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Abstract Book

Con il patrocinio di:

Local seismic response in complex geological conditions. Insights from the Cassino intermontane basin

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Local seismic response (LSR) analysis and microzonation studies represent fundamental tools for assessing and mitigating seismic risk in urban areas.

LSR studies and quantifies the modifications of seismic waves in terms of amplification or deamplification caused by their passage through lithologies characterised by different stiffness and density, from the earthquake source (hypocentre) to a specific point near or at the surface. The effects of such modifications could have a significant impact on infrastructures, such as roads, bridges and buildings.

Numerical analyses, although originating in the 1970s, were fully integrated into Italian technical legislation starting with D.M. 14/01/2008 (commonly referred to as NTC08), and particularly in the Lazio Region, they received additional impetus first from D.G.R. n. 489/2012 and subsequently from the following regional laws that integrate and/or modify it. Furthermore, the Lazio Seismic Regional Regulation n. 26 (D.G.R. n. 724/2020) introduces, for the first time, the two-dimensional LSR approach as mandatory in specific stratigraphic and morphologic conditions. On a territorial planning level, numerical analyses are a strict requirement for conducting level 3 seismic microzonation studies.

This work is being conducted in the city centre of Cassino, which is located geologically in the southern part of the Latium-Abruzzi carbonate platform, in a fluvial-lacustrine valley, where soft sediments (approximately 100 to 200 meters thick) overlay a calcareous/flyschoid bedrock. The goal is to evaluate the local seismic response of the subsoil and its impact on civil infrastructures. We performed such an analysis through 1D and 2D LSR analyses of the Cassino centre area, aiming at quantifying the variability in the results obtained from the two approaches.

The first step of the workflow involved creating a GIS project containing pre-existing geological, geotechnical, and geophysical investigation data (including approximately 90 boreholes, 75 cone penetration tests, 12 down-hole investigations, and more than 200 seismic ambient noise measurements). Additionally, new seismic ambient noise measurements were specifically conducted for this project. The interpretation of these data allowed us to model subsoil deposits through geological sections, parameterise lithologic units as required by LSR modelling, and identify the depth of the seismic bedrock beneath the superficial soft-soil deposits.

Furthermore, seismic ambient noise measurements were conducted on various types of buildings (performed both on the ground and on the top floor), selected based on parameters that can affect their vibration frequency, such as shape, construction age, number of floors, and construction materials. This classification of structures was based on the impact that the ground motion, previously estimated using LSR methods, had on them.

The results of this study and its approach could be instrumental in influencing future project decisions or in the field of Civil Protection, where territorial emergency plans should provide accurate risk scenarios.

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