

报告题目： 场地竖向地震反应：一个长期忽视的问题？

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摘要： 场地地震反应特征是地震工程的重要研究领域之一。在工程抗震设计中，无论是地上建筑（如房屋，桥梁）还是地下结构（如隧道，管道），关键抗震设计参数（如地表加速度，土层动应力及动应变）需通过场地地震反应分析得到。虽然实际场地土层受两个水平方向和一个竖直方向的地震作用，但大部分研究往往忽视竖向地震作用，只考虑水平地震作用。报告将通过实际地震案例分析指出现有设计分析方法对竖向地震作用考虑不足，并介绍一种简化的多向地震反应分析方法。利用该方法进一步研究了多向地震作用下场地土层在不同地震波输入和不同土质条件下的地震反应特征，包括不同强度地震动输入，地下水位变化，以及土的非线性和阻尼的影响。报告最后将简要讨论竖向地震作用对砂土液化和滑坡灾害评估的影响。

### **Vertical Site Response to Earthquake Loading: A Missing Issue?**

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Abstract: Site response to earthquake loading is one of the most important problems in earthquake-related research. Practicing engineers rely on site response analysis to predict ground surface motions and dynamic stresses and strains in the ground, which are key inputs for seismic design of engineering structures (e.g. buildings and bridges) and underground facilities (e.g. tunnels and pipelines). During an earthquake, the natural ground or engineering sites in general are subjected to three-dimensional ground motions, in both vertical and horizontal planes. Most studies of earthquake effects have tended to disregard the effect of vertical ground motion and concentrate mainly on horizontal ground motion. In this talk, we will present observations from recent large earthquakes showing that current analyses and engineering designs do not adequately account for the effects of vertical ground motion. We will then introduce a simple and practical procedure for computation of site response to both horizontal and vertical earthquake motions, and examine a number of factors that may influence the ground response to multidirectional earthquake loading, including the intensity of input motion and the associated soil nonlinearity, the variation of water table, and the damping property of soil. Finally, we will discuss the effects of vertical ground motion on soil liquefaction evaluation as well as landslide hazard assessment.

#### Key references:

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