

Nation-wide Map of Probability for Earthquake Ground Motion Intensity

Mine Demircioglu, Karin Sesetyan, Mustafa Erdik

Abstract

There are generally two well-known approaches for the quantification of earthquake hazard. One of them is the probabilistic seismic hazard analysis (PSHA), which accounts for all possible earthquake scenarios that could affect the site and results in hazard represented by ground motions parameters at reference ground conditions, such as peak ground acceleration and spectral accelerations. The other is the deterministic approach which relies on scenario based assessments. Even though empirical ground motion prediction equations that predict ground motion parameters such as PGA, PGV and SA's are dominantly used in practice, intensity based assessments are still needed and used in loss assessment studies associated with for example insurance sector, industrial facilities and non-structural elements.

In many regions of the world, earthquake risk assessment studies are performed to improve seismic emergency planning, to evaluate social and economic costs, and to identify priorities in retrofitting and risk mitigations programs. For that reason, a probabilistic approach is applied to assess the seismic hazard in Turkey. The probabilistic approach, as proposed by Cornell (1968) is used to assess the seismic hazard. The methodology used requires information about the location and seismicity rates for each of the defined seismogenic zones, as well as a ground motion prediction model. Considering the ground motion prediction equations, Campbell and Bozorgnia (2008), Chiou and Young (2008) and Boore and Atkinson (2008) relationships are utilized to calculate ground motion parameters such as PGA, PGV and SA at various periods. Specifically, a regional macroseismic intensity attenuation model (Sesetyan et al., 2005) derived from the Turkish macroseismic database is also used in the analysis.

The seismic hazard maps obtained in terms of PGA, PGV, SA at various periods and macroseismic intensities were conducted for 72, 475 and 2475 return periods that correspond to 50%, 10% and 2% probability of exceedance in 50 years, respectively. To reflect the effects of local site conditions ground motion are modified based on a recent QTM map of Turkey and site amplification method of NEHRP (2003).