Seismic Evaluation of Multistorey RC Building Subjected to Near and Far Earthquakes

Y. Bala Balaji[1a], Kalyani Banoth[1b] and Dr. B. Kavitha[1c]

[a]PhD Scholar, Department of Civil Engineering, National Institute of Technology, Warangal-506002, Telangana, India, balabalaji0722@gmail.com

[b]M Tech Scholar, Department of Civil Engineering, National Institute of Technology, Warangal-506002, Telangana, India.

[c]Assistant Professor, Department of Civil Engineering, National Institute of TechnologyWarangal-506002, Telangana, India.

1. INTRODUCTION & OBJECTIVE

Abstract

Near-field ground motions are significantly severely affected on seismic response of structure compared with far-field ground motions, and the reason is that the near source forward directivity ground motions contain pulse long periods. Therefore, the cumulative effects of far-fault records are minor. The damage and collapse of engineering structures observed in the last decades' earthquakes show the potential of damage in existing structures under near-field ground motions. Analysis of Multi-Storey office RC building subjected to Field earthquake. The study of seismic analysis of 15 story RCC office building considering different seismic intensities is administrated and the seismic response of such building is studied. The RCC building is sculptured with the assistance of SAP2000 Software Package. Then necessary dynamic characteristic of the earthquake is peak ground acceleration frequency content and period. These characteristics finding out the behavior of structure under seismic masses. The strength of the ground motion supported on PGA, frequency content and the way long the shaking continues. Ground motion has totally different frequency content resembling low, intermediate and high. Earthquake ground motion is considered in two types of condition Near Fault and Far Fault. In this current study the performance of the structure is investigated under two different ground motion conditions which are near and far from the epic Centre (Near Fault and Far Fault) in both normal and parallel component direction by the time history analysis method and the results are shown in terms of Acceleration, Base shear, Velocity, and story displacement.

Keywords: RC Multistoried building, linear time history analysis, near and far field, seismic.

[1]Font sizes are usually specified in points, abbreviated pt, which is a unit of length. One inch = 72 pt.; one cm = 28.4 pt.

2. RESULTS & HIGHLIGHTS OF IMPOINTANT POINTS

In this report three types of regular buildings namely 4,8, and15 storey were considered. All three kinds of regular RC building frames had plan symmetry. Linear time history analysis (THA) was conducted for each type of regularity and maximum base shear and top storey displacement obtained were compared with near fault and far fault earthquake. Three types of ground motion with varying frequency content, i.e., India (Sikkim)-Nepal border, East Srinagar region, Punjab-HP border frequency were considered. Time history analysis (THA) was conducted for each type of regularity corresponding to the above-mentioned ground motions and maximum base shear and top storey displacement were considered. As Peak Ground Acceleration increases base shear and top storey displacement of a building increases. High PGA observed at record stations which are near to the epicentre. Higher peak ground acceleration leads the structure to damage very high. It is better to not construct high rise building near the high PGA recorded area or can construct with good design analysis. Record station which is near to the epicentre is around 1.04,2.02, and 6.22 times more effected the building compared to farer one in the case of India (Sikkim)-Nepal border of magnitude 6.8, East Srinagar Region of magnitude 5.8 and Punjab-HP border of magnitude 4.7 all for 4 storey building. So, it is better to construct the building away from the epicentre. Record station which is near to the epicentre is around 3.5,2.9, and 7.2 times more effected the building compared to farer one in the case of India (Sikkim)-Nepal border of magnitude 6.8, East Srinagar Region of magnitude 5.8 and Punjab-HP border of magnitude 4.7 all for 8 storey building. Record station which is near to the epicentre is around 4,3.3, and 7.7 times more effected the building compared to farer one in the case of India (Sikkim)-Nepal border of magnitude 6.8, East Srinagar Region of magnitude 5.8 and Punjab-HP border of magnitude 4.7 all for 15 storey building. Higher the magnitude of earthquake results in high base shear and displacement of structure. Among the four magnitudes of 4.7, 5.8 and 6.8 the base shear and top storey displacement of buildings are high for 6.8 and low for 4.7. Among all three types of namely 4,8 and 15 storeys building 15 storeys has more base shear and 4 storey had less. 15 storey building experiences around 135% more near fault top storey displacement compared to that of far fault building for the base shear around 4 times of far fault. For low and medium rise building near fault is not that much harmful as it for high rise building. So, it is better to not go for near fault for high rise building.

REFERENCES

1. Niknam, A. Kazemi, M. and Niknam. A. Evaluation and comparison of seismic effects of near-fault and far-fault region with standard project spectrum of code of practice 2800 of Iran, Journal of Civil Engineering of Islamic Azad University, 2(1), 71-79 (2009).
2. Boore, D. M., 2001. Comparisons of ground motions from the 1999 Chi-Chi earthquake with empirical predictions largely based on data from California, Bull. Seismol. Soc. Am. 91, 1212–1217.
3. Amadio, C., M. Fragiacomo and S. Rajgelj, 2003. The effects of repeated earthquake ground motions on the non-linear response of SDOF systems. Earthquake Engineering and Structural Dynamics, 32: 291-308.
4. Baker, J.W., 2007. Quantitative classification of near-fault ground motions using wavelet analysis. Bulletin of Seismological Society of America, 97(5): 1486-1501.
5. Archuleta RJ, Hartzell SH (1981) Effects of fault finiteness on nearsource ground motion.Bull Seismol Soc Am 71:939–957
6. Aguirre, J. and Irikura, K. (1995), "Preliminary analysis of nonlinear site effects at port island vertical array station during the 1995 Hyogoken-Nambu earthquake", J. Nat. Disast. Sci., 16(2), 49-58.
7. Bayraktar, A., Altunişik A.C., Türker, T., Karadeniz H., Erdoğdu, Ş., Angın, Z. and Özşahin T.Ş. (2014), "Structural performance evaluation of 90 RC buildings collapsed during the 2011 Van, Turkey, Earthquakes", J. Perform. Constr. Facil., 29(6), 410- 440.