COST E 53 Conference - Quality Control for Wood and Wood Products

Wood and Wood Products Quality Evaluation in Slovakia

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ABSTRACT

For optimal utilization of wood raw material, the wood and wood products quality evaluation is one of the key points in wood processing. Authors pointed on recent state of wood quality evaluation in Slovakia based on direct or indirect methods for quality evaluation in relation to quality of final products, such as structural timber etc. Advantages as well as disadvantages of recent wood quality evaluation state in Slovakia are addressed.

INTRODUCTION

Compatibility of Slovak and European standards and usability of individual standards in recent Slovakian wood products industry are the key problems for the best utilizing of wood raw material. The aim of the article is to address standard-setting state of acceptance and implementation of European standards in Slovakia. Authors focused mainly on quality grading of roundwood, timber and timber for building constructions.

Quality grading of wood
Quality grading of roundwood, timber and timber for structural utilization is described in specific national standards STN as well as EN standards, which were accepted in Slovakia.

Quality grading of roundwood
Recently, we have two valid STN standards for quality grading of roundwood, STN 48 0055 for softwood and STN 48 0056 for hardwood species. Both standards are based on visual appearance grading of roundwood. Beside visual determined characteristics, the standards define minimal dimensional characteristics (length and diameter) for each individual grading class. Both softwood and hardwood species are assorted into six main quality classes: A1, B1, C1, C2, C3 a D1.
Roundwood of the highest quality A1 is used as veneer logs for sliced veneer or as a special raw wood for musical instruments. High quality class B1 is used for making peeled veneers, sporting goods or wooden barrels.
Average quality roundwood is categorized in class C1. This is used as saw logs (C1.1, C1.2, C1.3), logs used for constructions (C1.4) and logs for aggregate processing (C 1.5). Quality class C2 is used in mining industry as pit wood (C2.1) or thin poles (C2.2).
Pulpwood for chemical or mechanical processing and chips for particle boards are made from logs of C3 class.
Wood logs not sorted in previous classes belong to quality class D. Firewood assigns into this category.
Volume of individual assortment classes produced in 2005 in Slovakia is in Figure 1. As one can see from the graph, there are two majority volume classes, C1 saw logs and C3 pulpwood for chemical and mechanical pulp, respectively. Small volume in class A1 and B1 is caused by selling of good quality wood resources as stumpage as well as raw stems. Moreover, there is discussion about statistic reliability of Green report 2006.
Sorting criteria for appearance evaluation are based on determination of size and quantity of individual logs characteristics such as discoloration, fungal and insect attack, spiral grains, type and size of knots, checks and splits, shakes, taper and sweep of logs, eccentricity, reaction wood, double pith, false heartwood, etc.
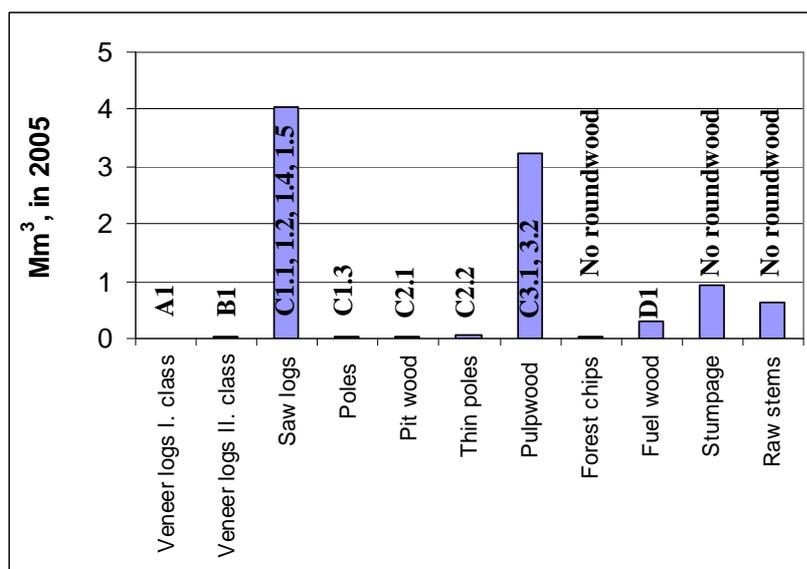
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Figure 1. Volume of individual assortment classes produced in 2005 (Green report 2006).

During the last decade, several European standards for grading roundwood have been accepted. According to Slovak classification, Standards STN EN 1316-1, 2, 3 and STN P ENV 1927-1, 2, 3 are assigned into group called "Qualitative assortment of roundwood without specified utilization purpose". The newest edition of the standards STN 40 0055 and STN 0056 from 2004 is assigned into group called "Qualitative assortment of roundwood with specified utilization purpose".

Despite the progress in Slovak normalization system, most of users are using old STN standards from 1984. The Slovak law 264/1999 allows using any standards in business relation including expired standards or national standards of other countries. In reality, only 5 % of users work with new STN standards. Implemented European standards STN EN 1316 and STN P ENV 1927 are barely used (Gejdoš et al. 2006).

Grading of sawn timber

Validity of different Slovak and European standards related to grading of sawn timber is intersecting recently. Both types of standards are based on similar appearance grading principles. Wood species of timber distinguishes usability of a European or Slovak standard due to continuous progression in handling of European standards. Slovak standards are used when EU standards does not cover grading wood specie. After implementation of any EU standard, a related Slovak standard is automatically expired. Sawn timber is usually not subject to mechanical or technological tests and is evaluated according to appearance. Required measured dimensions and appearance of timber characteristics are compared with prescriptive conditions of given sawn timber quality class according to a specific grading standard. Harmonization of measured matter with prescriptive conditions means determination of corresponding sawn timber class.

Objective grading respects needs of final utilization as well as differently defined requirements of specific quality timber classes. According to utilization, the grading standards can be divided into the following groups (Šúriková 2002 and 2003):

General grading of commercial timber (without specified of a utilization purpose)

STN 49 1011: Unprocessed timber. Softwood timber. Technical requirements.

STN 49 1012: Broad leaved sawn timber. Technical requirements.

STN EN 975-1+A1: Sawn timber. Appearance grading of hardwoods. Part 1: Oak and beech.

STN EN 975- 2: Sawn timber. Appearance grading of hardwoods. Part 2: Poplars.

STN EN 1611-1: Sawn timber. Appearance grading of softwoods. Part 1: European spruces, firs, pines and douglas firs.

Grading of structural timber
STN 49 1531: Structural timber. Part 1: Visual strength grading.
STN EN 338: Structural timber. Strength classes.
STN EN 384: Structural timber. Determination of characteristic values of mechanical properties and density.
STN EN 518: Structural timber. Grading. Requirement for visual strength grading standards
STN EN 519: Structural timber. Grading. Requirement for machine strength grading standards and grading machine
STN EN: 1912: Structural timber. Strength classes. Assignment of visual grades and species.
Timber used in pallets and packaging
STN EN 12246: Quality classification of timber used in pallets and packaging.
STN EN 12248: Sawn timber used in industrial packaging. Permitted deviations and preferential sizes.
STN EN 12249: Sawn timber used in pallets. Permitted deviations and guidelines for dimensions.
Exported timber is divided into the following groups: a) pilopad, b) export structure, c) sawn and partially sawn timber, d) Imballo a Charpente.

The last two timber export groups are graded according to export provisions of commercial timber given by STN 49 1113: Unprocessed timber. Export softwood timber. Technical requirements. Criteria from oversees standards.

Structural timber grading
The most significant regulation dealing with quality of wood for building structures in Slovak republic are the following: STN 49 1531, STN EN 338 and STN P ENV 1995-1-1. The standards are intertwining together and have position on national and/or European level. The basic is the standard STN EN 338, which determine strength classes for individual wood species and their characteristic values (poplar and softwood – classes C14 to C50, hardwood – classes D30 to D70). In the area of wood quality for building constructions, the standard aims to connect together the following standards:

1. STN 49 1531 (national) – specify four quality classes of timber (for softwood S0, SI a SII, and hardwood SD).
2. STN P ENV 1995-1-1 – specify design of wooden construction elements in terms of carrying capacity, serviceability, and durability.

The following methods are used for the determination of timber quality:
- *Visual method* – timber quality classes are determined on the basis of the defects occurrence. This requires a good knowledge of wood structure. Density of wood is not considered. The standard STN 49 1531 determines limiting values of the permitted timber defects for individual classes.
- *Mechanical method* – utilizes elasticity characteristics of wood in grading. The easiest and the most accessible method is based on the principle of bending. The standards STN EN 408, STN EN 384 and STN EN 338 include methods as well as utilization of the results.

From perspectives of timber quality evaluation, knots have dominant position. Natural occurrence of knots is visible mainly in sawn and edged timber. It has been recognized that effect of knots on timber strength depends mainly on proportional share of the cross section. Other characteristics of visual timber grading are spiral grains, size of checks and round face, annual ring width, biological properties and so on.
Size, quantity and position of knots together with other parameters such as density, moisture content, strength, elasticity are the substantial characteristics for mechanical timber grading according to strength.

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Visual evaluation of knots

The standard STN 49 1531 determines for individual classes the limiting values of the classification parameters which influence the strength and elasticity characteristics. From the classification point of view, knots have the greatest influence. There are two methods for judging the knots:

1. according to proportional knot dimensions (ratio of the sum of knot sizes across the surface and the edge to the double width of the sawn timber)

2. according to cross-sectional proportion of the knots $v = \dfrac{S_{knots}}{S_{total}}$ (ratio of cross-sectional surfaces of all knots S_{knots} to cross-section of the total board surface S_{total}).

Figure 2 describes measuring of knots and calculation of proportional size of knots for timber grading.

Figure 2. Measuring and calculation of proportional knot size of sawn timber. a) measurement method, b) one knot,
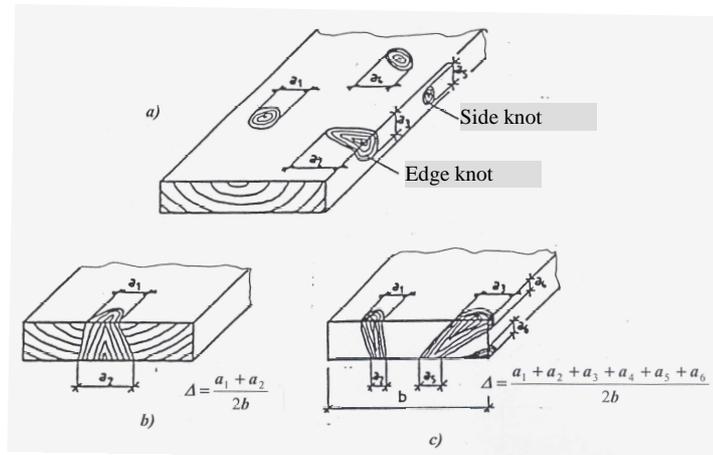

c) group of knots.

The second method determines a total cross-sectional proportion of knots as a ratio of cross-sectional surfaces of all knots on the considered cross-section to a total cross-sectional surface of the element. It also considers two marginal zones (h/4) creating ¼ of the side surfaces of the total surface (Figure 3).
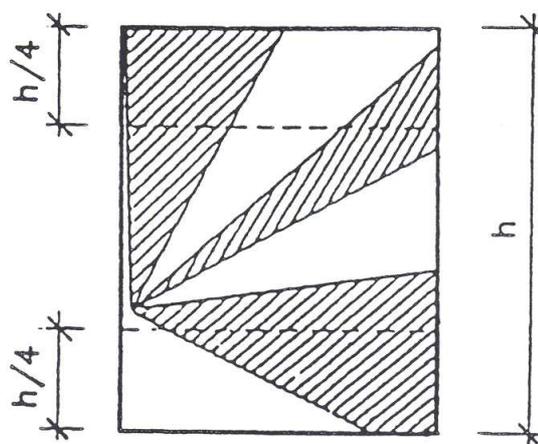
Figure 3. Way of the estimation of the cross-sectional knot proportion.

Figure 4 depicts the way of the knot measurement and calculation of the total cross-sectional knot proportion according to which the grade of sawn and squared timber is determined.
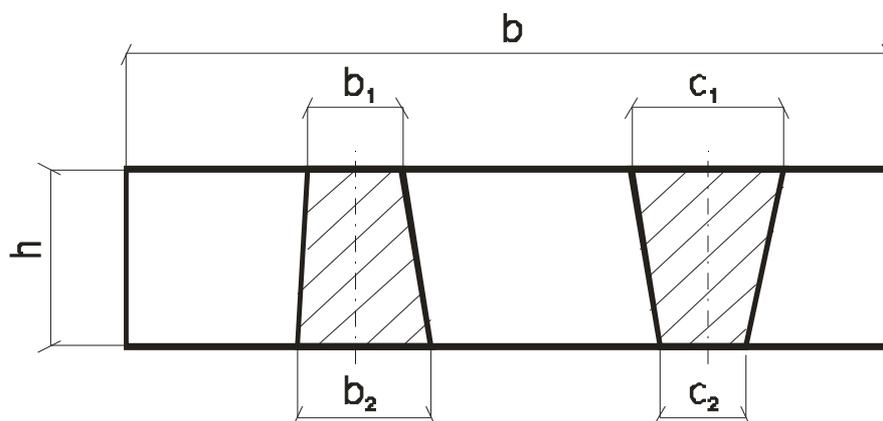
Figure 4. Cross-section of the board with the knot occurrence.

Effect of knots using bending method

When using the bending method, the influence of knots is manifested directly in the values of strength and elasticity characteristics which is one of the criteria for the determination of strength classes by means of the bending method (STN EN 408). When designing timber structures, the strength classes are considered according to the standards STN P ENV 1995-1-1 – SI and SII. There is currently an endeavor to include the strength class S0 which corresponds to a class C 30 according to STN EN 338. Effect of knot occurrence was experimentally observed according to visual and bending method. From the viewpoint of the knot occurrence there was a relative correspondence in comparison with the bending method. Visual method overestimate parts on a board without knots. Therefore, bending (mechanical) method is more objective and reliable.

According to the law of Slovak republic, a construction company is responsible for structural timber grading. In reality, only Slovak standard STN 49 1531 is only used for this purpose. Mechanical grading according to STN EN 51 is rarely used. On the other side, Slovak construction companies working for European market used required national standards of EU states (DIN, Eurocode 5).

The normalization is a living process. Even EU standard implemented in Slovakia are not without problems. After tragic disasters of wooden construction last year, the Slovak Institute of Technical Standardization issued a recommendation of not using the standard STN P ENV 1995-1-1 known as Eurokód 5 (SÚTN 2007). The reason is underestimation of joints according to this standard.

CONCLUSIONS

- Common European market leads in majority EU countries towards diverse supply of roundwood or timber. This supply increase number of species used by the wood processing industry, enlarge quality composition as well as expands different characteristic properties of wood supply. Normalization at the European level unifies and simplifies examination of selected material feasibility for further utilization. In the area of timber quality grading, many wood species are not cover; there are elaborated only the most used European wood species.
- Process of European standard implementation is not static matter. There is a need for revising of normalization process, which was confirmed by negative results of implemented of an EU standard on wood building constructions.
- Slovak republic, as a member of European Committee for Standardization, can not only implement others standards, but also can contribute on editing or creation new ones.

ACKNOWLEDGEMENT

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