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Evaluating Seismic Earth Pressure Effects on Building Lateral Stability: Sensitivity to Retention Height Differences and Sloped Site Conditions

Authors : Rod Davis, Sara Saminfar

Abstract : Earthquakes can induce dynamic earth pressures on retaining walls, which are in addition to the static earth pressures. This raises questions about how to effectively combine the seismic lateral earth pressure with other loads on buildings, including static lateral earth pressure. When basement walls retain soil with differing exterior grades on opposite sides, the seismic increment of active earth pressure should be considered. Additionally, buildings situated on sloped sites with stepped retention may experience unique dynamic effects due to soil-structure interactions, potentially amplifying the lateral pressures exerted on the retaining walls and influencing the building's response during seismic events. To account for the dynamic effects of the retained soil on the building's responses, it is essential to interconnect the building structure with the surrounding soil to facilitate their interaction as the embedded structure and the surrounding soil move together during an earthquake. Consequently, a finite element model of the building is developed, with the rigid retaining walls and restrained to the floor diaphragms. This paper aims to explore the dynamic effects of retained soil on the lateral stability of buildings and the sensitivity of the building's responses to differences in the retained heights on opposite sides of the building basement. Furthermore, the results are compared with those from a sloped site to evaluate the impact of stepped retention on dynamic soil pressure. These findings will help establish a minimum threshold for differences in retained heights on opposite sides of a building that necessitates the inclusion of dynamic soil pressure in the building's lateral stability analysis.

Keywords : dynamic earth pressures, soil-structure interaction, stepped retention, building retention
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