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A CONTRIBUTION TO ASSESS THE STRUCTURAL VULNERABILITY OF TRADITIONAL TIMBER PAVEMENTS

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ABSTRACT

In general, timber pavements are the main horizontal structural elements of the Portuguese traditional buildings. Since these types of buildings required to be preserved, the maintenance of timber pavements is crucial. However and unfortunately, the demolition of the interior of traditional buildings still is a current building option in rehabilitation processes. This building scenario is more expressive in private estate, in particular, in private dwellings. This option may be due to the lack of technical knowledge concerning timber pavements. Therefore, this paper intends to give a contribution in this matter by proposing an expedite methodology able to assess the structural vulnerability of these types of horizontal structural elements. Mapping the different structural vulnerability degrees of a traditional timber pavement may give guidance for maintenance, inspection and/or reinforcement design processes.

Keywords: traditional timber pavements, structural timber elements, structural vulnerability, pathology, mitigation, sustainability

INTRODUCTION

Granite, schist and tabique building are traditional Portuguese buildings. The differentiation of these types of buildings is basically related to the type of the respective main external vertical structural elements. In all the cases, the main external vertical structural element is a wall and instead of a column. Granite masonry, schist masonry and tabique wall are the main external vertical structural elements of the granite, the schist and the tabique traditional buildings, respectively. There is also the case of mixed type in which, an integrated combination of the above identified vertical structural elements is possible. For instance, this building scenario is highly expected in tabique buildings because stone masonry (e.g. granite or schist) placed at the ground floor level usually support the upper external tabique walls. In general, these types of traditional buildings have interesting building patterns such as, local and natural building materials, and an interior timber component tendency. In fact, the pavements, the stairs, the roof's structure and the partition walls are preferentially timber structural components. In the context of traditional timber pavements, they are essentially a braced beamed load distribution structural systems.

Apart of supporting dead and live loads, the timber pavements also support the self-weight of the partition walls. Meanwhile, they are essentially directly supported on the external walls and, therefore, they also may have an important bracing contribution of the overall building. These technical aspects lead us to the conclusion that the traditional timber pavements may have an important role in the overall structural integrity of traditional buildings. Pathology phenomenon, material and structural damages, and structural failure scenarios are some aspects that have to be considered concerning maintenance, inspection, structural reinforcing design and rehabilitation processes of traditional timber pavements. Additionally, the aging effect, the fact that wood is an organic building material (resulting in a heterogenic and anisotropic material), the building may be in service and no original design is likely to happen, are also aspects that have to be considered in these processes. Therefore, these processes may end up being complex. On the other hand, in the perspectives of cultural, social identity, sustainability and economical, to preserve the traditional buildings is a wise option. Unfortunately, this option is still frequently neglected and mainly concerning the rehabilitation of private traditional estate (e.g. dwellings), in which the demolition of the existing timber structural elements is a common decision. In order to invert this situation, technical knowledge dissemination among the community is required. In this respect, this paper intends to contribute by given a step forward on the structural vulnerability assessment of traditional building pavements and by integrating the typical pathology damages of structural timber elements with the critical structural point concept.

The most structurally vulnerable parts of a traditional timber pavement may be identified which may be extremely useful in the processes identified above. A similar approach has been done for the traditional timber roof structures (Murta, 2011) This paper is structured as follows: firstly, the traditional building topic is put into context. In particular, the main types of the traditional buildings of the Trás-os-Montes e Alto Douro region are briefly identified and described; secondly, some structural timber systems of traditional pavements are presented and described; thirdly, the most common timber pathologies are identified and exemplified; fourthly, a proposal of an expedite methodology for the assessment of the structural vulnerability of traditional timber pavements is done; finally, the main conclusions are drawn.

RESULTS AND CONCLUSIONS

The main traditional buildings of the north-east part of Portugal are identified and briefly described. Some typical timber pavements are presented and also their most frequent pathologies. An expedite methodology for the structural vulnerability assessment of these types of horizontal structural elements is explained and proposed.

REFERENCES

[1]-Murta, A., Pinto, J., Humberto Varum, H. (2011) - Structural vulnerability of two traditional Portuguese timber structural systems. *Engineering Failure Analysis* (2011), doi:10.1016/j.engfailanal.2010.12.017.