

# Typological characterization of ancient town walls for disaster prevention and mitigation. The Mo.M.U. project.

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## ABSTRACT

The problem raised by the steadily increasing number of failures in ancient town walls has recently attracted much interest. This typology of cultural heritage has always played a critical role in shaping local identities and still holds great potential as cultural resource but poses substantial challenges in management terms. In fact, multi-disciplinary methodologies for their study and analysis are missing. Starting from 2019, the Regional Government of Tuscany is promoting a systemic research regarding walled historic centres with the objective to develop a fit-for-purpose methodology to inform risk governance in its territory. Initially attributed only to extreme climatic events like heavy rainfalls, closer study of collapsed town walls reveals a more complex situation in which the weathering conditions of cultural heritage assets contribute to the progressive and slow degradation of materials and structures. The Mo.M.U. (*Monitoraggio delle Mura Urbane*) project brings an innovative contribution towards the analysis of ancient town walls in Italy, focusing on defining methods, technologies and tools for their multi-hazard risk analysis and monitoring. The project herein presented adopts a systemic approach to the organization of processes, ranging from the territorial scale to the more minute scale of individual elements, thus allowing for the multi-level risk prioritization, preventive conservation, and maintenance. This paper explores the main failure events recently occurred in town walls with the objective to identify their root causes and the parameters affecting the risk assessment. Then, it presents the territorial level investigations regarding a large number of Tuscan walled towns in order to define knowledge and evaluation forms, as well as to conduct benchmarking studies. The research activities comprise the implementation of a GIS platform that allows for storing and elaborating diverse types of data. The architecture of the database has been defined according to the research scope and supports knowledge management for risk assessment and governance.

## REFERENCES

- [1] Birkmann, J., Cardona, O.D., Carreño, M.L. *et al.* “Framing vulnerability, risk and societal responses: the MOVE framework.” *Nat Hazards* **67**, 193–211 (2013). DOI: 10.1007/s11069-013-0558-5
- [2] Moreno, M., P. Ortiz, and R. Ortiz. “Vulnerability Study of Earth Walls in Urban Fortifications Using Cause-Effect Matrixes and GIS: the Case of Seville, Carmona and Estepa Defensive Fences.” *Mediterranean Archaeology and Archaeometry* **19.3**:119-138 (2019).
- [3] Andreini, M., De Falco, A., Giresini, L., & Sassu, M. “Recenti eventi di crollo in mura storiche urbane.” In *Proceedings of the 3rd Conference Ingegneria Forense-su CRolli, Affidabilità Strutturale, Consolidamento (IF CRASC’15), Rome, Italy*. pp. 14-16 (2015).