

Managing natural disasters in historic areas: a novel holistic seismic risk assessment method applied to a relevant case study

M. Lucesoli [†], G. Bernardini [†] and E. Quagliarini ^{†,*}

[†] Department of Construction, Civil Engineering and Architecture (DICEA)
Università Politecnica delle Marche
via di Breccie Bianche 60131 Ancona, Italy

Corresponding author: Prof. E. Quagliarini, e-mail: e.quagliarini@staff.univpm.it

ABSTRACT

The resilience of historic areas is highly threatened by natural sudden onset events such as earthquakes. Major weak points of an urban environment, widely debated in the past literature, concern mainly masonry buildings. However, also the complex urban paths system could be prone to lose its functionality in the aftermath of a seismic event. Urban paths alterations due to earthquake effects can be attributed to extrinsic (i.e.: ruins formation from buildings) and intrinsic (e.g.: ground instability due to landslide or underground cavities) vulnerability; these factors jointly combined with exposure condition of hosted population in urban areas and with the local seismic hazard represent a possible impediment to evacuation process and at the same time, an obstacle to rescuers' teams occupied in offering a first aid response. Therefore, the work aim is to apply a tool for preliminary evaluation of risk, strictly related to urban paths system considering all abovementioned aspects from a holistic point of view. This goal is achieved by a simplified methodology applicable to a wide scale on a whole historic centre that takes advantages from a series of easy-to-detect parameters influencing the risk with limited availability of resources. Parameters grouped by topics (i.e.: path use and exposure; geometric features; physical-structural features; extrinsic vulnerability; seismic hazard) are assigned to scores and weights according to a multi-criteria decision-making process generating a numerical index. A typical Italian urban centre made by historical masonry constructions is assumed as a case study to implement the existing method. The detected risk indexes are then graphically provided through risk maps, a chromatic scale indicates which areas are more prone to possible unavailability of paths rather than others. Evacuation planners and emergency managers could embody this tool in their studies to prevent the high number of losses by guiding evacuees toward assembly points through the risk lower paths and to direct risk-reduction interventions punctually where critical condition emerges with different priority levels. Paths accessibility evaluation through a risk characterization could also result useful as a tool for rescuers' activities optimization and for inhabitant disaster preparedness in terms of being familiar with safest and alternatives paths in emergency conditions.