Facts about wooden buildings

– what you should know about achieving 100 years of service life

The building sector contributes up to 30% of global annual greenhouse gas emissions. To maintain our planet and living conditions, we must make smarter use of construction materials and keep them in the cycle for as long as possible.

In recent years, interest in the use of wood in construction has grown due to tightening sustainability requirements and new advanced building methods and materials. Engineered wood products, such as laminated veneer lumber (LVL), offer many benefits in efficiency, performance and environmental impact.

Wooden buildings typically achieve the same service life of 50–100 years as buildings made from other materials. With careful design, execution and maintenance, lifespans of even more than 100 years are well within reach.

SERVICE CLASSES IN WOOD STRUCTURE DESIGN

The performance of wood and wood-based materials in construction is quantified as the ability to withstand load, exposure or deterioration over time in specified conditions. In EN 1995 Eurocode 5, which applies to the design of timber structures, this is defined by three service classes:

- **Service class 1 (SC1):** heated indoor air conditions
- **Service class 2 (SC2):** ventilated outdoor conditions under a roof offering protection from direct weather exposure
- **Service class 3 (SC3):** direct weather exposure, high humidity or direct contact with water (LVL cannot be used in SC3 without preservative treatment against decay)

HISTORY OF USE FOR ENGINEERED WOOD PRODUCTS

Engineered wood products are composites of layers or strands of wood bound together utilizing adhesives, heat, and pressure to enhance their strength and stiffness. Plywood and glued laminated timber (glulam) – the first such materials – have been commonly used in construction for over a century. Laminated veneer lumber which is manufactured the same way, has been produced since the 1970s.

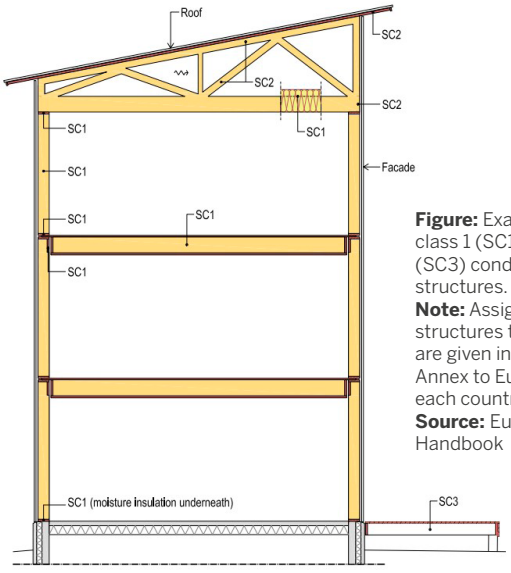

Figure: Examples of service class 1 (SC1), 2 (SC2) and 3 (SC3) conditions in wooden structures.
Note: Assignment of structures to service classes are given in the National Annex to Eurocode 5 for each country.
Source: European LVL Handbook

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PERFORMANCE OF WOOD MATERIAL AND ADHESIVES

According to research results and experience, engineered wood products will have roughly the same service life expectations as solid wood in dry (SC1) and moderately humid (SC2) conditions. The manufacturing process of LVL keeps the product drier than solid wood because the veneers are dried at high temperature to less than 5% moisture content, which alters the wood cell structure and makes the material less moisture absorbent.

Major durability problems with glulam and plywood have been affiliated with degradation of the timber material rather than the glue bond quality. This is because adhesives approved for constructional purposes are required to outlast the wood material.

On basis of experience and test results, plywood and LVL made with phenol-formaldehyde adhesive fulfil the requirements of a 100-year service life (SC1 and SC2). While products with polyurethane adhesives approved according to EN 15425, such as GLVL, do not have such a long history of use, there are no indications that their service life would not be of the same order as that of the other approved adhesives.

SAFETY FACTORS TO ACCOUNT FOR ENVIRONMENTAL LOADS ON STRUCTURES

EN 1990 Eurocode allows wooden buildings to be designed for a service life of more than 100 years as long as an increased safety factor is in place for structural loads caused by environmental actions, such as wind, snow and ice.

The safety factors are defined in national regulations. In Finland, for example, the environmental loads are evaluated to be

- **10% higher** than that for a 50-year service life when the service life is meant to be longer than 50 years and
- **20% higher** when the service life is meant to be longer than 100 years.

In practice, this means that the dimensions of the load-bearing roof structures in a 4-story wooden apartment building will increase by 5–10%.

The effects of increasing environmental loads are primarily directed at the wall structures and columns supporting the roof structures, requiring their dimensions to be increased also by 5–10%. However, environmental loads have no significant impact on floor structures.

DESIGN, EXECUTION AND MAINTENANCE FOR LONGEVITY

While buildings are normally designed to last 50 years, wooden buildings can be expected to achieve 100 years or more of service life with proper design, building and maintenance standards:

- using dry and CE-marked wood material
- using the correct glue type and glue class of engineering components
- good detailing and design
- good execution and protection against weathering during building process
- taking environmental loads into account
- proper maintenance and provision of a maintenance manual for users
- guaranteeing proper conditions for materials in the building throughout its service life, from ventilation and protection to drying of accidental water damage

"A service life of at least 100 years is well within reach."

LONG SERVICE LIFE OF WOOD ENHANCES CARBON STORAGE

One of the most important ways to mitigate climate change is to reduce dependence on fossil resources. Wood is a renewable, recyclable and reusable building material. Above all, wood stores carbon*. Wood construction is a part of the solution.

The long service life of Kerto LVL ensures long carbon storage times throughout its lifetime until it is released back to the atmosphere to be absorbed by the next generation of growing trees. We can enhance and accelerate carbon storage and promote long-term wood usage by working on prolonging the life of wooden buildings.

*One cubic metre of Kerto LVL contains stored carbon equivalent to 789 kg of CO_2.

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