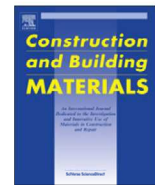




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# Construction and Building Materials

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## Properties of cork oak wood related to solid wood flooring performance

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### ABSTRACT

Application of cork oak wood as solid wood elements for flooring was experimentally assessed by measuring dimensional stability to air humidity and liquid water, response to loads applied while in service and abrasion due to people traffic using boards cut from the stem of five mature cork oak trees (*Quercus suber* L.). The results obtained from dimensional stability tests showed a performance of a medium movement in-service and small swelling in liquid water (2–3%). Hardness (55 N/mm<sup>2</sup>) and wear resistance allowed classifying cork oak wood as suitable for all domestic (including heavy traffic) and moderate commercial end-uses.

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### 1. Introduction

Oaks are considered to be a valuable source of timber for construction purposes and they are highly regarded for indoor joinery and furniture due to good mechanical properties and aesthetical value. Considerable research has been carried out to assess oak wood properties and their variation especially for the best known commercial species i.e. *Quercus robur*, *Quercus petraea*, *Quercus pubescens* [1–4].

Cork oak (*Quercus suber* L.) has not been included in these research efforts as extensively as other oaks. Cork oak studies focused on wood anatomy [5–8], and a recent detailed analysis was made on anatomical features, including biometry of rays and fibers, and vessel's size and distribution [9–12]. Cork oak wood is a dense wood with a mean ring density of 0.86 g cm<sup>-3</sup> and small intra-ring variability, with an earlywood density of 0.80 g cm<sup>-3</sup> and latewood density of 0.90 g cm<sup>-3</sup> [13].

Cork oak wood was successfully used in the past for shipbuilding and tools manufacturing. Today, cork oak is mostly known as the tree that produces cork, the material used worldwide for wine bottle corks [14] and the wood has only minor uses (e.g. for charcoal and as firewood).

The cork oak occupies large areas around the western Mediterranean basin in Southern Europe and North Africa, over a total area of more than 2 million ha, mainly in Portugal (725 thousand ha) and

Spain (475 thousand ha). Most of the *Q. suber* forests integrate an agro-forest system (“montado” in Portugal and “dehesa” in Spain) that combines forest, agriculture and animal production [15].

The cork oak forests have been directed during the last century for the production of cork. However a diversification of utilization has been consistently advised as a strategic approach to strengthen the sustainability and economic soundness of cork oak forests. In this context the potential of cork oaks for production of high value wood products should be considered (<http://www.suberwood.com>). The availability of considerable amounts of cork oak wood is foreseen resulting from thinning material from recently planted areas, corresponding to approximately 50 thousand ha [16].

This rationale led to recent research on the technological quality of cork oak wood, namely on important properties such as density [13,17–19], or stem quality for sawing and production of wood products, to be used either as solid wood or in composite or assembled products such as flooring components [20,21].

Wood flooring in the European market is subject to mandatory CE marking since March 2009. Performance characteristics are defined for nine different types of wood flooring products including factors with direct visual impact in end-users (wood features e.g. knots), factors that affect the quality of installation (e.g. geometry of the boards) and factors that affect performance (short and long-term) of the floor.

The aim of this study was to evaluate the behavior of cork oak wood as solid wood flooring boards. For that purpose some of the relevant properties that determine the performance of wood flooring for interior uses were assessed, such as dimensional

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