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Soil-Building Resonance in the Matera (Italy) Microzonation Framework

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Besides being the first example in Italy of participatory regulations in the sector, the 'Guidelines for seismic microzonation', published in the 2008, today represent an innovative tool for urban planning and seismic design. They have long been tested and used, however some aspects can be improved and the presence of buildings is not considered in any way. As the buildings play a fundamental role in the ground motion in terms of energy and frequency, both for small displacements and during earthquakes, the urban environment should be assessed in its entirety for the evaluation of the urban subsoil characteristics. For these reasons, a holistic approach where the evaluation of the urban site response is carried out considering not only the litho-stratigraphic and geotechnical conditions but also the soil-building resonance and the site-city interaction effects would lead to a more effective seismic risk mitigation strategy. Countless observations following earthquakes have highlighted peculiar damage to some buildings due to the soil-building resonance and the site-city interaction effects. In the framework of the CLARA (Cloud platform and smart underground imaging for natural risk assessment) project, the soil frequency and the overly building responses have been estimated to evaluate the soil-building resonance map for the whole built environment of the city of Matera (Italy). The availability of detailed geological maps, a high number of direct and indirect geophysical and geotechnical tests and an extensive seismic survey with passive prospecting techniques have allowed to obtain the isofrequency map of the whole urban soils. Moreover, the period-height relationship for the Matera buildings was experimentally derived by using seismic passive single-station measurements carried out on 90 buildings representative of the main building typologies. Based on the soil isofrequency map and building frequencies, it has been possible to determine the soil-building resonance map and to spatially identify those buildings for which possible resonance conditions with the relative foundation soil might occur.