



# Hygroscopic and mechanical behaviour of earth bricks

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**Abstract** Considering the challenges imposed by the current movement towards green development, earth construction appears to offer promising possibilities for improving thermal comfort, energy consumption and indoor humidity regulation. However, the difficulties in predicting the behaviour of earth as a construction material is an obstacle to the development of this technique. The principal objective of this study is to establish the scientific bases needed to predict its hygroscopic and mechanical behaviour as a function of the relative humidity that is one of the main factors controlling the home comfort. For this purpose, it is necessary to find correlations between the variability of the soils (density, pore size distribution, chemical and mineralogical composition) and the hygro-mechanical behaviour of the earth bricks

(adsorption, hydric buffering and compressive strength). The results, in terms of hydric and mechanical behaviour specific to each brick, show that the behaviour of this material depends on several factors, namely, the  $\text{SiO}_2/\text{Al}_2\text{O}_3$  ratio, the porosity rate, the pore size distribution, the nature of the clay minerals, and their content.

**Keywords** Unfired clay brick · Anisotropy · Physical properties · Microstructure · Chemical composition · Mineralogical composition · Hygroscopic properties · Mechanical properties

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## 1 Introduction

The building sector is believed to be the largest of the economic sectors and the greatest energy consumer. The development of sustainable construction practices is therefore essential, not only in order to comply with current objectives for reducing greenhouse gas emissions, but also to limit energy consumption worldwide. In this context, the development of energy-efficient building materials with limited environmental impacts appears to be a promising challenge.

Building with earth, in its various forms (rammed earth, adobe or compressed earth blocks), has become an interesting construction technology offering many advantages. The first point of interest in earth constructions is linked to the rising cost of energy,

