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Potential Risks of Using Disconnected Composite Foundation Systems in Active Seismic Zones

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Abstract : Choosing the suitable infrastructure system is becoming more challenging with the increase in demand for heavier structures contemporarily. This is the case where piled raft foundations have been widely used around the world to support heavy structures without extensive settlement. In the latter system, piles are rigidly connected to the raft, and most of the load goes to the soil layer on which the piles are bearing. In spite of that, when soil profiles contain thicker soft clay layers near the surface, or at relatively shallow depths, it is unfavorable to use the rigid piled raft foundation system. Consequently, the disconnected piled raft system was introduced as an alternative approach for the rigidly connected system. In this system, piles are disconnected from the raft using a cushion of soil, mostly of a granular interlayer. The cushion is used to redistribute the stresses among the piles and the subsoil. Piles are also used to stiffen the subsoil, and by this way reduce the settlement without being rigidly connected to the raft. However, the seismic loading effect on such disconnected foundation systems remains a problem, since the soil profiles may include thick clay layers which raise risks of amplification of the dynamic earthquake loads. In this paper, the effects of seismic behavior on the connected and disconnected piled raft systems are studied through a numerical model using Midas GTS NX Software. The study concerns the soil-structure interaction and the expected behavior of the systems. Advantages and disadvantages of each foundation approach are studied, and a comparison between the results are presented to show the effects of using disconnected piled raft systems in highly seismic zones. This was done by showing the excitation amplification in each of the foundation systems.

Keywords : soil-structure interaction, disconnected piled-raft, risks, seismic zones
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