

# Structural conditions and seismic vulnerability of timber roofs

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In the seismic strengthening of traditional buildings, avoiding the replacement of timber roof structures and adopting wherever possible less invasive strengthening techniques appears as a better option after several cases of extended damage and collapse occurred in buildings that had undergone massive interventions. In Italy, the recently issued national design code guides in this direction specifying that the original timber roofs are usually more compatible in terms of mass and stiffness with the supporting masonry wall structure and indicating that interventions should preserve the original conceptual design where valid.

In this perspective, a methodology for assessing the seismic vulnerability associated to timber roof structures has been developed by the authors. The criterion followed is typical of vulnerability studies and consists in examining the structure according to a codified visual inspection procedure, by which data on geometry, details, and the health state of its members are collected, and evaluating from the general picture resulting from this examination a series of vulnerability indicators. Each of them concerns a specific issue or feature that affects the capability of the structure to respond to seismic action. As a result, indications are obtained on the global level of response that may be obtained of the structure; possible specific criticalities are highlighted.

The effectiveness of the approach, however, strongly depends on the possibility and extension of its calibration. In this work, the procedure has been applied to a set of cases from historical buildings of different character. The roof structures were from a covered gallery in a monumental building, a rural building, a building originally open to public and now used as meeting room after some rehabilitation interventions, and a country church currently in a rather degraded state.

At a general level, testing the procedure on structures of very different origin and condition aimed at assessing or improving its robustness in extracing the essential features of a structural system and pointing out criticalities. Some simplifications and some additions to the data collecting step suggested by this work have been carried out. The procedure has positively performed, giving effective guidance in evaluating the characteristics that affect the seismic response for these structures that are usually seen rather in their capability of supporting vertical loads.

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