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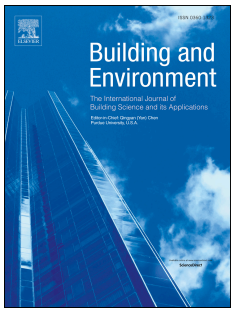

A review of structural, thermo-physical, acoustical, and environmental properties of wooden materials for building applications

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REVISED VERSION ROUND 3

A review of structural, thermo-physical, acoustical, and environmental properties of wooden materials for building applications

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Abstract: The current environmental and energetic crisis and the resulting regulations led to a new interest in using sustainable materials for building applications. Wood can be a material with high sustainable rates because it is recyclable, reusable and naturally renewable. Moreover, its excellent strength-to-weight ratios, thermal insulating and acoustical properties make it useful for different kinds of applications in buildings, ranging from structural beams and frames, insulating envelopes, windows, door frames, to wall and flooring materials and furniture.
Although wood is commonly classified as a sustainable material, its real sustainability depends on different issues: appropriate forest management, manufacturing methods and site assembly, distance required for transportation and use of glues. Wood has also good seismic performances due to its lightweight and even if timber elements are not able to have a ductile behavior, using steel connection allows to build dissipative structure, as well platform frame and X-LAM panels systems. Insulation properties are related to low thermal conductivity values. Furthermore, wooden elements can be used to minimize sound transmission and they can be employed as sustainable materials as several Life Cycle Assessment studies demonstrate.
This review paper aims to analyze the structural, thermal, acoustical and environmental properties of wooden materials for building applications; other properties such as fire resistance and durability were also taken into account. The work is completed by several tables and graphs with wood properties and by an updated and thorough reference list.

Keywords: Wood, Buildings, Structures, Thermal properties, Acoustical properties, Sustainability.

Nomenclature

CLT	Cross Laminated Timber
GLT	Glued Laminated Timber
LVL	Laminated Veneer Lumber
LSL	Laminated Strand Lumber
K_{mod}	Modification factor to strength values, allowing for load duration and moisture content [-]
K_{def}	Modification factor for the evaluation of creep deformation that takes into account the relevant service class [-]
q	Structure behavior factor
ρ	Density of a material [kg/m^3]
c_s	Specific heat [J/kgK]
λ	Thermal conductivity [W/mK]
U-value	Thermal transmittance [W/m^{2}K]
R	Thermal resistance [m^{2}K/W]