DEVELOPMENT OF DESIGN RESPONSE SPECTRA FOR SRI LANKA

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Abstract:

Sri Lanka is located within a tectonic plate known as "Indo-Australia plate". According to the historical records a very few number of earthquakes were recorded within the country. Historical records indicate that there was a devastating earthquake (Mw=6.4) in 1615 in Sri Lanka.
Then, the seismic resistant design of those important structures will be playing a major role in the design process. However, there are no specific guidelines for seismic resistant designs available locally to meet the performance based seismic design requirements in order to satisfy the expectations of various parties. The performance based seismic design of structures is the most common method that engineers can be used to produce economical designs.
Therefore, the objective of this study is to fulfil this requirement by introducing response for Sri Lanka for different return periods of earthquakes by carrying out a Probabilistic Seismic Hazard Assessment (PSHA) for Sri Lanka. PSHA is the most widely used procedure to determine the ground motion parameters such as peak ground acceleration (PGA) and spectral acceleration (SA) to which structure has to be designed by an engineer.

The first step involves the identification and delineation of all potential sources of seismicity that may affect the site or sites of interest. These sources of seismicity may be represented as area sources, fault sources, or, point sources, depending upon the geological nature of the sources and available data. In the second step, the temporal behaviour of earthquakes is assumed to follow a Poissonian process and it is determined for each source by establishing a magnitude recurrence relationship over the range of magnitudes that are likely to be generated by each seismic source. The third step involves the use of ground motion prediction equations (GMPEs) to establish the conditional probability of exceedance of a pre-specified ground motion value for each site given the occurrence of an earthquake at a particular magnitude and location and the final step of the analysis computes the annual number of events that produce a ground motion parameter, e.g. SA that exceeds a specified level, z. This number of events per year, ν, is also called the “annual frequency of exceedance”. The inverse of ν is called the “return period”. Several probability distributions for each seismic source defined in the previous steps are introduced.

In the Current study different response spectra for three different levels of 50, 475 and 2475 years return periods was produced by carrying out probabilistic seismic hazard assessment for different cities in Sri Lanka. The Peak Ground Acceleration (PGA) and Spectral Acceleration(SA) were calculated within logic tree frame work incorporating different parameters such as maximum cutoff magnitude and ground motion predictive equations for shallow crustal intraplate earthquakes. The study produced 5% elastic damping response spectra for rocky or hard soil sites.

Keywords: Earthquake, Peak Ground Acceleration, Spectral Acceleration, Attenuation relationship