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PROPERTIES OF THE METHODS, USED FOR THE ELECTRONIC WOOD RECEPTION

Karel Janák

Abstract

The aim of the presented paper is to show properties of chosen procedures for evaluating the volume of logs. Chosen methods are used for the timber trade in the Czech Republic - Recommended rules for measuring and classifying of wood 2008, Austrian 1021 ON L Vermessung von Rundholz, German Framework Agreement and the EN 1309-2 Round and Sawn Timber - Method of Measurement of Dimension. The results are compared with the method which calculates the volume of logs as close to the geometric volume as possible from the data scanned by currently used systems. Characteristics of current practices are determined in the relation to this "geometric" volume too. The work gives the deviation dependences on the thickness and length of the measured round wood. It outlines the possibility of comparing the results determined in accordance with different methods.

Key words: *log, round wood measuring, timber volume, round wood reception*

INTRODUCTION

Tree stem or in part - log is irregular body, whose shape as well as volume can be determined only approximately by simple procedures.
For manual measurements in Central Europe, Huber method is the most widely used. It compares the stem to the cylinder. The main advantage of this method is easy and fast measurement (length + thickness of a piece in the middle of its length) and satisfactory precision. Electronic measuring systems in the log yards today evaluate the thickness of the scanned logs almost continuously with an accuracy of ± 1 to ± 2 mm and a length with an accuracy of ± 1 cm. Procedures for evaluation of electronic timber volume are not uniform unfortunately. They differ mainly in the method of log diameter determining. It means that the results of electronic procedures differ among themselves, disagree with the results of manual measurements and do not correspond to the geometric volume of logs. The data scanned electronically about individual pieces of logs allow to evaluate the volume of logs far more precisely than the original method of Huber. However, they remain unused or are used to minimize the volume of wood evaluated. The difference of the results leads to an effort to determine differences between various methods and to determine the simply recalculating coefficients based on these differences. The actual shape of the logs, however, is not regular geometrical body. Furthermore, it is burdened with a great individual diversity. This causes the deviation between the values of the volume of wood,

Ústav základního zpracování dřeva LDF MZLU v Brně, Zemědělská 3, CZ 613 00 Brno
e-mail: karel.janak@mendelu.cz

quantified by different methods, often based on different, although they are very carefully evaluated. Practical experiences of the producers or processors of wood, mostly saw millers, are also different.

MATERIAL AND METHODS

The study was focused on properties of procedures currently used mostly for timber measurement and determination of its volume. From the perspective of their users in the Czech lands are the following procedures:
- Recommended rules for measurement and classification of wood in the Czech Republic, 2008
- ÖNORM L 1021 Vermessung von Rundholz, Austria, 2006
- Rahmenvereinbarung für die von Werksvermessung Stammholz, Germany 2008

These procedures were assigned standards - EN 1309-2 Round and Sawn Timber - Method of Measurement of Dimension - Part 2: Round Timber, 2006 and CSN 48 0050 Rough round wood. Basic and common provisions. Both are used marginally, but both show very good agreement with the real volume of logs.
The values of the volume of logs obtained by the above regulations were compared with the value "geometrical" volume, obtained by the reference method. Evaluation of the "geometrical" volume based on the segmental method: volume of the log is the sum of volumes of the individual sections. The lengths of sections are 10 cm, which corresponds to the highest distance of thickness measurement points on the logs, set the current regulations. Section thickness is equal to the average value of two perpendicular measurements at the beginning and end point (4 values), the volume of the section is defined as the volume of the cylinder. Described determination of "geometric volume" is feasible for any today used equipment.
Comparative measurements were performed on approximately 180,000 spruce logs. Dimensions and quality (shape) properties correspond to the logs for sawmill processing (grade class III, grades A, B and C, classification in due Recommended rules for measurement and classification of wood in the Czech Republic, 2008). Supplies consisted of 72% logs in basic sizes 3 to 6 m lengths (predominantly 4 and 5 m), 28% of deliveries were common length logs in lengths from 7 to 14 meters, but mostly from 8 to 12 meters (relatively equal representation). The parameters of each log (thickness values, scanned horizontally and vertically in 10 cm intervals of length and length value), obtained by the long-term operational measuring in the saw mill have been saved and subsequently processed according to the above regulations. This ensured consistency of input data. Values of individual coefficients are obtained as the median values of compared volumes of individual logs determined in accordance with above prescriptions, not as a comparison of total supply volumes. Due to the jump character of deviations in determining the volume of the same log according to different procedures (mainly due to conversion mm to cm) the ordinary statistical treatment of results did not give too illustrative picture of the actual properties of individual procedures. In the evaluation clearer graphical presentation of the properties of individual procedures was chosen therefore.

RESULTS

The Properties of *EN 1309-2 Round and sawn timber - Methods of measurement of dimensions* are formed by two opposite effects - Hubert's method, on which the standard is based on, and conversion millimeter to centimeter of log mid thickness by cutting out the units of mm, which is used. The influence of Hubert's method prevails in the area of thick logs, which is reflected in the decline characteristics in its end. In the area of thin logs the influence of Huber method (inclination) is more than offset by the conversion of diameter values from millimeter to centimeters (intensive declination). The decline in the beginning is possible to observe on the figure 1. The characteristic in the most common log thickness area (20-30 cm) is relatively stable – but form 1.2 to 1.7% lower than real volume.

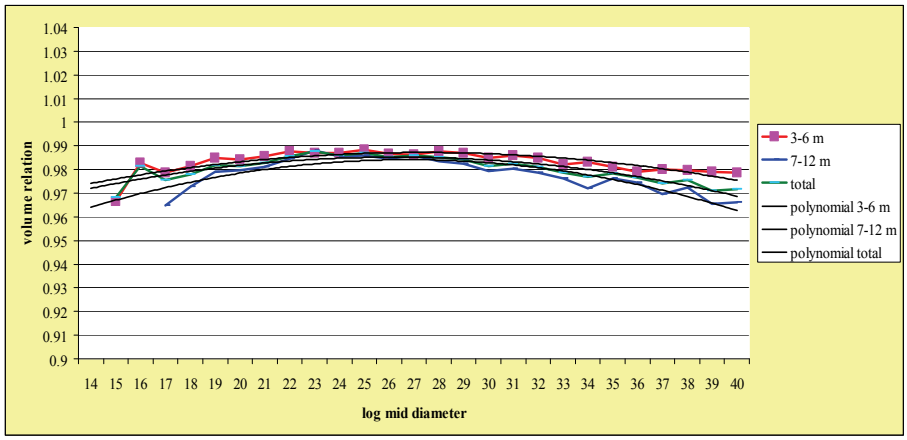

Figure 1. The relationship between the volumes of logs determined according to the EN 1309-2 Standard – Round wood and sawn timber – Methods of measuring dimensions and a comparative method).

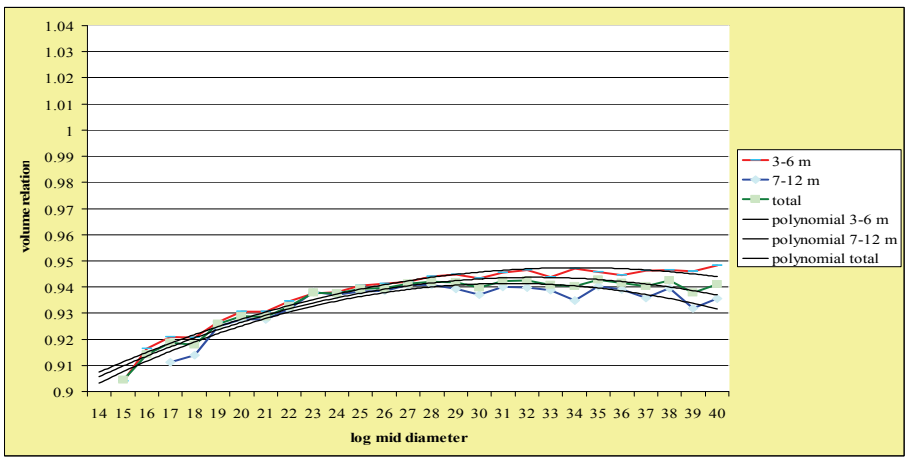

Figure 2. The relationship between volumes of logs determined according to Recommended rules for the measurement and grading of timber in the Czech Republic 2008 and a comparative method.

Recommended rules for measurement and classification of wood in the Czech Republic 2008 converts the measurement values given in mm to whole cm and then also the average values of these data by cutting (the units of mm are not taken into the account). This "double cutting" is reflected in a strong decrease of the log volume values (figure 2). The decrease is especially noticeable for thinner slots (up to about 26-27 cm).

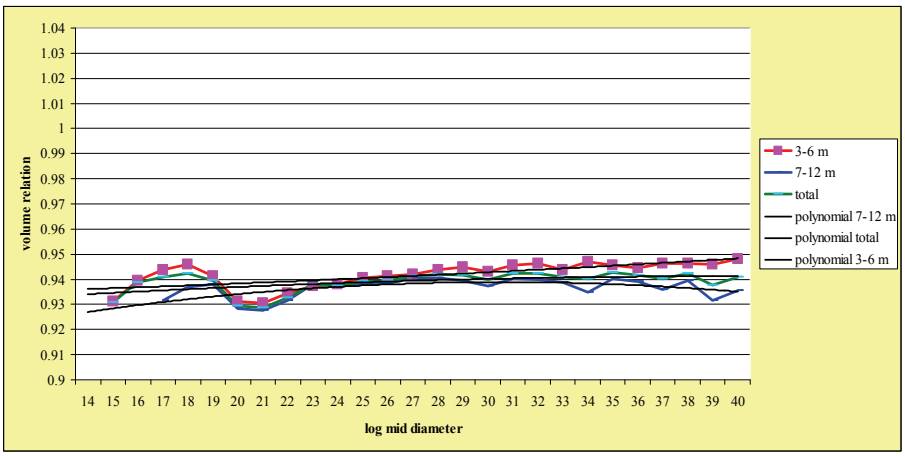

Figure 3. The relationship between the volumes of logs determined according to Rahmenvereinbarung für die Werksvermessung von Stammholz 2005 and a comparative method.

Rahmenvereinbarung für die Werksvermessung von Stammholz, used in Germany, tries to equalize the described decrease at any rate. Therefore the conversion of measured values is not done for logs up to 20 cm thickness. The calculated thickness value is converted only. So "only" one cutting is done. The total evaluated log volume is closer to reality (on the average 94% of the evaluated geometric volume, the average deviation is 6%). This value is only approximate, in fact, it depends on the log thickness in particular delivery (Fig. 3).

Austrian *ÖNorm L 1021 Vermessung von Rundholz* (2006) is close to the Recommended rules for measurement and classification of wood in the Czech Republic 2008 in determining of the log mid diameter and calculating its volume. Only mid diameter is not determined as the average, but the smaller of the thicknesses measured in both points and the mid position is derived from the geometric, not the nominal length. Thereby the measuring point moves about half the length of an length allowance to the log top end. The values of the diameter and consequently the log volume are slightly lower. The characteristics of ÖN L 1021 compared to the Recommended rules in CR 2008, are shifted on the average about 0.3% down.
The above standard *ON L 1021 Vermessung von Rundholz* allows to evaluate the mid diameter and consequently the log volume by usage the values given in the millimeters, without conversion to the centimeter. Otherwise the procedure is identical to the previous.
This version draws near the significant thickness and log volumes to the actual geometrical values and at the same time it totally eliminates the decline of evaluated volumes of small diameter logs. It remains only to underestimation of strong logs characteristic of the Huber method in general.

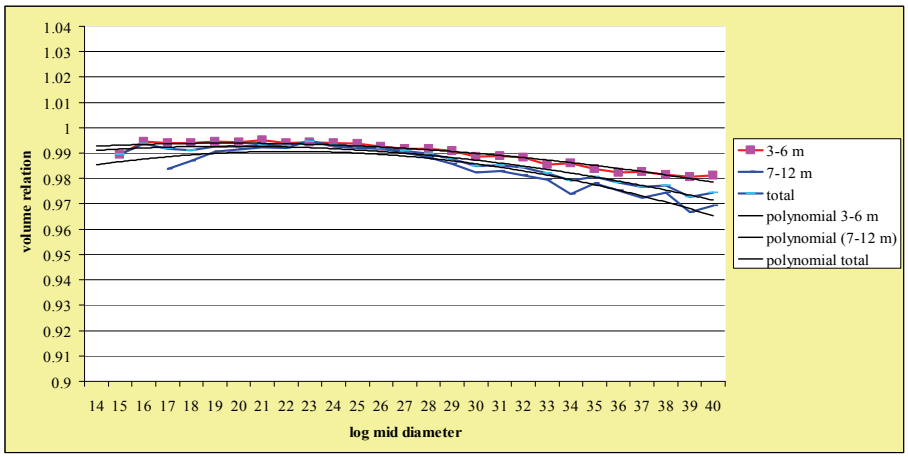

Figure 4. The relationship between the volume of logs determined according to the Austrian Ö-Norm L 1021 (2006) Standard and a comparative method. Values of a mid diameter are given in mm.

But the fact is that there was no sawmill using the provided ÖNORM L 1021 version in practice.

DISCUSSION

The most accurate reference method is volumetric method. Outside the difficult and costly implementation of laboratory measurements this method was not chosen because it can not be made in a practice. The chosen method is sufficiently precise, providing identical input data for all types of data processing and can be done on any operating equipment that meets the minimum requirements prescribed.
It can be reasonably assumed (and practical experiences suggest it) that outside the log diameter and log length also other parameters have an impact (convergence, flattening, machining). But their influence is (according to the test simulations) on the border of distinctiveness of precision of scanning and uneven log surface (especially when scanning in the bark). It is also significantly reduced by filtration. Moreover even if the effect would be proven, it would be difficult to apply it in practice. Based on practical experience we can say that setting of scanning device or filtering parameters is more accurate by use "feeling" according to the results after some period of operation. Method of data filtering is not implemented in any known Central European regulation. Thus, the actual value of its influence can not be stated. Different types of filtration relied on the same log data have been achieved up to about 2% deviation from the values presented in this work.

In practice, the amount of deviation is affected quite much by undefined direction of scanning and the ability to search minimum thickness value by 3D scanning. According to experience, its influence is around 2 - 3.5%.

CONCLUSION

The paper shows the influence of logs diameter and log length on the size of the log volume, provided electronically by different rules. Results are based on operational measurements.
Properties of majority of Central European regulations for electronic measuring and evaluating the log volume are influenced both by Huber method, which the regulations are in its principle based on, and by converting the measured values in mm to whole cm. Huber method slightly underestimates thin and overestimates thick logs. The slight underestimation of thick logs is visible in the characteristics of majority methods. Overestimation of thin slots is completely suppressed by carrying out the log diameter in centimeters and converting of measured values in mm to whole cm by cutting off the mm units. This procedure causes a significant decrease in the volume of all logs evaluated and it especially occurs in thin logs. The rate of decline due to the geometric volume reaches 8 to 9% (Czech Recommended Rules 2008, the Austrian ÖNorm L 1021, cm version). German framework agreement reduces extreme decline by the logs to 20 cm diameter by conversion limits. The volume values do not fall below the -6.5% in this case.
Procedures which conversion of diameter values from mm to cm is limited or which does not use it show a much lower deviations (EN 1309-2 - 1.5% to 3%, millimeter version of ÖNORM L 1021 - 0.7% to 3%, CSN 48 0050 - 0.3% - 0.8%). Unfortunately, these prescriptions are used in practical production of at least (It was not found in the CR).
The increasing log length slightly increases the described trends. Its influence is not significant.
Values of log volumes, obtained in one procedure, can not be "recalculated" to the values obtained in different procedure using a universal coefficient (with operationally usable precision). It is always necessary to take into account the features of the specific log supply. When you need to know the estimate, it should be known at least an average mid diameter of the logs and the share of logs in the single (3-6 meters) and combined lengths (usually 7-12 m).
The ideal solution for the future is the unification of procedures. The experiences reached in the meetings of the stakeholders unfortunately do not allow believe in an early implementation of this solution.

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