

Development of Response Spectrum in Indian Context and It's Comparison with Design Spectrum

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ABSTRACT :

Seismic force induced due to earthquake is an important parameter in designing structures and to assess strength of existing structures. Earthquakes are recorded by accelerograph in the form of ground motion. It is established that all earthquake ground motions do not have potential to produce enough seismic force that causes damage to the structures. However, earthquakes quantified as Strong Ground Motion only possess that potential. Various parameters used by researcher to quantify earthquake records as strong ground motion includes, Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV), Frequency Content, Ratio of Peak Acceleration to Peak Velocity, Root Mean Square (RMS) Acceleration, Areas Intensity and Duration. Each strong ground motion consists of varied frequency content in it and offer different seismic demand on the same structure.

In the present study 184 ground motions recorded at 23 recording stations of Indian subcontinent are compiled. Based on PGA and duration of the motion, 67 ground motions are quantified as strong ground motion. These strong ground motion records are categorised into four segment named North Region, South Region, East Region and West Region. Response spectrum for each strong ground motions (67 nos) are developed solving second order differential equation of motion through Newmark-Beta numerical algorithm using MATLAB. A Mean, Mean plus One Standard Deviation (1σ) representative response spectrums are derived using statistical analysis for each region of the country.

The Mean and Mean + 1σ response spectrums are compared with IS code specified Design Spectrum for extreme seismic zone V. It is found that IS based design spectrum shows higher seismic demand as compared to mean response spectrum for each region of the country. However, barring few strong motions in East and North region that shows higher seismic demand as compared to mean + 1σ response spectrum, rest strong motions of each regions shows lower response. With respect to given data, it seems IS code specified design spectrum is conservative in nature.

A comparison among code based design spectrum and mean & mean + 1σ response spectrum is shown in Fig. 1 (a) & (b), respectively.

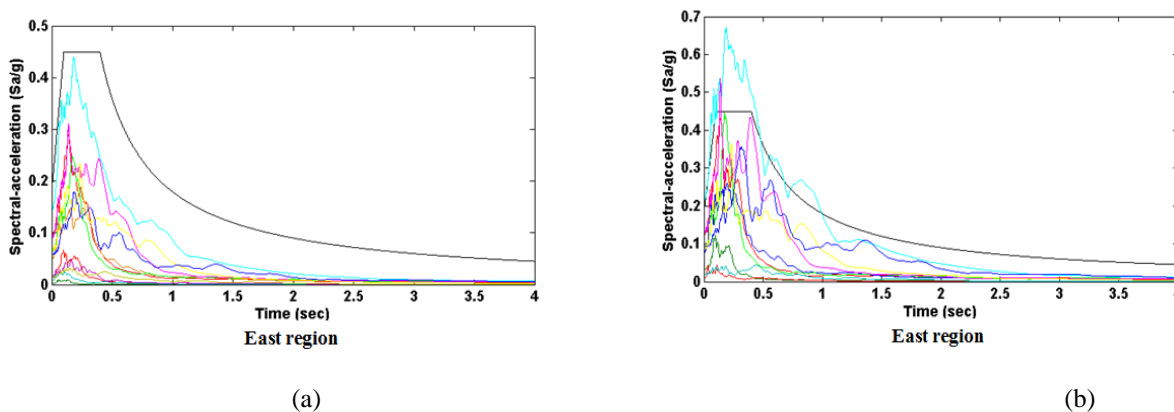


Fig. 1 Comparison among IS based design spectrum and (a) mean (b) mean + 1σ response spectrum