

The seismic risk assessment and reduction: towards a knowledge system for archaeological preexistences

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ABSTRACT

The earthquake is a serious risk factor for archaeological heritage and the preventive protection assumes a strategic importance especially in this thematic area, because of the lack of purpose that a reconstructive intervention would produce. However, the multiple problems of conservation and enhancement of the archeological heritage make the *planning of damage mitigation* complex, according to the criteria adopted for historical architecture.

The legislation development on the evaluation and reduction of cultural heritage seismic risk in Italy shows a generic extension of the specific architectural monuments' provisions to the archaeological ones, in which the absence of connections or their intrinsic weakness, if present, increases its vulnerability. Currently, it is clear that the absence of a specific "functional connotation" of ruins, apart from the visit one, places these contexts on the margin of the most recent regulations reconsiderations. The *Linee Guida per la valutazione e riduzione del rischio sismico del patrimonio culturale (Mibac 2011)* articulate the vulnerability assessment on three distinct levels according to a growing level of knowledge and completeness of structural modeling (L_{V1} , L_{V2} , L_{V3}). However, the rapid evaluation methodology on a territorial scale (L_{V1}) is exemplified for some architectural types, not considering the archaeological structures. The *Linee guida per la conservazione di architetture di interesse archeologico* for the archaeological sites of Rome and Ostia Antica (Cecchi 2011) represent an attempt to integrate the *Linee Guida Mibac 2011* for a possible application to ruins. However, the knowledge system proposed for the territorial scale evaluation, is weakly connected to the analytical dimension.

The paper illustrates a methodology for reading the archaeological seismic vulnerability on a territorial scale, aimed at a first-level rapid evaluation (L_{V1}), based on a knowledge system calibrated according to the specificities of these pre-existing structures. This approach is developed in a Phd research in the History, Design and Restoration of Architecture of the Sapienza University of Rome. The paper illustrates some results obtained in this work, with applications conducted on the Roman Forum structures. Specifically, leaving out the ruins made in itself, which show an overall structural behavior similar to historic buildings still in use, for whose structural analysis the current guidelines are considered valid, the attention is focused on the ruins constituted by walls without connections, whose structural behavior, far from the global one, can be assimilated of a 'macro-element'.

Using a hierarchical system identification of structural 'morphos-types', the simpler types are considered, articulated in the *vertical structures* (columns, pillars and wall fragments), and the more complex systems according to the trilithic or triumphal arch, to *single span* or to *multiple spans*, called *linear systems*. Finally, there are the ruderal structures originating from the masonry buildings in which, depending on the different level of conservation and the connections, it is possible to identify *incomplete, complete* or *aggregate masonry cells*. For each 'morphos-types' analyzed are investigated the geometric parameters that denote the macroelement; the materials and the state of conservation; the connection and reinforcement elements; the previous interventions and the material additions; the links between the parties; the signs of structural degradation and discontinuity; the projection elements; the state of damage made by cracks, collapses, crushing, ejections and inclinations.

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