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NUMERICAL INVESTIGATION OF POTENTIAL FOUNDATION INTERVENTION AS A MEANS FOR MITIGATING SEISMIC RISK

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ABSTRACT

Interventions at the foundation and the surrounding soil of existing buildings are commonly employed as a means to increase the foundation-soil system resistance and/or reduce excessive ground deformations under strong ground shaking. However, current research has highlighted the potential to improve the seismic performance of buildings by mitigating the imposed earthquake loading that is transmitted through the foundation. The scope of the present paper therefore, is to investigate whether such a potential modification of the soil-structure system dynamic characteristics could result to the upgrade of seismic safety while investigating the physical mechanisms that describe the behavior of the coupled SSI system. The examined foundation intervention methods include both commonly applied construction techniques, such as diaphragm walls and soil stiffening, as well as more innovative methods implementing low shear strength materials that are injected within the soil mass. All these solutions are studied with the use of advanced numerical tools through extensive experimental validation and parametric analyses that aim at investigating a specific beneficial or detrimental trend for various combinations of earthquake scenarios, soil conditions and SDOF and MDOF structural characteristics. The numerical analysis results derived reveal that, notwithstanding the significant complexity of the problem, particular interventions could potentially mitigate the imposed earthquake input, thus improving the anticipating building seismic performance under certain conditions.

Introduction

Interventions at the soil-foundation level of buildings are commonly applied over the last decades mainly in order to enhance soil resistance and bearing capacity and improve the structural response under both static and dynamic loading as well as towards the reduction of soil deformations. In this context, soil densification, pile reinforcement, jet grouting and several other techniques have been implemented to directly enhance resistance-related soil properties. Furthermore, in cases of critical soil behavior under dynamic loading, such as potentially

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