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RELATEDNESS REQUIREMENTS AND CHARACTERISTICS OF MATERIALS FOR A SOME AREAS OF APPLICATIONS IN TIMBER STRUCTURES

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ABSTRACT
European norms and standards, particular Eurocode EC 5 recommended the minimum requirements in material properties with respect to specific area of application.
On the market there is a large number of wood-based materials. To facilitate the choice of material for a specific area of application it is important to know the connectivity requirements in respect of certain traits and characteristics of various wood materials.
In the paper will be presented one example of modus of interrelatedness request and material properties in timber structure.
Keywords: European norms, requirements of design, properties of wooden material

1. INTRODUCTION

The use of wood as building material for the production of various buildings for housing, vacation travelers, keeping animals and food, production of utilities in daily life dated from the early moments of human history. Development and technology of production of new manufacturing equipment, development of information technology and new scientific discipline has influenced the development of new production techniques and technology for the production of materials. This resulted in a large number of new materials based on wood on the market.
Technical characteristics of wood structures must be such that during the building with a prescribed or specified project execution and maintenance of wooden construction, she submitted all the effects of normal use and environmental impact, so that during the construction and use of predictable effects on buildings do not cause: the demolition of the building or its part deformation impermissible degree of damage of building an assembly or equipment due to deformation of wooden construction, disproportionate damage to the building or its parts in relation to the cause of why they occurred. Design, installation, maintenance and use of buildings shall be such as to meet the requirements prescribed by national and international standards and norm. The unification of Europe into the European Union (EU) to facilitate easier flow of goods and services within the EU and beyond are looking for a change of national legislation in the common (European) standards. European standards and norms, Harmonized Standards and Eurocodes (EC), especially EC Eurocode 5 are prescribed requirements which must comply with during the design, construction, maintenance and use of wooden structures.

2. REQUIREMENTS FOR DESIGN OF TIMBER STRUCTURES

Each buyer and user as wooden construction sets out certain requirements in terms of safety, cost, functionality, fire protect, aesthetic characteristics and durability of this construction should satisfy. These conditions are the designers of wooden structures analyzed in detail and define the requirements for design, i.e.:

– The requirements to building usage - function, size, space division and in-plan organisation;

– The requirements to meet service installations: ventilation systems, heating, acoustics/ lightning, water supply, waste removal;
– Special considerations regarding fire protection, acoustics surrounding properties, environmental requirements;
– The requirements for the load which the structure or member of structure are exposed to – dead load, live load, the load of snow / wind and outstanding load (strikes, etc.).
– The requirements related to site: ground conditions, access to building, topography

3. REQUIREMENTS AND RECOMMENDATIONS OF THE EUROPEAN NORMS AND STANDARDS FOR TIMBER STRUCTURES

When designing structural elements need to check out the following:

1. Maintain static equilibrium structure (whether it appears skating or uplifting element);
2. Bending stress and prevention of lateral torsion instability;
3. Shear stress;
4. The relationships and ration of the load
5. Torsion loads (if relevant in a given case);
6. Buckling and
7. Vibration.

Eurocode EC 5 is only concerned with requirements for mechanical resistance, serviceability, durability and fire resistance of timber structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered, but these claims describe other European norms. Depending on the demands of different levels of reliability of timber structures designed different models for the limit states. It is necessary to take into account:

- The different properties of building materials (e.g. strength and stiffness);
- Different time-dependent behaviour of the materials (duration of load, creep)
- Different climatic conditions (temperature, moisture variations)
- Different design situations (stages of construction, change of support conditions).

Organizational chart EC5 standard process flow follows the design of timber structures. The rules defined in these regulations are applicable to all relevant design parameters, design and control of timber structures. Include the following:

- characteristic values and design values for a combination of action,
- characteristic values and design values of mechanical properties of resistance building material,
- checking the ultimate limit states (for the existing distribution of stress),
- checking the serviceability limit states
- checking the limit state of stability of the basic structural elements and structures as a whole, i.e. checking the deformations structural and non-structural member of structure be such that facility it supports will be able to function as designed, that there will be no adverse visual effects, no structural implications and service must be able satisfactorily
- verification of structural stability, i.e. checking structural and non-structural members of structure in order to determine whether the aforementioned strain caused by the inability to use the structure.

General settings calculate and their associated expressions guarantee a minimum required level of security and reliability. Dimensioning concept with partial safety factors based on statistical probability of some uneven sizes, especially the impact (load) and material properties, which means that these values are subject to the methods of probability and statistics. The security measure is reliable and it is uniquely defined by limit states conditions. Basic requirements and principles given in the regulations (EC %) are based on the concept of limit state probabilities and appearance of a certain standard load, and includes the ultimate limit states and serviceability limit states.

4. INTERDEPENDENCE OF THE REQUIREMENTS AND CHARACTERISTICS OF MATERIALS

Controlling calculate value of work on a wooden structure as a whole or a particular structural element according to the recommendations given in Eurocode EC 5 and the exact way to check features and values given in the European norms leads to the important data for the selection of materials for timber structures.

Each of the building materials (solid wood, wood based panels) has the characteristic values of mechanical properties, as well as other important characteristics for its application. This value limits and/or recommended material, whose properties can be applied for the required conditions of use of the structure.

Modus choice of material for its applications in a timber structure with all its properties and compliance with European norm will be explained on the example of panel.

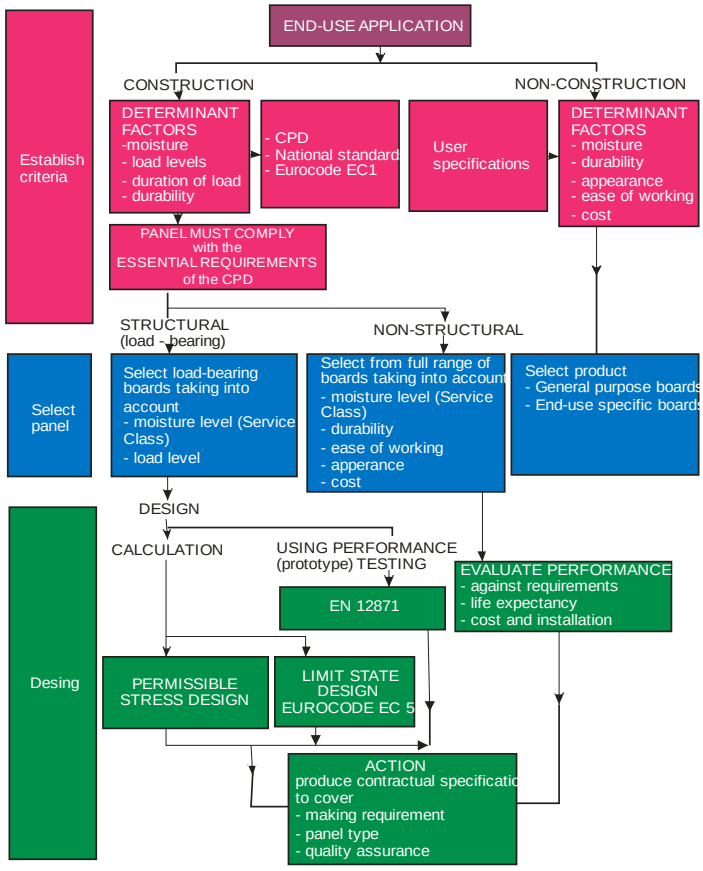

Figure 1. Modus selection panels and areas of use

Construction Products Directive (CPD), which was adopted by the Council of Ministers in 1988, said the six Essential Requirements on the performance of buildings - structures that must be met: the mechanical resistance and stability, safety in case of fire, hygiene, health and the environment, safety in use, protection against noise, energy economy and retaining heat.

In this way done with the selection result in certain characteristics of the material, but also the way in building a structure (on Figure 1). For example, the selection of wood based panels for floors depends on number factors of witch the most important are: the type of floor, the load that floor has to carry and the ambient moisture conditions. It is convenient to recognise the following different types of floor:

- Suspended floors in which the floor decking is attached to a series of joists.
- Floating floors in which the floor decking rests either on insulation above a structural sub-floor or on a series of battens which has insulation between them.
- Overlays which are attached to an existing floor (usually suspended) to improve the quality of surface or to reduce the transmission of sound.
- Raised access floors in which the floor segments are supported on short pillars to permit access to cables below the floor.
- Industrial platform floors which embrace both mezzanine and raised storage floors.

Second criterion for the selection is the load that floor has to carry. When designing a floor using permissible stress design, it is convenient to design the floor to one of three load classes:

- domestic- with a maximum load of 1,5 [kN/m^2] and a maximum concentrated load of 2.7 [kN/m^2]

- non-domestic light-duty with a maximum load of 2,5 [kN/m^2] and a maximum concentrated load of 2, 7 [kN/m^2]
- non-domestic heavy duty with a maximum load above 2, 5 [kN/m^2] and concentrated loads
- 2, 7 [kN/m^2] respectively.

Humidity (moisture content), acoustic and thermal properties panel for floors should be in accordance with the conditions of use of the floor. The values of these properties are provided with appropriate standards for each material, i.e. when using panel for flooring can be applied following the wood based panels materials:

Table 2. The minimum requirements that boards should meet for use in flooring

Domestic floors	Service Class	Plywood EN 636	PARTICLEBOARD EN 312	OSB EN 300	MDF EN 622-5	FIBREBOARD EN 622-3,4
Suspended floors	1	EN 636-1	EN 312-P4	OSB/2	MDF.LA	MBH.LA 1
	2	EN 636-2	EN 312-P5	OSB/3	-	-
Floating floors	1	EN 636-1	EN 312-P4	OSB/2	MDF.LA	MBH.LA 1
	2	EN 636-2	EN 312-P5	OSB/4	-	-
Overlays	1	EN 636-1	EN 312-P4	OSB/2	MDF	MBH.HB
	2	EN 636-2	EN 312-P5	OSB/3	MDF.H	MBH.H.HB.H
Non-Domestic floors	Service Class	Plywood EN 636	PARTICLEBOARD EN 312	OSB EN 300	MDF EN 622-5	FIBREBOARD EN 622-3,4
Suspended floors	1	EN 636-1	EN 312-P6 (P4)	OSB/4 (3)	-	MBH.LA 1
	2	EN 636-2	EN 312-P7 (P5)	OSB/4 (3)	-	-
Floating floors	1	EN 636-1	EN 312-P6	OSB/4	-	MBH.LA 2
	2	EN 636-2	EN 312-P7	OSB/4	-	MBH.HLS 2
Raised Access	Provided the performance requirements set out in EN 12825 are met, any panel product may be used					
Overlays	1	EN 636-1	EN 312-P4	OSB/2	-	HB.HLA 2 MBH.LA 2
	2	EN 636-2	EN 312-P5	OSB/3	-	HB.HLA 2

For applications in floor can be used and better board of the above, and accordingly it is possible to replace these panels with thinner board of better quality.

5. CONCLUSION

- The design of timber structures should take into account the requirements of the aforementioned structures to satisfy (the requirements to building usage, the requirements to meet service installations: ventilation systems, heating, acoustics/ lightning, water supply, waste removal; special considerations regarding fire protection, acoustics surrounding properties, environmental requirements; the requirements for the load which the structure or member of structure are exposed to – dead load, live load, the load of snow / wind and outstanding load (strikes, etc.) and requirements related to site: ground conditions, access to building, topography).
- Eurocode EC 5 provides recommendations for testing timber structures, i.e., checking the ultimate limit states, serviceability limit states and stability of wooden construction.
- The harmonized standards (norms) and Directive provide the correct procedure for control (testing) materials (solid wood and wood based board) and exact values of certain properties that material should have.
- Based on user requirements, eurocode (especially EC5), European standards and Directives can make the module - for the diagram of the method for selecting materials for a specific application area. This would significantly facilitate the work of designers in the design of timber structures.

6. REFERENCES

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