

Structure-soil-structure interaction between multi-tower structures and large underground structures

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ABSTRACT

The complex high-rise structure integrating multiple towers, podiums, and large-space underground structures has grown rapidly in large cities due to the versatility of buildings. Under seismic excitation, such complex high-rise structures form a complex "structure-soil-structure" system with soil, and the internal coupling interactions of the structure and soil-structure interaction have a significant impact on the seismic response of the overall structure. In this study, the nonlinear finite element numerical model of a two-tower structure with an integral large underground basement considering soil-structure interaction was established. The effects of the interaction between the podium and the tower, between the adjacent towers, and between the above-ground and underground structures on the seismic response of the entire structure were investigated using comparative analysis. The results show that although the embedded effect of the podium on the tower delays the damage development at the bottom of the structure, it also amplifies the seismic response of the upper part of the tower. The displacement and acceleration responses of the single tower decrease after considering the effects of the adjacent tower. The soil enhances the connection between the towers, and the beneficial effect of the adjacent tower on the single tower is enhanced after considering the impact of the soil. The influence of the large underground structure on high-rise structures above ground varies with the increase of seismic intensity. When the seismic intensity is low, the embedded effect of the underground structure inhibits the seismic response of the above-ground high-rise structure; when the seismic intensity is high, the unfavorable vibration effect of the underground structure intensifies the seismic response of the above-ground high-rise structure.

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