Study for improvements in design codes of timber structures regarding developments in time

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Summary

This paper presents the results on experimental research of the bending creep behaviour of softwood timber beams in uncontrolled microclimate conditions (unheated building, winter climate in the region near the Baltic Sea) under different levels of a constant load not exceeding the proportional limit. Experimental evidence is produced to corroborate the Eurocode 5 conditions for predictions of creep effects under variable load. Deflection values of beams in four point bending are measured daily during 3 months simultaneously performing monitoring of the moisture content of the wood, relative humidity and air temperature. It has been observed that at the initial period the character of creep development differs significantly comparing it with later period till the end of the test. The linear equations are found as sufficiently good approximations for relationship creep versus time at the moderate load levels not exceeding the proportional limit.

Keywords: timber structures; beams; bending; DOL effects, creep.

1. Introduction

Displacements in timber constructions provide many undesirable effects during service, also longterm and unlimited deformation may lead to damage or failure of structures. Bending elements are especially prone to exhibit deformations.

Creep, the development of deformations in time under longterm loads is an important phenomenon in timber engineering creating a lot of problems when predictions of load levels and service life are under discussion. The account of creep effects is more significant for bending elements because large deflections may lead to nonfunctional properties of structure or worse as collapse. The forecast of creep effects as might be really would result in safe wood structures when design is controlled by a correct final deflection forecast and limitation values.

During the last decades a lot of research activities have provided an important background for the analysis and defininition of estimates of creep effects. However there is no generally recognized mathematical model developed for the description of creep effects under all possible combinations of moisture content and stress levels as the results of bending DOL (duration of load) experiments contain a mix of affecting factors. And it is clear that one model cannot solve this problem. It is necessary to restrain a study regarding some specific aim taking into account the factors influencing the creep process significantly and neglecting the secondary ones.

Eurocode 5 presents the factor k_{def} for the prediction of creep deformation under permanent load in terms of instantanenous value, and the sum of both values is referred to as the final deformation. The contribution in creep deformation due to variable loads has been forecasted using some quasi-static it's value. Deformation factor k_{def} is defined as dependent on the material type and service class. The experiments undertaken in this study are aimed to test the validity of codified values for variable loads. This study includes the analysis of experimental tests in static loading of timber beams.

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