



Possibilities of Bamboo Construction: From Vernacular Techniques to Industrialized Solutions

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Abstract

Bamboo based materials are opening new construction possibilities, being used as structural materials for large scale buildings. In this work, vernacular construction using bamboo is analysed as to understand what are the design principles that may be applied for different scenarios, whereas industrialized bamboo materials are studied as to propose solutions for the limits that vernacular construction poses. With this information a set of properties of bamboo as a natural and transformed material is obtained and a hierarchical matrix with different scales is proposed to allow designers to associate a product to its potential uses. Therefore, the main result of this work is a state-of-the-art where it is promoted the elaboration of an array of possibilities that includes a hierarchical database and allows the search for future solutions anticipating probable human and technical constraints on today's and tomorrow's structures.

Keywords: bamboo; engineered bamboo; vernacular construction; industrialized processes.

1 Introduction

Increased interest in, and the development of, bamboo in modern construction and its application to large scale buildings have been driven by increasing needs for sustainable materials to meet rising demand due to rapid urbanisation. According to [1], bamboo use can be grouped in six global aspects, being: 1) construction; 2) furniture; 3) paper production; 4) textile; 5) pharmaceutical; and 6) household-items. Regarding construction, even if there are over than 1000 species of bamboo worldwide, only a few number may be adequately used for construction. As mentioned by [2], only about 50 bamboo species exhibit adequate properties for

construction, but that does not pose an issue for vernacular construction. Bamboo may be used as a building material for decoration or partition (non-structural) and as load bearing elements (structural). Traditionally, where bamboo grows naturally the local population has been using it for housing, being used as poles, purlins, trusses, rafters, mats, floorings, ceilings, roofs, walls, windows and door frames, and even for foot bridges, fence posts and scaffolding. Nevertheless, due to the inherent limitations of building with bamboo culm, such as connection issues and low durability, new products have been proposed in the last decades. Industrialized solutions in the form of engineered composites allow for more resistant and less variable materials. Nevertheless,