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Selection of Ground Motion Prediction Equations for Probabilistic Seismic Hazard Assessments of the Izmit Bay Bridge

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This study investigates the effects of using global and regionalized ground motion prediction equations (GMPEs) developed for shallow crustal and active tectonic regions on the outcomes of probabilistic seismic hazard assessment (PSHA) for the target region (Gülerce and Abrahamson, 2014). We selected the PSHA conducted for the Izmit Bay Bridge (Chacko et al., 2014) which employed the global Next Generation Attenuation (NGA)-W1 GMPEs (Power et al., 2008) in the original version as the case study. Gülerce et al. (2016) proposed a regionalized version of these models which are applicable to Turkey (TR-NGA-W1 GMPEs). Additionally, new global GMPEs (NGA-W2),(Bozorgnia et al., 2014) have been developed based on an extended global ground motion database (Ancheta et. al, 2014). The seismotectonic model developed for the Izmit Bay Bridge in the original version (Chacko and Giannakou, 2013) is directly adopted and the full set of TR-NGAW1 GMPEs is implemented in a commercial PSHA software (EZ-Frisk 8.0, Fugro Consultants, 2015). PSHA analyses are carried out for North Tower (located on rock) and South Approach (located on soil) of the Izmit Bay Bridge using three separate sets of GMPEs (NGA-W1, TR-NGAW1, and NGA-W2). Spectra and design scenario earthquakes obtained for three sets of GMPEs are compared to evaluate the effect of GMPE selection on the design scenario earthquake and the site amplification. The differences between the spectral ordinates obtained using the three sets of GMPEs at the North Tower and for the relevant vibration period of the Tower are negligible. The same differences at the South Approach are more notable, including the period of vibration of the viaduct structure and are mainly due to site amplification effects.

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