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Soil-Foundation-Structure Systems Beyond Conventional Seismic Failure Thresholds

Abstract

A new paradigm has now emerged in performance–based seismic design of soilfoundationstructure systems. Instead of imposing strict safety limits on forces and moments transmitted from the foundation onto the soil (aiming at avoiding pseudo-static failure), the new dynamic approach “invites” the creation of two simultaneous “failure” mechanisms: substantial foundation uplifting and ultimate-bearing-capacity slippage, while ensuring that peak and residual deformations are acceptable. The paper shows that allowing the foundation to work at such extreme conditions not only may not lead to system collapse, but it would help protect (save) the structure from seismic damage. A potential price to pay: residual settlement and rotation, which could be abated with a number of foundation and soil improvements. Numerical studies and experiments demonstrate that the consequences of such daring foundation design would likely be quite beneficial to bridge piers and building frames. It is shown that system collapse could be avoided even under seismic shaking far beyond the design ground motion.

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Biography

George Gazetas has been Professor of Geotechnical Engineering at the National Technical University of Athens for 30 years, following an academic career in the US, where he taught at SUNY-Buffalo, Rensselaer (RPI), and Case Western Reserve University. His main research interests have focused on the dynamic response of footings, piles and caissons; the seismic response of earth dams and quay-walls; soil amplification of seismic waves; and soil–structure interaction problems. Much of his research has been inspired by observations after destructive earthquakes. An active writer and teacher, he has been a consultant on a variety of (mainly dynamic) geotechnical problems. The recipient of prestigious awards for his research contributions, he has given the Coulomb (2009) and Ishihara (2013) Lectures, and received the Excellence in University Teaching Award in Greece (2015).