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A Review: Dynamic Analysis for Controlling Seismic Response of R.C. Frame Structure by Virtual Work

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Abstract: ***The Performance of The RCC Building During Earthquake Depends Upon the Distribution of Stiffness Amongst The Storeys. If The Distribution Is Non- Uniform To A Large Extend, The Performance of The Building is Poor. The Storey Stiffness is Contributed By The Columns As Well As The Brick Infill. If The Effective Storey Stiffness of A Floor is Less Than 70% of the Storey Above Or Below It , Then It Is Called The Soft Storey. It Is Learnt From The Past Earthquakes That Soft Storey Are More Vulnerable To Failure.***

The Study of Building Performance During Past Earthquakes Has Revealed That Maximum Failures Have Occurred In The Parking Storey.

Most of the buildings were damaged and collapse during in strong earthquake hence we will have to confirm safety against the earthquake force that are affecting the structure, and determine seismic responses of such building. In this project we will analyse the G+5 building through response spectrum analysis to develop the economic design. Computer software's are also being used for the calculation of forces, bending moment, stress, strain & deformation or deflection for a complex structural system.

Keywords: Distribution of Stiffness, Soft Storey, Seismic responses, Response spectrum.

I. INTRODUCTION

As our country is the fastest growing country across the globe so the need of shelter for highly populated cities where the cost of land is high and further horizontal expansion is not possible due to unavailability of space, so the only solution is vertical expansion. After an earthquake occurs it causes great damage due to unpredictable seismic motion striking & when the height of building is increased the wind load effect also acts on building. This causes major loss of life with a more casualties therefore such structures need to be analyzed and designed properly before constructing.

Since an earthquake causes ground movement, it produces inertia force, which is proportional to the mass of the structure. Along these lines, the seismic research is controlled by the mass of the structure being analyzed, which adds some stiffness to the structure. Because it is economical to construct a structure that is entirely vibration, it is important for the structure to suffer some damage, spreading the vitality provided to it during the seismic tremor.

According to India Standard, the structure is created specifically to avoid any structural damage even under slight shaking, so that they can be structured individually for a portion of the forces that they may encounter However, there would be some initial stiffness. To make the task practical, the seismic investigation should have the ability to adjust economy and adequate hard. This is possible, as it were, based on extensive research and specific post-quake harm assessment considerations. In this method, structures might be designed to withstand the effects of seismic tremors rather than quake verification. The structure has to survive a massive relocation movement request without causing structural damage, failure, or a loss of cohesive for a safe and conservation development.

The soft storey irregularity, refers to the existence of a building floor that presents a significantly lower stiffness than the others, hence it is called soft storey. This irregularity refers to the existence of a building floor presenting a lower lateral structural resistance than the immediate superior floor or the rest of the floors of the building. The building's weakest part would suffer severe damages due to its inability to withstand the different types of loads (lateral vertical and moments) produced by the ground motion. Soft storey configuration is often generated in hotel and hospital buildings, in which not only the first floor is designed less walls than the other floors, but generally, due to its importance, it also has a greater height than the rest of the floors.

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II. LITERATURE SURVEY

1) *"Response spectrum analysis of g+13 multi storied building in different seismic zone by using staad pro." (IRJET), (July 2021). Anirban Mandal.*

This paper represents the "Mass" of Building in seismic design is related with building stiffness. earthquake induces inertia Forces which is proportional to mass of building earthquake forces increases direct proportional with ground acceleration & mass of the building it implies Newton's low, (F = ma) small building affect by High frequency wave. Tall building affect by long period (F = 1/T). Building is Analysis in Different Earthquake Zones (II, III, IV,V) Using Staad pro V8i Software. After Comparison of this zones the result of this analysis come out in terms of lateral deformation displacement, Peak Storey Shear, Axial Force, and bending moment and which is imparted in the results.[1]

2) *"Response spectrum analysis of a G+4 building with mass irregularity on a sloped surface." P Conference Series: Materials Science and Engineering, IOICRIET ,(2020-2021). Anirudh Raajan , Balaji G C and Vasavi V.*

In this paper Building design in e-tab Software & structure placed in the sloping ground with Horizontal inclination 20°. Here The mass. irregularity is induced at every storey by inducing on ones they at a time for 3 different zones (III, IV, V) The response of the structure with respect to variation in the storey Drift & storey displacement has been record. Storey Drift and Storey Displacement for each storey, both along and across was obtained from E-tab Software. And according to that Graphs drawn with storey in x direction and storey displacement in y direction.in This report discussed about structure irregularity such as vertical irregularity, mass irregularity , Stiffness irregularity etc. and also carried out dynamic analysis to determine the maximum peak responseof the building with respect to natural time period.[2]

3) *Francesco "Seismic design and analysis of a medium-density residential building. "NZSEE 2021 Annual Conference.(2021). C. Gribbon, Z. Jennings, T. J. Sullivan and G. De Francesco.*

In this paper, developed a RUAUMOKO3D to determine the probable floor accelation & drifts. using reference to new Zealand functions. The low damage criteria should lead to a reduction in losses.The comparison between loss estimates obtained for a code compliant and low damge seismic design of a multi-storey medium density Residential Building. And the expected losses for each hazard level also decreased with low damage seismic design. RUAUMOKO3D was used to conduct non-linear time history analyses of the two buildings designed.The inter-storey drifts and acceleration obtained with both the non-linear time history analysis and modal response spectrum analysis were compared to verify the accuracy of the results obtained for 250 and 500 years return periods.[3]

4) *"Seismic analysis of multistorey building using etabs with comparison of response spectrum method and time history method." Journal of Emerging Technologies and Innovative Research (JETIR)*

In this papers G +10 & Zone 2 is Considered & earthquake data is taken (EL Centro 1940) Base shear & max. deflection is carried out by e-tab software result is found base shear obtained from RSM is Higher compared to THM. & deflection is more in Response Spectrum as compared to time. By comparing time history and Response spectrum method, the response spectrum method will get higher base shear value 2% and higher displacement value 15 to 25%. This Study Concluded that use of time history method will give reasonable value when compare to response spectrum method. Time history method should be preferred whenever detailed analysis is required but response spectrum is not a bad approximation. Response Spectrum method gives fairly accurate Results.[4]

5) *"Evaluation of the seismic performance of an existing RC educational complex in the city of Khulna, Bangladesh." (may2020). Montaseer Meraz, Tanjid Mehedi, and Nusrat Jahan Mim.*

In this paper the non-linear pushover analysis is carried out using etabs software. models plastic Hinge properties of beams & Column using Stress stain models for concrete & steel. Safety of the structure under earthquake loading like capacity curve, ductility ratio & slinge placement. Pushover analysis is used to validate the intended buildings safe performance during a demand earthquake in this Paper pushover analysis is performed and calculated displacement by pushover analysis. And storey drift, Torsional irregularity and stiffness was calculated for both the global-X and Global-Y direction.[5]

6) *"Dynamic Analysis of Multistory Structure using Linear Time History Analysis." International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE),(11, November 2021). Prajapati Ramdev, Prashant R. Barbude, Dr. A.P. Patil.*

In this paper different regions is taken according to zone & modelled in e-tab software & analysed effect for same structure in different location. The effects like Storey Shear, building deflection & drift. In this study of report it shows that time history analysis procedure leads to good estimates of the trends of building response. Response spectrum method and Static method are not sufficient for Structure in higher Seismically active region (for zone V). Time history method analysis represents a seismic design method which avoids the other seismic analysis method, which leads to conservative results and easily applied to any Building.[6]

7) *"Response Spectrum Analysis of Base Isolated Regular and Vertical Irregular Building in Different Types of Soil." International Journal for Research in Applied Science & Engineering Technology (IJRASET) ,(10 Oct 2021). Priya Namdev and Dr. Raghvendra Singh.*

In this paper G+1O Building is considered of different vertical irregularities for zone IV by using Combination loading. model of building with a fixed base & base isolation device. The response of building decreases by using base isolation devices. This Study Explain the behavior of Lead rubber bearing isolation system uner the performance of dynamic loads. Displacement in x-direction in static lateral load method is also reduced in base isolation building compared to fixed base, and building very small displacement produced due to earthquake. And the Base isolation building very effective work in Hard Soil. [7]

8) *"Dynamic analysis of multi storey building with and without shear wall." International Journal of Engineering Applied Sciences and Technology, (may 2021). Sarwan Gupta, Shubham Gaikar, Kewal Patil, Swapnil Shelar , Harshad Thakare.*

In this paper dynamic characteristics of building with different structural Configuration is Compared in different earthquake zones in different soil & observed the behaviour by using e-tab software. The main Purpose of this Study is to compare the dynamic characteristics of building with different structural configuration in seismic zones and soil types. And also the dynamic behavior of building in all seismic zones of magnitude III and on Different types of soil (Such as Media). The Response Spectrum analysis was carried out by Using E-tabs Software.[8]

9) *"Response Spectrum Analysis for Regular Multistory Structure in Seismic Zone III." International Journal of Engineering Research & Technology (IJERT),(09September-2020). S. R. Kangle and D. S. Yerudkar.*

In this paper, by using software calculated forces, bending moment Stress-Strain & deformation or deflection for structure. modal Participation factor is gotted 75% in earthquake excitation.As the Modal mass Participating Factor more than 75% in the higher mode, The considered Structure is stiff for earthquake Excitation. When the Response Spectrum analysis was performed on the building result was Structure has good Resistance to smaller earthquake of moderate magnitude and intensity. Earthquake motion was applied in the X-direction as compared to Y-Direction.[9]

10) *"Wind and Seismic Analysis of Building Using ETABS."(12 June 2021). Yashashri ankalkhope, Vaishnavi ghale , Pratik harmalkar , Mahesh giri4, Nikhil mhaske.*

In this paper, for economical structure used rectangular & Circular Column & Carried out Bending moment, shear forces, Base reaction, storey stiffness, storey Shear, overturning moment, displacement, & Drift. by using response Spectrum method. in This study Discussed on Linear Static Analysis method and Linear Dynamic Analysis(Response Spectrum Analysis) Method.This study was undertaken with a view to determine the extent of possible changes within the seismic and wind behavior of R.C. Building Models. And introduced the symmetrical bare frame building models on using Response Spectrum Analysis.[10]

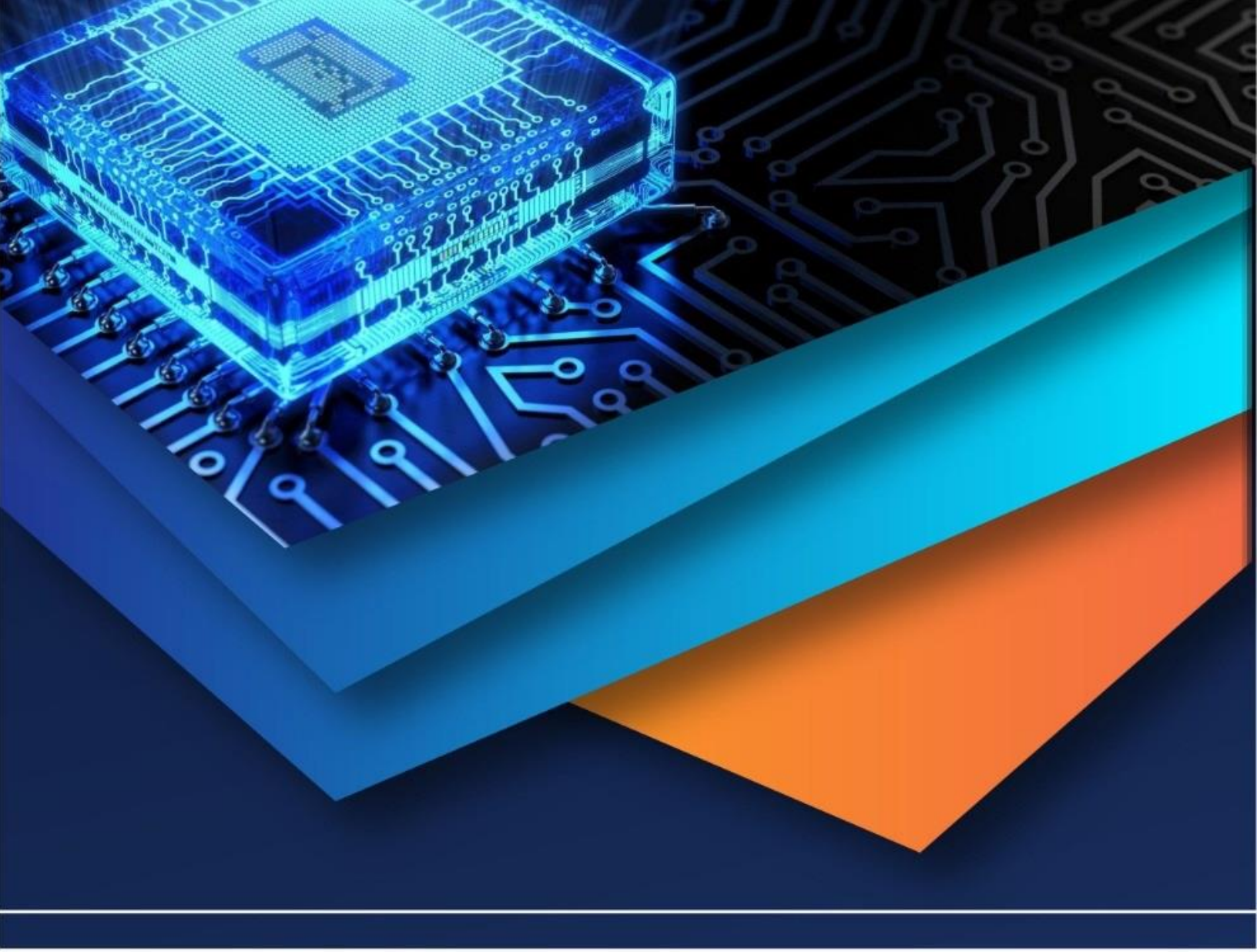
III. CONCLUSION

The RC frame buildings with open ground storey are known to perform poorly during strong earthquake shakings.The strength demands in the first storey columns are very large for buildings with soft ground storey. It is not very easy to provide such capacities in the columns of the first storey. Thus, it is clear that such buildings exhibit poor performance during a strong shaking. This hazardous feature of Indian RC frame buildings needs to be recognized immediately and necessary measures should be taken to improve the performance of such buildings. The open first storey is an important functional requirement of almost all the urban multi-storey buildings, and hence, cannot be eliminated. Alternative measures need to be adopted for this specific situation. The following measures can be adopted for the solution to this problem in general: providing adequate lateral strength and stiffness in the ground storey. The possible schemes to achieve the above are provision of strong column weak beam in the first storey and provision of a concrete service core in the building.

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