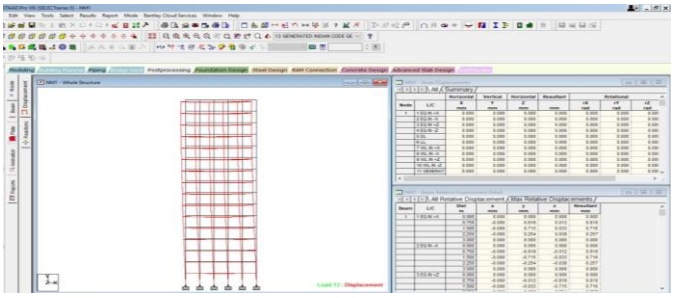


Figure 3: Shear and Bending Moment

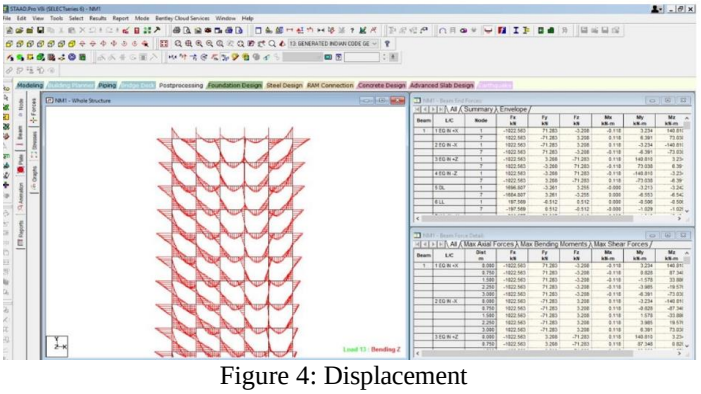


Figure 4: Displacement

V.RESULTS AND DISCUSSION

Result Comparison STAAD PRO

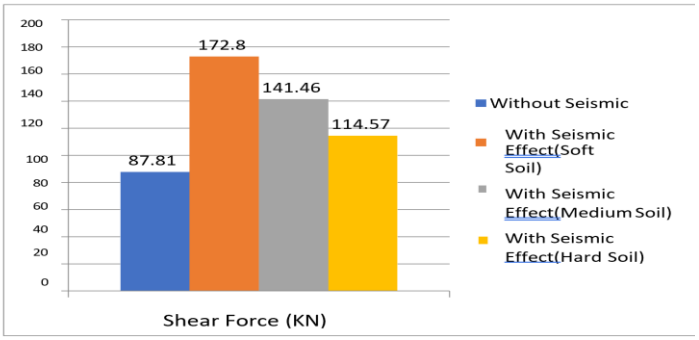
Results Comparison

Variables	Without Seismic Effect	With Seismic Effect		
		Soft Soil	Medium Soil	Hard Soil
Shear Force (KN)	87.817	172.840	141.469	114.572
Axial Force (KN)	4467.867	4833.533	4525.210	4466.145
Moment (KN-m)	84.455	259.941	212.685	160.604
Displacement (mm)	39.104	178.266	145.374	106.776

Result Comparison Graph

Shear Force (in KN):

The graph shows the effect of soil with & without seismic effect in different conditions



Axial Force (in KN):

The graph shows the effect of soil with & without seismic effect in different conditions:

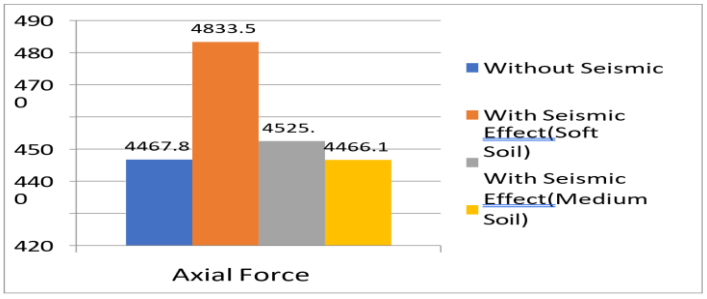


Figure: Axial Force (in KN)

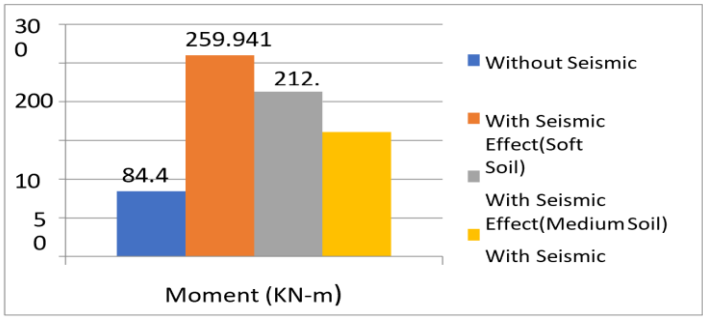


Figure: Moment Force (in KN-m)

VI.CONCLUSIONS

Following conclusions are drawn from all of the preceding research when the soil conditions are altered and all seismic boundaries are maintained.

- The greatest bending moment value is greater in soft soil when compared to medium and hard soil. The reaction value is greater in soft soil when compared to all three.
- Storey displacement is more significant for model M1 with soft soil and less significant for model M3 with hard soil as the hardness attribute of the soil layer declines.
- Out of the different load combinations the governing load cases consist of different combinations with earthquake load. It is also observed that there is a wide variation in the decrease of displacements from loose soil to hard rock at ground floor level when compared with the displacement.
- The value of story displacement for all models lies within the maximum allowable story displacement value according to IS code 1893:2002.
- The soft soil has a higher shear value when compared to the medium and hard soils.

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