

Seismic behaviour analysis and retrofitting of a row building

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ABSTRACT: Rammed earth is one of the oldest building materials in the world, and it is present in Portugal with a particular focus in the South of the country. The mechanical properties and the structural behaviour of rammed earth constructions have been the subject of study of many researchers in the recent years. This study is part of a broader research on vernacular seismic culture in Portugal. Numerical analyses were carried out to assess the influence of different retrofitting solutions in the behaviour and seismic performance of a rammed earth building, representative of the vernacular heritage of Alentejo region. Understating the structural fragilities of this type of constructions allowed determining the most appropriate retrofitting solutions.

1 INTRODUCTION

Vernacular constructions exist all around the world. Many of these constructions, besides their cultural and architectural heritage value, in many cases, present a pronounced level of degradation, urging for the need of conservation and strengthening actions.

Portugal may suffer from moderate seismic events, as evidenced in historical past events. The past seismic activity, particularly in the south of the country, have drove the implementation of some retrofitting measures in the built vernacular heritage, including the insertion of strengthening elements like ties, reinforcing rings, buttresses and other reinforcement elements. The insertion of these elements contributes to enhance the connection between structural elements, and to the improvement of the structural behaviour and performance of the buildings.

This chapter presents the main results of a numerical study of the influence and effectiveness of common seismic improvement measures, typically found in vernacular constructions.

In this study, it was selected a building, representative of the vernacular architecture in certain localities in the South of Portugal. The building model was calibrated with information on material properties and structural characteristics. With the calibrated model, parametric analyses are performed to assess the influence of different retrofitting solutions in their behaviour and seismic performance.

The analysis of the numerical results gives a first insight on the behaviour of these type of vernacular constructions, and points out which retrofitting solutions may be more efficient in their seismic performance enhancement. The numerical results may also contribute to a better understating of the structural fragilities of these constructions, namely in terms of seismic demands in the structural elements and structural damage distribution. (Vicente et al., 2011).

2 DESCRIPTION OF THE CASE STUDY

For the selection of the building studied were taken into account the objectives of the numerical study developed under the SEISMIC-V project. The case study is located in *Alcácer do Sal*, district of *Setúbal*, in Portugal. It is a building with eight spaces, and the vertical structural elements are principally rammed earth walls, with some elements in stone/brick masonry. The walls are 3.0 m high in average, and have a thickness of 0.50 m. The building has a regular plan (see Fig. 1–2). The roof is gabled, and possesses a wooden structure coated with ceramic tiles (Correia, 2007).

3 FINITE ELEMENT MODEL AND STRENGTHENING SOLUTIONS

To understand the structural behaviour of this traditional building typology, the selected building was