DIPARTIMENTO DI GEOSCIENZE

UNIVERSITÀ DEGLI STUDI DI PADOVA

Arduino Lecture

Investigation of soil-structure interaction effects through wave propagation analysis in building-soil-layers

Giovedì, 7 dicembre 2017 - 16:30
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Abstract:

The study of soil-structure and city-soil interaction is currently one of the main challenges for the seismological and engineering communities. Until now, most investigations of these effects have been carried out based on 2D and 3D numerical simulations. Studies based on real data sets were usually performed separately in order to investigate either the dynamic properties of a building or the soil.

In this study, soil-structure interaction is investigated empirically by analyzing a real data set composed of earthquake recordings from a borehole-building strong motion installation at three test locations (Bishkek, Kyrgyzstan, Istanbul, Turkey, and Mexico City, Mexico). The buildings equipped with sensors are located close to borehole installations. Each test case involves different soil conditions and building construction types, where for each of the analyzed cases, the impedance contrasts between the building and the soil are different, as a well as the wave propagation speeds in the subsurface and building.

The soil-structure interaction effects are investigated by the joint deconvolution which has been shown to appropriately identify wave propagation through the building-soil layers. Both the real seismic input (the ground motion at various depths without the effect of down going waves) and the wavefield being radiated back from the building to the soil are separated through the adopted constrained deconvolution approach. Finally, the energy being radiated back from the building to the soil is estimated.

The values obtained show that even at great depths (and therefore distances), the amount of wavefield being radiated back by the building to the ground is significant (e.g., for the Bishkek case, at 145 m depth, 10-15% of the estimated real input energy is expected to be from the building; for Istanbul at 50 m depth, the value is also 10-15% of the estimated real input energy while for Mexico City at 45 m depth, it is 10-25% of estimated real input energy).

Proponente: Giorgio Cassiani