

Diagnosis of timber structures. A case study

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Abstract

The need to intervene in timber structures is very frequent and especially so in the rehabilitation or conservation of ancient buildings. This paper presents the diagnosis work performed in the future “Wine Museum of Bucelas”, that was subjected in the last years to a total lack of maintenance, the main reason why different biological degradation agents had every condition to increasingly install themselves. The design and maintenance deficiencies of the building roof that led to the present damage level are also presented and related to the degradation problems they cause.

1. INTRODUCTION

Nowadays, it is consensual that old buildings are an integral part of the historical heritage to be preserved. Furthermore, the conservation of ancient buildings has proven to be a solution for modern societies from both the economical, environmental and cultural points of view. However, only in the last decades has this idea developed in society, allowing a generalized degradation and abandonment state of the greatest part of the built heritage.

Among the various buildings degradation factors moisture is the one that leads to the greatest damage in the most diverse materials and components [1]. Water and water vapour exert a direct action on timber, mortars, stone or ceramic pieces, affecting their durability. Their effects are very slow to become apparent, leading to a continuous and silent change of the materials, modifying their mechanical behaviour and leading eventually to the overall collapse of the buildings.

Timber is an organic material and moisture is its main degradation factor, leading to dimensional variations (shrinkage and swelling), fissures and warp development, changes in its mechanical properties and most of all allowing the installation of biological agents [2]. As a matter of fact, when factors like flawed design, poor construction practices and misuse of construction happen, chronic dampness in a structure (old or new) may lead to a cascading biological succession, from simple moulds to severe wood rot and insect infestation [3] particularly by termites.

In intervention procedures the initial stage has to be a thorough inspection and global diagnosis study of the building with special emphasis and detail on the timber structural elements and preferably including the understanding of the history of the building taking into account the original design and construction, any changes that have been made and obviously the effect of time [4, 5].

On that respect, the International Wood Committee of ICOMOS [6] recommends that a thorough and accurate diagnosis of the condition and the causes of decay and structural failure of the timber structure should precede any conservation intervention. The diagnosis should be based on documentary evidence, physical inspection and analysis, and, if necessary, measurements of physical conditions and non-destructive testing methods. This should not prevent however necessary minor interventions and emergency measures.

The inspection phase should be preferably articulated in three stages; according to Mannucci [7] and Cruz et al. [8]: a) Visual inspection; b) Use of auxiliary diagnosis means; c) Treatment of data and recommendations. From the visual inspection, meticulously performed with the aid of basic tools such as a knife or chisel, a lantern or a mirror, fundamental data for the development of the whole work can be collected [7, 8, 9, 10]. In what concerns the auxiliary means of diagnosis, there are various authors who elect the controlled perforation technique, *Resistograph*, as the one that better allies the ease of