

Site-Specific Seismic Ground Response Analysis for Sustainable Construction in Islamabad

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Understanding how soil behaves during earthquakes is important for designing safe and sustainable buildings, especially in earthquake-prone areas like Islamabad. In this study, we investigated the dynamic properties of soils in Islamabad by collecting undisturbed samples from 30 locations and testing them in the laboratory using cyclic triaxial and resonant column tests. From these tests, we developed site-specific shear modulus and damping ratio curves, which helped improve the accuracy of seismic ground response analysis (GRA). The study evaluated the ground response to different earthquake motions and analyzed the results in terms of surface acceleration time history, shear stress to vertical effective stress ratio over time, acceleration response spectrum, Fourier amplitude ratio as a function of frequency, and other key parameters. These findings provide better estimates of ground motion and will be useful for engineers and planners in designing earthquake-resistant infrastructure. The results are especially important for local authorities and disaster management organizations working to reduce earthquake damage in Pakistan.

Keywords: Dynamic soil properties; Shear modulus; Damping ratio; Earthquake-resistant design; Nonlinear site response