Dynamic Analysis of RC Multi-Storeyed Building - A Comparative Study

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Abstract— In India with a seismic moderate zone, the equivalent static force method to estimate the seismic force, subsequent vulnerability and behavior of RC building under seismic load is inadequate. The main goal of this paper is to show how the modal analysis can contribute to the understanding of behavior of building using Response Spectrum Method. In this study, Dynamic Analysis of four storied Reinforced Concrete building was investigated using Staad pro and Etabs software packages. For this, Response Spectrum Method was used to evaluate the base shear, frequency, modal mass participation and the mode shapes of the building have been plotted for 15 frequencies. Seismic Zone 3 has been considered and base shear was calculated as per the procedure recommended by IS 1893-2002. The results shows that only slight variation in frequencies and modal participation factors was observed as each software has its own way of considering the mass.

Key words: Dynamic Analysis, mode shape, frequency, mass participation.

I. INTRODUCTION

Response of reinforced concrete framed structures will experience to seismic action is dynamic in nature that depends on the duration, magnitude, intensity, and frequency content of the exciting ground motion. It is important to estimate and stipulate these lateral forces on the structure in order to design the structure to resist an earthquake. The building codes often suggested equivalent static load analysis for design of buildings in seismic zones due to its simplicity. However dynamic analysis becomes even more complicated, questionable and accurate when nonlinearity in materials and geometry is considered. Therefore, the analytical tools such as Staad Pro, Etabs, and Sap were used for further development and enhancement in earthquake engineering with significant advances achieved in recent years. Haroon and Umesh (2012) seismic analysis was carried out on reinforced concrete (RC) frame building with different model such as bare frame, infilled frame and open first story frame. Results showed that the infilled frames must be preferred in seismic regions than the open first story frame, because the storey drift of first storey is very large than the upper storeys, this may most likely cause the collapse of structure. Mohit Sharma and Maru (2014) performed the static and dynamic analysis of RCC framed structure in zone II and III and the results obtained from the dynamic analysis are higher than the values as obtained from static analysis. Amin (2014) performed the pushover analysis of an asymmetric building and results showed that the maximum displacements of the buildings which are obtained from pushover analysis are higher than the response spectrum analysis. Sunayana Varma et al (2014) studied the seismic response of reinforced concrete framed structures in different seismic zone and comparisons were between the Staad pro and Etabs results.
between the staad pro and etabs was just 1.3%. Natural frequency is the multiplicative inverse of model natural period and it plays a vital role in deciding the number of modes under the dynamic responses. Modal combination was carried out for the modes having frequency less than 33Hz and missing mass correction was applied to consider the effects of higher modes. A cutoff frequency of 33Hz was applied in both software as to maintain the frequency limit. Similarly, missing mass correction was applied in software. In this model, the first fifteen modes were dominant as they contributed for more than 99% mass participation and effect of the remaining mass was considered by applying missing mass correction. The frequencies and modal mass participation ratios obtained from Staad-Pro and Etabs are tabulated in Table 2. Slight variation in frequencies and modal participation factors was observed as each software has its own way of considering the mass. The mode shapes of first fifteen frequencies are shown in Figure 3. The mode shapes were similar in both Staad-Pro and Etabs, with the first two modes being translational and followed by torsional mode beyond the third. This is because the building was symmetrical in plan and loading.

Dynamic analysis of RC buildings by response spectrum method need proper attention in structural modeling, understanding the suitable choice of ground motion records, and thorough knowledge and awareness of the analyst with the procedures and computer software employed. The base shear difference between the staad pro and etabs was just 1.3%. The mode shapes obtained from the Staad-Pro and Etabs are very similar, the first two modes being translational and followed by torsional mode beyond the third frequency, this is because the building was symmetrical in plan and loading.

### REFERENCES


