Abstract

This thesis focuses on the creep study of cross-laminated timber (CLT) panels, a material widely used in the construction of high-rise buildings. Due to the orthogonal stacking of the wood layers, the shear stiffness of the panels is composed of both the longitudinal and rolling shear stiffness. Furthermore, wood is a material subject to creep and this phenomenon must be investigate to correctly design timber buildings as it amplifies the short-term deflection. This thesis presents an experimental protocol to measure directly the shear stiffness and creep at a relevant scale for CLT panel.

Two experimental campaigns are carried out in a climatic room regulated at constant temperatures and humidities corresponding to service class 1 (Eurocode 5). First, the study of the loading of five sandwich beams with the wooden core oriented in the radial direction allows to measure a rolling shear stiffness equal to (121 ± 15) MPa. Relative creep is extrapolated by fitting a power law on the 8-month measured delayed displacements. A rolling shear creep coefficient is calculated at 50 years and is equal to 2.8 ± 0.2. Then, six sandwich beams are loaded on the experimental set-up. The longitudinal shear modulus is measured equal to (460 ± 108) MPa and the ratio between these moduli and wood density is consistent with the literature. The study of the deferred rotations over 181 days does not allow to conclude on the evolution of the longitudinal creep during the experiments. Thus, when fitting a power law on the deferred displacements, two assumptions are made. When the longitudinal creep is assumed to be zero, the coefficient of longitudinal shear creep estimated at 50 years is calculated to be equal to 1.70 ± 0.53 and in the opposite case, a value of 0.83 ± 0.29 is found. We conclude that the creep in rolling shear is 1.5 to 3 times higher than that in longitudinal shear.

In view of these results, the proposed creep coefficient in the next version of the Eurocode seems consistent and safe. However, we suggest to differentiate two creep coefficients in the construction standards for the class service 1. The definition of these two coefficients is compatible with the use of the shear analogy method and seems relevant for a better dimensioning of CLT panels.

Mots-clefs : Rolling shear, Longitudinal shear, stiffness, Cross Laminated Timber, Experimental set-up, Creep