Bending creep of notched beams in sheltered outdoors conditions: applications on Gabonese and European wooden species

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1.Context

Interactions between climatic variations (1, 2, 3) and mechanical loads (4)

General objective:
- Evaluate the influence of initial defects on the structural response and crack propagation, and adapt the design codes to the context of structural use of wood in tropical and temperate environments

Specific objectives:
- creep tests in 4-point bending of notched beams in sheltered outdoor conditions
- Characterization of diffusion process
- Coupling between rupture, creep and sorption

3.Methods

The characterization is done on tropical wood Iroko (Fig.1a) Padouk (Fig.1b) and Okume (Fig.1c). Specimens (L=680 x 40x60 mm) were brought back from Gabon to Clermont-Ferrand.
Fig 1: Raw beams of tropical species brought back from Gabon: (a) Iroko (b); Padouk (c); Okume

Determination of specimen geometry:
(9) allowed us to validate the geometry of the beams presented in (Fig. 2.) I = 38,3 mm and Lr = 63,3 mm.

Fig 2. Geometry of test specimens (a); Padouk (b) Iroko (c); okume

3.2. Experimental approach

Fig 3: (a.b) Measurement of Young's modulus; (c.d) rupture test

4.Results

Fload = F0 3 FL 1 - FL (11)

\( \varepsilon = \frac{F_0}{167Lc} \) (12)

\( y = \frac{F_0}{E_0} \left( \frac{L}{c_1} \right) \) (13)

Wood | Density | MC (%) | Emod (MPa) |
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Okume | 0,47(0,03) | 13,11(0,58) | 7 694(421) |
Padouk | 0,77(0,09) | 10,44(0,12) | 10 898(748) |
Iroko | 0,60(0,06) | 10,96(0,56) | 10 194(277) |

| Wood | \( \varepsilon_{1a} \) (%) | \( \varepsilon_{1c} \) (%) | \( \varepsilon_{1d} \) (%) | \( \varepsilon_{load} \) (%) | Fmax (daN) | F0 (daN) | Fmin (daN) |
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Okume | 0,183(0,015) | 0,313(0,051) | 0,51(0,096) | 0,26 | 29,64 | 36,6(39) | 51,1(67) |
Padouk | 0,234(0,023) | 0,394(0,064) | 0,509(0,062) | 0,27 | 43,42 | 59,7(97) | 68,8(130) |
Iroko | 0,157(0,017) | 0,202(0,026) | 0,293(0,024) | 0,16 | 25,34 | 30,4(30) | 30,4(30) |

5. Experimental setup for creep tests

Bibliography


6. Conclusion

This study presents the dimensioning and the characterization of the beams in outdoor conditions. It is based on strength of materials and experimental approaches. This approaches enables us to validate the specimens geometry and to estimate the loading strain and the loading forces for the creep test.