



Assessment of Strength and Stiffness Properties of Wood in Existing Structures

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Abstract

In this study specimens cut from intermediate timber floor beams that have been in service for more than 120 years were tested. The objective of this paper is to determine the strength characteristics and stiffness modulus of old wood and examine relationships between different properties. Experimental tests for determining the mechanical properties in bending have been carried out in short-term static loading. Also shear strength and compression strength perpendicular to the fiber direction was determined by tests. It is concluded that the modulus of elasticity of wood during long-term service under load decreases faster than the strength properties. When evaluating the relationship between wood strength and stiffness properties, a weak correlation was found between bending strength and modulus of elasticity. As well as other properties (density, moisture content etc.) didn't show any remarkable correlation significance.

Keywords: strength of old wood; bending strength/ modulus of rupture; modulus of elasticity; compression strength perpendicular to grain, shear strength.

1 Introduction

Adequate selection of the characteristics of the mechanical properties of wood is always a highly responsible task for an engineer performing a technical survey of historical wooden building structures with the aim of assessing their suitability for future use. Experimental destructive methods give the most reliable results, however they are expensive and time-consuming. Moreover, often it is complicated to get sufficient number of specimens from existing structures.

Nowadays some non-destructive methods are developed for assessment of mechanical properties of timber. For example, resistographic method when density of timber is measured basing on power consumption in electronic drilling device. Using density measurements strength of wood may be determined by known correlation

equations strength versus density. For old wood it is doubtful suggestion as correlation between wood properties may be moderate or weak.

In many cases it is expected to extend service life of structures due to its importance from an architectural point of view. Then question arises, how much is residual strength of old wood? Are the relationships defined for new wood still valid in existing structures after long-term use under load?

The aim of this work is to examine the physical and mechanical properties (density, bending strength, modulus of elasticity, shear and compression perpendicular to fiber direction), as well as to prove the relationships between some properties for old wood that has actually served in structures of building much more longer than the intended time, nevertheless not degraded by decay or insects.