Seismic Hazard Assessment in Urban Cities in India: A Few Case Studies

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As strong and large earthquakes cause widespread destruction to life and property and hinder the development of urban areas, the seismic hazard assessment warrant urgent attention. The seismologists play a key role in defining the source parameters of earthquakes and estimating the associated site-specific ground motion amplification commonly termed site response. The relevant analyses are usually performed using either recorded ground motion for a handful of moderate to large magnitude earthquakes and or by recording seismic noise. Seismic sources are characterized by the physical parameters such as corner frequency *fc*, seismic moment M_0, and stress drop $\Delta\sigma$, that are derived directly from the waveform data, *i.e.*, strong ground motion records for events with significant magnitude. On the other hand, site amplification of ground motion is attributed to the geomorphological and or to the thick alluvium-filled terrain that causes reverberations due to trapped energy. The potentially severe consequences of such phenomenon have been demonstrated in the damage patterns of several earthquakes in India in the recent years, such as the 1999 Chamoli earthquake in the western Himalaya, the 1997 Jabalpur earthquake and the 2001 Bhuj earthquake in peninsular India. In view of these, the Department of Science and Technology, and now the Ministry of Earth Sciences, Govt of India have taken a long term project for microzonation mapping in the urban city areas. The first attempt was made in Jabalpur area, Central Tectonic Zone (CTZ) where major damages due to the 1997 moderate magnitude earthquake (Mw 5.8) were studied in view of the site responses. A major project was then initiated in the Guwahati city area, which is in the vicinity of large and great earthquake source zones in the eastern Himalaya, Shillong plateau and in the Indo-Burma ranges. In addition to these, microzonation studies are conducted in several large and small cities in India, like Delhi, Sikkim Chandigarh, Ahmedabad, Agartala etc by different organizations like CMMAC, IIT_Kgp and Guwahati, WIHG, NGRI, IMD, GSI etc. The results have brought out detailed microzonation maps for seismic hazard mitigation. Another aspect of ground motion is the attenuation of seismic waves along the propagation path connecting the earthquake source and the recording site (observatory). The strong-motion attenuation is an exponential function of the type Q_s (= $Q_0 fn$). The site-specific seismic hazard analysis is also performed by detailed analysis related to earthquake source, site, attenuation using available strong ground-motion data of the recent earthquakes recorded in some of these areas. Results of several such projects in many parts of India are reviewed and would be discussed in this presentation.