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Seismic Analysis of Regular and Irregular Building by Time History Method and Response Spectrum Analysis

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Abstract: Research studies for earthquake since long time indicate that we are not fully predicted the sign of earthquake and still they earthquake are unpredicted to safely design and construct the structure. So many research are carry out to construct the earthquake safe structure.

We observed from last earthquake and research regular structure may safe in low zone but irregular structure required a properly earthquake design.

Any type of irregularity may affect the building behaviour. Concept of regular and irregular configuration to perform well in earthquake a building should possess four main attributes simple and regular configuration and adequate lateral strength stiffness and ductility. STAAD PRO software is used to study and analyzed on multistoried RC framed structure model. I consider G+10 building for analysis purpose.

Method of analysis adopted are the time history analysis and response spectrum analysis to analyze the model for the present study and observe the lateral displacement of structure in regular and irregular structure. The major parameter considered in this study to observe the seismic conduct and base shear lateral displacement in various level according to IS 1893-2002 seismic load are calculated.

The lateral displacement forces are calculated using STAAD pro and result are compared. In this research will compare regular structure to vertical irregular by response spectrum and time history method.

Keywords: Comparison of irregular structure to regular structure.

I. INTRODUCTION

Earthquake is unpredictable natural disasters during earthquake it is very difficult to protect our engineering property it may cause loss of life in dense area. The behaviour of building during the earthquake is depend upon many conditions like stiffness, strength, ductility and most probably on configuration of structure.

A. Structural Irregularity In Buildings

1) Vertical irregularity

- Stiffness irregularity; it is nothing but soft storey in this stiffness of the member in the frame are not equal and they vary according to floor height. Soft storey in which the lateral stiffness is less than 70 percent of the storey above or less than 80% of the average lateral stiffness of the storey above. extreme soft storey – an extreme soft storey is one in which the lateral stiffness is less than the 60% of the storey above or less than 70% of the average stiffness of the three storey above.
- Mass irregularity; mass irregularity shall be considered to exist where the seismic weight of any storey is more than 200% of that of its adjacent stories. In case of roof irregularity need not to be considered.
- Vertical geometric irregularity; the structure is considered to be geometrical irregular when horizontal dimension of lateral force resisting system in any storey is more than 150 % of that in its adjacent storey.
- In plan discontinuity in vertical element resisting lateral force; an in plan offset of lateral force resisting element greater than the length of those element.
- Discontinuity in capacity; weak storey, weak storey is one in which storey lateral strength is less than is 80% of that in storey above.

II. METHOD OF ANALYSIS

A. Time History Method

Time-History analysis is most accurate method for analysis of building procedure where the loading and the response history are evaluated at successive time increments. During each step the response is evaluated from the initial conditions existing at the beginning of the step (displacement and velocities and the loading history in the interval). In this method, the non-linear behaviour may be easily considered by changing the structural properties (e.g. stiffness) from one step to the another. Therefore, this method is very effective to determine the non-linear response. However, in linear time history analysis, the structural properties are assumed to remain constant and a linear behaviour of structure is assumed during the entire loading history.

B. Response Spectrum Method

It is the exact method The representation of maximum response idealized single degree freedom system having certain period and damping during earthquake ground motion. The maximum response plotted against of undamped natural period and for various damping value and can be expressed in term of maximum absolute acceleration maximum relative velocity or maximum relative displacement for this purpose response spectrum analysis have been performed according to IS1893-2002. The story displacement base shear and frequency time period in response spectrum method are performed. response spectrum shows the maximum response of SDOF system corresponding to various earthquake having time periods as represented on the horizontal axis.

It is an exact method for analysis. The design horizontal force at each floor in each mode is calculated by STAAD provide outcomes i.e. design value, story base shear, and modal masses.

The design lateral shear force at each floor at each mode is computed by staad pro accordance with is 1893 part 1. user provide the $(z/2) \times (i/r)$ as factor input spectrum. program calculate the time period for first six mode by default. program is calculate the s_a/g for each mode utilizing time period and damping for each mode. the program is calculate the design horizontal acceleration spectrum A_k for different mode. then program calculate the mode participation factor for the different mode. the peak lateral seismic force at each floor at each mode is calculated. the peak response quantities are then calculated as per CQC SRSS or TEN OR CSM as defined by user to find the result.

III. REVIEW OF LITERATURE

- A. Poncet, L. And Tremblay (2004) he used the equivalent static load method and response spectrum analysis method for the analysis of eight storey building and considering the effect of mass irregularity and impact of braced steel frames structure with different setback configuration. and find response spectrum give the more accurate result.
- B. J.P. Sweetlin, R. Saranraj, P. Vijayakumar (2016) Studied comparison of displacement for regular and irregular building for the zone 2. They analyse the G+10 building for the analysis purpose by using the STAAD-PRO software. They consider only the geometric irregular building with different setback. And conclude that the displacement have direct correlation with mass of building so displacement in regular building is more than irregular building and story drift is also more in regular building. because they consider only the geometric irregular building.
- C. Ashvin soni (2015) present a paper on effect of irregularities in building and their consequence. she use the response spectrum method for the analysis of G+10 building. She consider the 5 frames to make the building irregular in 1 frame consider regular building in second floor consider swimming pool on top storey in third frame consider heavy loading at 4th and 7th floor in fourth frame consider 1st and 2nd floor have a soft storey and in last 5th frame consider 4th and 5th storey is soft storey and find the result in form of storey drift and displacement. So she observed that frame 2 and frame 5 was weakest it suffer maximum displacement and frame 1 suffer least displacement. and storey drift is maximum in frame 3 which change abruptly and frame 4 and frame 5 also give max storey drift for bottom two storey and middle storey.
- D. Hassballa A.E. et al. 2018 he analyse the multistorey building by response spectrum method by using STAAD PRO SOFTWARE studied the seismic analysis of RC building and investigate the performance of existing building if exposed to seismic loads. They consider the static load and seismic load for the analysis of multistoried building and result was obtained from this study is that for the large displacement response spectrum require a large dimension for seismic analysis. And conclude that drift is obtained from this analysis is about 2 to 3 times the allowable drift. resulting from large displacement due to combination of static load and seismic load. Dubey et al. 2015 presented design of multistorey irregular building with 20 storey and modeling it throw software STAAD Pro for the seismic zone for in india, dynamic response of the building under the actual earthquake DELTA (ALASKA 2000) have been consider this paper highlights the comparison of time history method and response spectrum method the story displacement method has been obtained both the method of dynamic analysis and

concluded that time history analysis is 2 to 8% higher than response spectrum analysis in both the type of building i.e regular and the irregular building for highrise building it is necessary to provide the dynamic analysis for non linear distribution of force storey displacement is found greater in THM as compared to RSM and base shear is greater than RSM than the THM hence it is concluded that time history method is better and more economical for designing

- E. Rakesh Kumar Gupta¹, Prof. D. L. Budhlani²(2018) Present a paper on plan irregularity of different type he used a G+10 building for the seismic analysis by considering the seismic load live and dead load using the STAAD PRO software by using the response spectrum method as per IS 1893 :2016 and 1893:2002. All combinations are considered as per IS 1893-(part I). Result is obtained from this study is such that seismic analysis as per guidelines of IS 1893:2016 shows higher value of base shear than as per IS 1893:2002. Also maximum lateral displacement in horizontal directions shows large value by response spectrum method as per IS1893-2016
- F. V. Rajendra kumar. Ranga rao V. Compare the regular and irregular structure using staad pro and using method of analysis are response spectrum and time history and observe the result for structure in various zone .result is obtained in form of displacement and base shear at various level analysis is done for G+10 building it is observed that the zone 3,zone4,zone5 having 37%,58%,and 72% more base shear than zone 2.and lateral displacement is maximum in zone 5 and minimum in zone 2.

IV. CONCLUSION

In this review paper analyse the G+10 building by response spectrum method and time history method and determine the base shear ,storey drift and displacement in both regular and irregular building and find which will give a more accurate result.

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