

# Prediction of fatalities for potential strong earthquakes in Portugal

Holger Lovon<sup>1</sup>, Vitor Silva<sup>1</sup>, Romeu Vicente<sup>1</sup>, Tiago M. Ferreira<sup>2</sup>

<sup>1</sup> – Department of Civil Engineering & RISCO, University of Aveiro

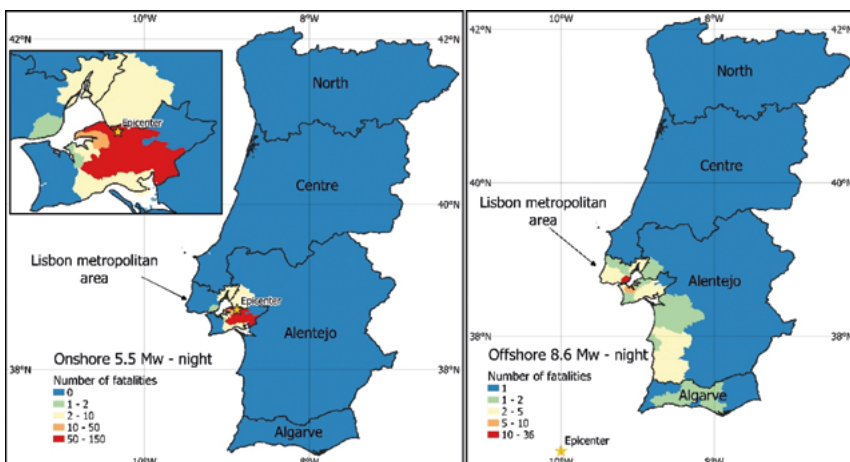
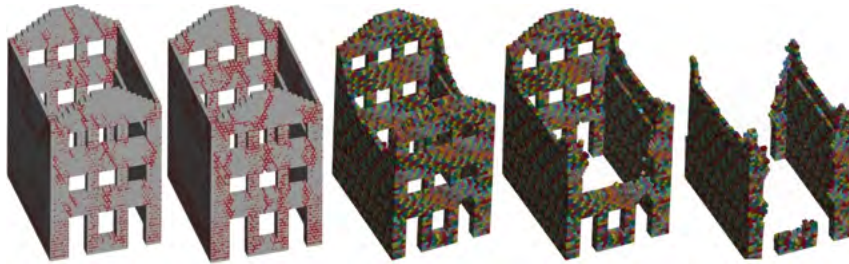
<sup>2</sup> – Department of Geography and Environmental Management, University of the West of England, United Kingdom

**FIGURE 1**

Distinct stages of damage for a 3-storey masonry building.

**FIGURE 2**

Onshore and Offshore earthquake scenarios for an event occurred during the night.



Earthquakes have demonstrated a high destructive power around the world producing both economic and human losses. The Portuguese masonry building stock has experienced strong earthquakes in the past (e.g. 1722 ~M6.0 Algarve, 1755 ~M8.5 Lisbon, 1909 M6.3 Benavente, 1969 M7.8 Algarve) demonstrating a poor performance.

The study started with a characterization of masonry buildings by gathering geometric and mechanical properties. After that, advanced numerical modelling was conducted to predict the response of masonry buildings against a set of earthquake records. The latter approach allowed us to implement an innovative

procedure for a more accurate assessment of fatalities. Outcomes were employed for the development of earthquake scenarios for the two most common sources of earthquakes in Portugal. An onshore M5.5 event was investigated, the latter is produced by a crustal fault at a very superficial depth. This is the critical event that can affect the Metropolitan Area of Lisbon because of its closeness to the populated area but also its superficial character. A second offshore M8.5 event was developed, in this case the event arises near the Pombal fault. The latter event affects a larger area but produces less losses, it could be explained because of the large distance at which the event takes place.

Simulations were performed at different times of the day (i.e. day and night) since the dynamic of the population changes accordingly. During the night, most of the population is at home, while during the day most people is in public but not in residential buildings. It was found that for events occurred during the night where 280 and 110 fatalities are predicted in average for onshore and offshore events, however the uncertainty around these values is still significant.

Research is still being conducted with promising results, outcomes might be used to aid the development of emergency response plans and the formulation of strategies for earthquake risk reduction.