Nonlinear Earthquake Site Response Analysis of Layered Soil Deposits at Shakardarra and Muzaffarabad

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The present work deals with the test of the adequacy of site response analyses (e.g., strain dependent shear modulus and damping curves) to predict the effects of soil deposits on site responses during earthquakes. The selected sites are Shakardarra (Kohat) and Muzaffarabad (Azad Kashmir). For this, the site responses at the vertical strong motion arrays at the Shakardarra and Muzaffarabad were analyzed prior to occurrence of any earthquake. The site response analysis program, which is based on the nonlinear hysteretic soil model (NERA), has been used for the purpose. The site response models were constructed using different borehole profiles, shear and compression wave velocity profiles, and the available geotechnical data. The analysis neglected other nonlinear and geometrical effects such as stiffness reduction due to pore pressure buildup, liquefaction, two-dimensional and three-dimensional effects due to wave propagation and non-uniform soil layering. Two site-response analyses were carried out for two input ground accelerations, 0.07 g and 0.17g. Based on the NERA analysis, the Muzaffarabad and Shakardarra sites ware found to have comparable responses over a wide range of earthquake motions, which is justified in view of the similarities of soil profiles at the Shakardarra and Muzaffarabad sites. At Shakardarra site, NERA predicts site amplification for acceleration up to 0.07 g, and attenuation of surface acceleration for higher levels of accelerations. While at Muzaffarabad NERA predicts site amplification for acceleration up to 0.17 g. The results are beneficial for both the researchers and engineers alike.