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Seismic Performance of Slopes Subjected to Earthquake Mainshock Aftershock Sequences

Authors : Alisha Khanal, Gokhan Saygili

Abstract : It is commonly observed that aftershocks follow the mainshock. Aftershocks continue over a period of time with a decreasing frequency and typically there is not sufficient time for repair and retrofit between a mainshock–aftershock sequence. Usually, aftershocks are smaller in magnitude; however, aftershock ground motion characteristics such as the intensity and duration can be greater than the mainshock due to the changes in the earthquake mechanism and location with respect to the site. The seismic performance of slopes is typically evaluated based on the sliding displacement predicted to occur along a critical sliding surface. Various empirical models are available that predict sliding displacement as a function of seismic loading parameters, ground motion parameters, and site parameters but these models do not include the aftershocks. The seismic risks associated with the post-mainshock slopes ('damaged slopes') subjected to aftershocks is significant. This paper extends the empirical sliding displacement models for flexible slopes subjected to earthquake mainshock-aftershock sequences (a multi hazard approach). A dataset was developed using 144 pairs of as-recorded mainshock-aftershock sequences using the Pacific Earthquake Engineering Research Center (PEER) database. The results reveal that the combination of mainshock and aftershock increases the seismic demand on slopes relative to the mainshock alone; thus, seismic risks are underestimated if aftershocks are neglected.

Keywords : seismic slope stability, mainshock, aftershock, landslide, earthquake, flexible slopes
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