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QUALITY ESTIMATION AND CLASSIFICATIONS OF SAWN AND PLANED WOOD ACCORDING TO SFS AND GOST

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ABSTRACT
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The purpose was to find out the reasons why there are a number of problems with quality estimation of timber patterns imported from Finland to Russia, to study why European quality grades could not be simply equal to Russian quality sorts. Russian specialists have to produce similar procedures of quality estimation right from the beginning, which requires additional working hours and increases costs.

In the theoretical part of the study the main issue was to find the differences between main normative documents about sawn and planed timber from two sides: Russian GOST and Finnish SFS. Previous studies have indicated that the lists of defects and definitions are similar, but there are essential differences between the limit values of the defects in processes of quality estimation. In the empirical part of the study the main concern was to estimate the patterns of wood production in the Russian and the Finnish way and to compare the results. The empirical part consists of practical measurements on site.

As a result of this project it could be stated that European and Russian algorithms of quality estimation of sawn and planed timber products are similar and based on the same principle, but juristically European grades could not be simply converted into Russian ones, deeper analyses are need. May be reasons was declared and little support was found for the creation of a united juridical document in sector of sawn and planed timber quality estimation and more widely – timber international trading between Russia and Europe.

Keywords: Sawn and Planed Timber, Quality Estimation

CONTENTS

1 INTRODUCTION

Nowadays customer interest to wooden buildings is growing in Russia. But unfortunately wood as a building material was not widely used here since 20th years of XX century, so today architects and builders are unable to rely in their work to the experience of preceding generations.

The sphere of activities of the international company HONKA comprises industry of wooden houses. It has a half-century experience in it and has recently entered the Russian market. But when entering a new market a company gets a few problems, such as significant differences between normative and technical literature of different countries.

Quality estimation of timber in terms of both Russian and European norms is not equivalent. This work is aimed at studying the differences between major Russian documents relating to sawn and planed timber, and documents which Honka-company uses as an example of European (Finnish) regulations. A comparative analysis of these documents may help the author of this work in the development a wood quality estimation algorithm more specifically for Honka-company, taking into account these and other requirements.

Russian and Finnish systems of timber quality grades are similar by algorithm but deffer by limit values. That makes a lot of problems when Finnish sawn timber was first introduced on the Russia and Russian specialists could not simply convert European sorts in Russian sorts and have do all similar procedure of quality estimation from beginning.

This work is mainly focused on softwood, as the company Honka works mainly with it. The most common representatives of softwood – pine and spruce – are described in detail in all normative documents and they could be analyzed easily.

2 TERMS AND DEFINITIONS

Before comparing the methods of quality estimation of wood according to Russian and Finnish standards, it is necessary to introduce the terms used by specialists in both countries during this process. The key terms are connected with wood defects. Due to climatic differences between countries, the lists of wood species and defects described in the normative literature are different. In the main Russian normative document, GOST 2140-81 "Visible defects of wood" defects are classified according to reason for appearance, in Finnish SFS 4891 RT 21-10188 "Sawn and planed timber. Timber, definitions and assessment methods of characteristics", which we consider, in alphabetical order (Finnish). Table 1.1 shows a comparison of definitions of defects, used on both countries in alphabetical order (English).

Table 1.1 Comparison of definitions of defects from GOST 2140-81 and RT 21-10188

Term	Definition	
	GOST 2140-81	RT 21-10188
2.1 Bark	Bark area which was saved on sawn timber surface (Section 2 “Terms and definitions”, section “Foreign inclusions, mechanical damages and faults machining”). Is measured by length and width or by square of occupied area in percents of sawn timber square. It increases the amount of shook waste, often drops out, leaving flat deepening and through holes in shook (Appendix 1 “Defects influence on wood quality”, section 8 “Foreign inclusions, mechanical damages and faults machining”). Figure 15 in Appendix 1 shows example of bark.	On timber surface it may form a partially or completely filled cavity. A small cavity is measured by length, a large cavity is also measured by width. Small cavity: length ≤ 50 mm. Large cavity: length> 50 mm. Figure 4 in Appendix 1 shows example of bark.

Term	GOST 2140-81	RT 21-10188
2.2 Biological damages	Wormhole – moves and holes, made in wood by insects. Surface wormhole – wormhole, entered in wood on depth not more then 3 mm (Figure 30 in Appendix 1). Not deep wormhole - wormhole, entered in wood on depth not more than 15 mm in round timber and not more then 5 mm in sawn timber. Deep wormhole - wormhole, entered in wood on depth more then 15 mm in round timber and more than 5 mm in sawn timber. (Figure 31 in Appendix 1). Not large wormhole – deep wormhole with hole diameter not more then 3 mm (Figure 31 in Appendix 1). Large wormhole – deep wormhole with hole diameter more than 3 mm (Figure 31 in Appendix 1). Through wormhole – wormhole, going through the material. Wood damages from parasitic plants – holes in sawn timber, appeared in result of parasitic plants life (mistletoe, loranthus).	Biological damages in timber are caused by insects and animals, feeding on insects and insect larvae. Insect damage is divided into two groups: - caused by Hymenoptera - caused by bark beetles Damage assessment is made cavity size and depth estimation visually. (Figures 29 and 30 in Appendix 2).

Biological damages	GOST 2140-81	RT 21-10188
	Not deep wood damages from parasitic plants - wood damages from parasitic plants to depth not more than 5 mm. Deep wood damages from parasitic plants - wood damages from parasitic plants to depth more than 5 mm. Damage from birds – cavity in round timber, appeared in result of bird life. (Section 2 “Terms and definitions”, section “Biological damages”). Surface wormhole doesn't affect the mechanical properties of wood. Shallow and deep worm canals violate the integrity of wood and reduce its mechanical properties. Lesion of wood by worm canal usually entails its lesion by sapwood fungal coloring, browning and sapwood rot. The presence of in a worm canal living larvae indicates that the process of damaging of wood by insects has not yet stopped; in debarked timber it stops fairly quickly and is not accompanied by a significant increase of timber damage, in undressed timber process can be continued until the end of larval	

Biological damages	GOST 2140-81	RT 21-10188
	development with some increase in damage to the wood. Damage of wood by parasitic plants violate the integrity of the wood and reduce its mechanical properties. Damage by birds violates the integrity of round timber, could make its use more difficult according to appointment. Increases the amount of waste when cutting and clipping. (Appendix 1 “Defects influence on wood quality”, section 7 “Biological damages”).	
2.3 Blue timber	Gray coloring of sapwood with blue and green blooms. (Section 2 “Terms and definitions”, section “Fungic defects”). It slightly reduces the resistance to impact loads of wood), but impair its appearance and increases water permeability. Fungi, coloring sapwood, can destroy glues and paint-and-lacquer coatings (Appendix 1 “Defects influence on wood quality”, section 7 “Fungic defects”).	Blue timber is accompanied by color changing of wood. It could be bright or dark. Blue timber does not influence the strength of wood. It appears after sawing. Degree of blue is determined on the area of surface, where it is observed (Figure 31 in Appendix 2).
2.4 Cracks	Wood gap along fibers (Section 2 “Terms and definitions”, section “Cracks”).	Dry cracks are formed during drying. The size of crack is determined by length and depth

Cracks	GOST 2140-81	RT 21-10188
	Cracks, particularly cross-cutting, violate the integrity of the timber and in some cases, reduce their mechanical strength (Appendix 1 “Defects influence on wood quality”, section 2 “Cracks”). The types are: Heart crack - radial directed crack in core, departing from it and having considerable length along pattern length (Figures 27 and 28 in Appendix 1). Appears in growing tree and increases in cut wood during drying. In round sawn timber comes out on ends; in sawn timber on ends and on lateral surfaces, where usually takes form of long chains of discontinuous cracks, separated by narrow bridges. Simple heart crack – heart crack, located on pattern end in one plane along radius or diameter (Figures 27 and 28 in Appendix 1). Complicated heart crack (star crack) – heart crack consisted of one or several cracks and located on pattern end in different plates (Figures 27 and 28 in Appendix 1). Ring crack (wind crack) – crack, located between annual rings, appeared in core of growing tree (Figure 27 in Appendix 1). Increases in cut tree during drying. Is observed on ends in form of	depending on the lighting, as well as its width (Figure 24 in Appendix 2). Circular crack is parallel to the annual rings. Its size is determined by length and depth, taking width in account (Figure 25 in Appendix 2). Core crack is radial crack in the heartwood. Its size Its size is determined by length and depth, taking width in account (Figure 26 in Appendix 2).

Cracks	GOST 2140-81	RT 21-10188
	curved or circular cracks, on side surfaces – in form of longitudinal cracks. Frost crack (frost cleft) – radial directed crack, goes from sapwood to core and having large extent by pattern length (Figure 27 in Appendix 1). Appears in growing tree exposed to low temperatures and is accompanied by formation on trunk characteristic ridges and crests of spread wood and bark. In round timber is observed on side surface in form of long and deep cracks, on ends in form of deep (usually to core) radial cracks with extended annual rings near it; in sawn timber – in form of long radial cracks with curved annual rings near it and dark (for softwood tarred) walls. Shrinkage crack – radial directed crack, appears in cut tree during drying. Differs from heart and frost cracks by lesser extent by pattern length (usually not more then 1 meter) and lesser depth. Side crack – crack, goes to pattern side surface or on side surface and end (or ends). Face crack – crack, goes to face or face and end (Figure 27 in Appendix 1). Edge crack – crack, goes to edge	

Cracks	GOST 2140-81	RT 21-10188
	or edge and end (Figure 27 in Appendix 1). End crack – crack, goes to end or ends and have not exit on side surface (Figure 27 in Appendix 1). Non-through crack – crack, goes to pattern side surface or one side surface and end. Not deep crack – non-through crack in round timber with depth not more than $^{1}/_{10}$ of corresponding end diameter, but not more then 7 sm, and in sawn timber – with depth not more then 5 mm, in sawn timber thicker then 50 mm – not more than $^{1}/_{10}$ of its thickness. Deep crack - non-through crack in round timber with depth more then $^{1}/_{10}$ of corresponding end diameter and in round timber thicker then 70 sm – more than 7 sm, and in sawn timber – with depth more then 5 mm, in sawn timber thicker then 50mm –more than $^{1}/_{10}$ of its thickness. Through crack – side crack, goes to two side surfaces or having two exits on one pattern side surface. Closed crack – crack with width not more than 1,0 mm. Open crack – crack with width more than 1,0 mm. (Section 2 “Terms and definitions”, section “Cracks”).	

Term	GOST 2140-81	RT 21-10188
2.5 Curl	Is changing of pattern shape during sawing, drying and storage (Section 2 “Terms and definitions”, section “Defects of wood structure”). Curl, especially cross-cutting, reduces the strength of wood in compression and tension along the fibers and the static bending and impact resistance in bending. Strength is markedly reduces in case of location of curls in the tension zone of dangerous section (Appendix 1 “Defects influence on wood quality”, section 4 “Defects of wood structure”). Type difference by geometry: Longitudinal curl by face - curl by length in the plane perpendicular to face; Simple curl - curl by longitudinal face, characterized by only one curve; Complicated curl - curl by longitudinal face, characterized by several curves; Longitudinal curl by edge - curl by length in the plane parallel to face; Transverse curl – curl by width; Twist (spiral curl) - spiral curl by length. Longitudinal curl by face and longitudinal curl by edge are measured by pattern amount of deflection (Figure 16 in Appendix	Type difference by geometry: Curl is a violation of timber plane in two directions (Figure 5 in Appendix 2). Concave and convex are types of distortions of timber surface in one direction. Figures 6 and 7 in Appendix 2 show examples of concave and convex. Concave of the longitudinal axis from the plane of sawn timber pattern is distortion of the surface of the timber in one direction, curvature of the longitudinal axis from the plane of sawn timber pattern (Figure 8 in Appendix 2). Concave of the longitudinal axis in the plane of sawn timber pattern is distortion of the surface of the timber in one direction, curvature of the longitudinal axis in the plane of sawn timber pattern (Figure 9 in Appendix 2).

Curl	GOST 2140-81	RT 21-10188
	1, dimensions a_1 и a_4). Transverse curl is measured by pattern amount of deflection (Figure 16 in Appendix 1, dimension a_5). Twist (spiral curl) is measured by largest deviation of pattern surface from the plane (Figure 16 in Appendix 1, dimension a_6). Complicated curl is measured by amount of deflection of largest curvature, which made it (Figure 16 in Appendix 1, dimension z). (Section 2 “Terms and definitions”, section “Defects of wood structure”).	
2.6 Knots	Part of branch, cased in trunk wood (Section 2 “Terms and definitions”, section “Knots”). Knots worsen appearance of wood, violating homogeneity of its structure, and sometimes and integrity, causing fiber distortion and annual layers difficult machining. Sizes of knots, shape, relative positions, degree of coalescence with the surrounding wood, etc affect timber quality. Knots, especially rib, oblong, stitched and group, reduce the strength of sawn timber and components in tension along the fibers and bending. In transverse compression and longitudinal	The types are: Live knot is surrounded by a pitch (Figure 10 in Appendix 2). Dry knot is partially or completely separated from the surrounding wood, hard and durable (Figure 11 in Appendix 2). Knot with bark is partly or completely surrounded by living bark (Figure 12 in Appendix 2). Rotten knot is knot completely or partially damaged by rot (Figure 13 in Appendix 2). Leaf-knot is oval knot in massif of wood (Figure 14 in Appendix 2). Knot with shear consists of knot wood and full or partial shear of its core. Its size is determined as the size of the whole knot (Figure 15

Knots	GOST 2140-81	RT 21-10188
	chipping knots increase strength of wood. Snuff-colored knots indicate the presence of heartwood rot, because in round timber rot can be hidden and do not go to the ends (Appendix 1 “Defects influence on wood quality”, section 1 “Knots”). Types are (Figure 17 in Appendix 1): Open knot - knot that goes on timber lateral surface; Round knot - knot, cut so that the relation between the larger diameter and the smaller one is not more than two; Oval knot - knot, cut so that the relation between the larger diameter and the smaller one is more than two, but not more then four; Oblong (spike) knot - knot, cut so that relation of larger diameter to less is more than four; Face knot – knot goes to timber face; Edge knot – knot goes to timber edge; Rib knot – knot goes to timber rib (Figure 18 in Appendix 1); End knot – knot goes to timber end; Stitched knot - knot goes simultaneously to two ribs of the same side (Figure 19 in Appendix	in Appendix 2). Knot with the prolapsed core is often formed by falling of the knot core. Its size is determined as the size of the whole knot (Figure 16 in Appendix 2). A knot group is formed by several knots, which surrounding wood fibers in the process of tree growing directly influence each others (Figure 17 in Appendix 2). Round knot is far from cut branch, proportion between maximum and minimum diameter in the cross section is less than two (Figure 18 in Appendix 2). Horn-shaped knot is a knot, which is caught in sawing such way that it is seen on more than one of sawn timber facets in case when pattern section forms regular polygon. It is counted separately from other knots (Figure 19 in Appendix 2). Oval knot is far from cut branch, proportion between maximum and minimum diameter in the cross section is more than two (Figure 20 in Appendix 2). Edge knot is a knot, which is caught in sawing such way that it is seen on more than one of sawn timber sides in case when pattern section forms irregular polygon (Figure 21 in Appendix 2).

Knots	GOST 2140-81	RT 21-10188
	1); Scattered knots - knots, located singly and separated by distance exceeding the width of sawn timber, and in case of sawn timber width more than 150 mm - at a distance more than 150 mm; Group knots - round, oval and rib knots, concentrated in a number of two or more at a distance equal to the width of sawn timber, and in case of sawn timber width more than 150 mm - at a distance 150 mm (Figure 20 in Appendix 1); Branched knots (paw-shaped sticks) – two oblong knots of the same node or oblong knot combined with oval or rib knots of the same node, regardless of presence between them third - round or oval knot (Figure 21 in Appendix 1); Intergrown knot - knot, which annual rings is intergrew with surrounding wood for not less than 3 / 4 of the perimeter of knot cut section; Partly intergrown knot - knot, which annual rings is intergrew with surrounding wood for from $^{1}/_{4}$ to $^{3}/_{4}$ of knot cut section; Not intergrown knot - knot, which annual rings have not intergrowing with surrounding wood or intergrew with it for less than 1 / 4	Symmetrical knots are estimated as two different knots (Figure 22 in Appendix 2). Wane appears on the surface of wood when a knot was located far from cut branch and at acute angle to the plane of cutting. It is determined by the proportion of its length to the length of sawn timber pattern (Figure 23 in Appendix 2). Size of a knot is determined by its sawing surface perpendicular to the main axis of the sawn timber in the direction from left to right.

Knots	GOST 2140-81	RT 21-10188
	of the perimeter of knot cut section; Loose knot (loose not intergrown knot) - knot, which has not intergrowing with surrounding wood and holds in it not tightly (Loose knots like group of defects include holes from loose knots); Healthy knot – knot, which have wood without rot; Bright healthy knot - healthy knot, which wood is bright and which has color close to surrounding wood (Figure 22 in Appendix 1); Dark healthy knot (dark tarred knot) – healthy knot, which wood is more darker then surrounding wood, abundantly impregnated with resin, tanning and core agents, often with uneven staining (Figure 23 in Appendix 1); Healthy knot with cracks; Starting rotten knot – knot with rot, occupied no more than 1 / 3 of knot square cut section (Figure 24 in Appendix 1); Rotten (unsound) knot - knot with rot, occupied more than 1 / 3 of knot square cut section (Figure 25 in Appendix 1); Snuff-colored knot - starting rotten or rotten knot, in which wood turned wholly or partly into a friable mass of rubiginous or brown (snuff-colored) or albescent	

Knots	GOST 2140-81	RT 21-10188
	color (Figure 26 in Appendix 1); Single-sided knot - knot goes to one or two adjacent sides of sawn timber; Traversing knot - knot, goes on two opposite sides of sawn timber; Overgrown knot - knot that does not go to timber lateral surface, detectable by traces of overgrowth (bulging, wound spot, brow). (Section 2 “Terms and definitions”, section “Knots”).	
2.7 Mould	Is abnormal color area of wood with a decrease in hardness, caused by the influence of wood-fungi (Section 2 “Terms and definitions”, section “Fungic defects”). It doesn’t affect the mechanical properties of wood, but also impairs the appearance, could pass to foodstuff and goods and destroy the animal glues, after drying is easily removed (sweep), leaving on the wood surface sometimes dirty or colored spots (Appendix 1 “Defects influence on wood quality”, section 6 “Fungic defects”). Figures 1-14 in Appendix 1 show types of mould.	Is a common defect. There are hard and soft mould. Hard mould: process of decay, progressed not so much that wood structure became soft, sound of normal wood. Soft mould: process of decay progressed so that wood lost strength. Mould is determined on the surface of the material, where process of decay takes place. It doesn’t affect the mechanical properties of wood, but also impairs the appearance, could pass to foodstuff and goods and destroy the animal glues, after drying is easily removed (sweep), leaving on the wood surface sometimes dirty or colored spots. Figure 1 in Appendix 2 shows example of mould, figures 2 and 3 – examples of hard and soft moulds respectively.

Term	GOST 2140-81	RT 21-10188
2.8 Pitch	Pocket: dammar or resin damage fluxed from pockets damages the surface of product and prevents it facial finish and laminating. In the fine detail of pockets can reduce strength of wood. Pocket (pitch pocket) is cavity inside or between annual rings, filled by dammar or resin (Figure 29 in Appendix 1). Is observed on tangential surfaces in form of oval flat hollows, on radial surfaces – in form of narrow longitudinal slits, on ends – in form of short curved cavities (Section 2 “Terms and definitions”, section “Defects of wood structure”). Pitch pocket not significantly affect the mechanical properties of wood. However, significantly reduces the impact resistance in bending, reduces water permeability and difficulties finishing and gluing, and laminating of materials (Appendix 1 “Defects influence on wood quality”, section 4 “Defects of wood structure”). Pitching – wood part of soft wood timber, abundantly impregnated with resin. In round timber is detected by presence of wounds	Pitch area is a wood area with exceptionally high pitch content (Figure 27 in Appendix 2). Pitch pocket is usually pitch-filled cavity between annual rings. Its size is determined by the length. Small pitch pocket: length≤50 mm. Large pitch pocket: length>50 mm (Figure 28 in Appendix 2).

Pitch	GOST 2140-81	RT 21-10188
	and resin cumulation. In sawn timber and veneer pitch impregnated areas are much darker then surrounded normal wood and shine through in thin materials (Section 2 “Terms and definitions”, section “Defects of wood structure”). It is measured by width and length of area, occupied by defect. If it is due to pattern specific, it is permitted to measure one of these parameters; or by square of area, occupied by defect (in percents of square of appropriate pattern sides) (Section 3 “Round timber defects measuring”, section “Defects of wood structure”). Canker changes the shape of round of logs and wood structure, for softwood is accompanied by strong resinosis and tarring of wood, complicates the use of logs according to appointment and machining. (Appendix 1 “Defects influence on wood quality”, section 4 “Defects of wood structure”). Streak (trunk damage, made during tapping) is accompanied by wood tarred (Section 2 “Terms and definitions”, section “Foreign inclusions, mechanical damages and faults machining”).	

We can see that there are no great differences between the terms definitions under the same title, but there are different limits for determination of analogical defects by damage value.

2.9 Other terms

For further work it is necessary to list the terms and definitions from two documents which have no analogues. These data are given in the following table 1.2.

Table 1.2 Comparison of definitions of defects from GOST 2140-81 and RT 21-10188

Document	Term	Influence on wood quality
GOST 2140-81	Section “Defects of trunk shape”	
		Appendix 1 “Defects influence on wood quality”
	Trunk falloff	increases the amount of waste when sawing and clipping
	Round wood and timber dressing	causes the appearance of the radial fibers tilt in sawn timber, veneer and shook
	Butt maturity	complicates the use of round timber to destination, increases the amount of waste when sawing and clipping round wood and timber dressing, causes the appearance of the radial fibers tilt in sawn timber, veneer and shook
	Roundness	may hinder the use of round wood, increases the amount of waste in timber dressing, is an external sign of the presence of careen and reaction wood in the trunk
	Build-up	complicates the use of round wood according to appointment and complicates processing
	Curvature	complicates the use of round wood according to appointment, increases the amount of waste when

		sawing and clipping round wood and timber dressing, causes the appearance of the radial fibers tilt in sawn timber, veneer and shook, reduces the limit of compressive strength for timber used in a circular form
	Fibers slope	increases the strength of wood when it is cleaved, makes it difficult to machining (planing and a hewing), reduces bending ability, reduce the strength of sawn timber, veneer and shook under tension along the fibers and bending. Lumber with tangential fibers slope differs increased longitudinal shrinkage and casting
	Careen	increases hardness of the wood and its strength under compression and static bending, reduces the impact resistance in case of bending and tensile strength, sharply increases shrinkage along the fibers, causing increased tendency of sawn timber and components to longitudinal cracking and casting, significantly reduces the water absorption of wood, making it difficult for its impregnation, worsens the appearance
	Reaction wood	increases the strength of wood in tension along the fibers and impact resistance in bending, reduces the compression strength of fibers and the static bending strength, increases shrinkage in all directions, especially along the fiber, which contributes to the emergence of casting and cracking, difficulties in processing, which leads to the formation of fluffiness and surface mossiness
	Curly-grain (knog)	reduces the strength of wood in tension, compression and bending, increases the cleavage strength of wood, as well as spalling strength in a

		longitudinal direction, makes it difficult wood gouging and hewing
	Eyes	eyes that are in a dangerous section of small element, reduce its strength in static bending and impact resistance in bending.
	Heartwood	elements with heartwood crack easily
	Dual heartwood (core)	difficulties in processing (sawing, and clipping) of wood and increases the amount of waste. Elements with dual core crack easily.
	Inosculated cores	may trouble use of round timber to its destination. It is an external sign of the presence in trunk careen and reaction wood.
	Stepson	violates the homogeneity of the structure of wood, in sawn timber and details sometimes its integrity, reduces the mechanical properties of wood, especially when bending and stretching
	Side dryness	violates the correctness of the form of round timber and the integrity of the wood, causes local curvature of the annual rings
	Dark wood	violates the integrity of the wood, accompanied by the curvature of adjacent annual rings
	False core	spoils the appearance of wood, characterized by poor permeability, reduced tensile strength along the fibers and increased fragility. In birch, in addition, the false core can easily crack. By resistance to decay false core exceeds sapwood.
	Spotting	has no effect on the mechanical properties of wood. In shook in places of large spots sometimes causes cracking of wood. Makes worse the appearance of wood.
	Inner sapwood	not different from the core (heartwood) on the mechanical properties, has heightened permeability to liquids and reduced resistance to decay

	Frost heart	is cause of cracking, reduces the impact resistance in bending and is often accompanied by rot
	Chemical staining	does not affect the physical and mechanical properties of wood, changing its color and luster. Intense color impairs the appearance of wood.
	Fungal heartwood spots (bands)	don't significantly affect the mechanical properties of wood (sometimes some reduction of the strength of wood under shock loads is observed), spoil the appearance and increase the water permeability of the wood
	Sapwood fungal colorings	don't affect the mechanical properties of wood (sometimes in long-term effects of fungi, the deep blue timber slightly reduces resistance to impact loads of wood), but impair its appearance and increase water permeability. Fungi, coloring sapwood, can destroy glues and paint-and-lacquer coatings.
	Browning	changes a little strength under static loads and the hardness of the wood, can reduce the impact resistance in bending, impairs the appearance of wood, for beech reduces water permeability, in case of storage unseasoned wood is the precursor of sapwood decay
	Motley sieve, brown cracking, white fibrous and heartwood rots	significantly affect the mechanical properties of wood. Timber grade of quality with these rots, depending on the size of lesions is reduced until it is full technical unfitness. In the cut timber further development motley sieve rot stops. Development of brown cracking and white fibrous rot of unseasoned wood can continue

	Firm sapwood rot	somewhat reduces the strength of wood under shock loads and increases its permeability and water absorption
	Soft sapwood rot	drastically reduces the mechanical properties of wood. When storing unseasoned wood process of destruction of wood by sapwood rot continues
	Outdoor mouldering rot	drastically reduces the mechanical properties of wood, the process of destruction can continue not only to unseasoned, but in relatively dry wood, doted wood is a dangerous source of fungal infection for a variety of wooden structures
	Hollow	violates the integrity of elements, makes it difficult to use them as intended. In case of large development leads to a complete technical unfitness of doted timber.
	Foreign inclusion	troubles the processing of wood, often is a reason of accidents
	Charring	is accompanied by loss of part of wood and changes the shape of the lateral surface of timber, may trouble the use of timber according to appointment, increases the amount of waste when cutting and clipping round wood and timber dressing
	Barking	reduces resistance of undressed round timber to fungal lesions and cracking
	Butt trimming	reduces the actual length of element, makes it difficult to use according to appointment, increases the amount of waste in transverse dressing
	Wane	reduces the actual width of the sides of element, complicates the use of sawn timber according to appointment, increasing the amount of waste when dressing
	Line marks,	are indicators of the quality of processing, determine

	waviness, mossiness, fringe, tear-out, ragged end, jag, ripple of shook	the surface roughness, reduce the actual size of the material and makes it difficult materials finishing, gluing, laminating
	Flakes, chip, score, snag, gash, mark, streak	violate the integrity of the wood, impairs the appearance, reduce the actual sizes of the material, in case of larger sizes reduce the mechanical strength of the material, make it difficult to use it according to appointment
	Peak, burr, scallop	are indicators of the quality of machining by cutting
	Insufficient milling, insufficient grinding, excessive grinding	worsen the appearance, disturb propriety of element's forms, require additional processing
	Pincher, scratch, burn	worsen the appearance of parts and products
	Warpage	changes the shape of sawn timber and parts, troubles using according to appointment, processing and dressing. Value of warpage changes during drying and wetting of wood.
RT 21-10188	Core band	is a band of wood, differing by color from other wood. It is determined by the proportion between its length and length of sawn timber pattern.
	Color changes	are mostly superficial defects acquired during drying, storage or transportation of sawn timber.

3 MEASURING THEORY FOR TIMBER DEFECTS AND SYSTEMS OF QUALITY RANGES

In this section it will be considered what the main difference between the approaches to timber defect measuring in the Russian and the Finnish ways are for the first necessary to understand how quality degree is given to a pattern, what quality estimation algorithm is in real life in both approaches. To achieve this goal necessary normative documents like legal primary source of these technological procedures are needed.

Soil conditions as well as geographical conditions in direction from north to south greatly influence the properties of growing trees, resulting in differences in wood structure, therefore a classification in grades (RT 21-10750-ru) is needed.

The Russian way is found in the system of grades (Perfect - best and from 1^{st} to 4^{th} - lowest). It is presented in GOST 2140-81.

From Finnish side it is logical to consider document RT 21-10750-ru (normative card, instead RT 21-10626), which is a modified version of the normative card RT 21-10626, because it is practically used by Honka company in this case. It focuses on softwood products made of spruce and pine. By RT 21-10750-ru according to qualitative characteristics sawn timber is classified into 4 main grades: A, B, C and D. Grade A is the highest and it is in turn divided into four subcategories: A1…A4. The Normative grades of sawn timber from pine and spruce presented here are based on common Scandinavian sawn timber classification norms.

3.1 Russian way by GOST 2140-81

The Russian way is reduced to an analysis of all defects on any 1-meter-long piece of pattern. Table 3.1 shows all the needed parameters.

Table 3.1 Standards of defects limitation in sawn timber for grades (GOST 2140-81)

Defects of wood by GOST 2140-81	Standards of defects limitation in sawn timber for sorts									
	Perfect		1-st		2-nd		3-rd		4-th	
1. Knots										
1.1. Fused healthy, and in uneven bars and partially fused and unfused healthy:	Allowed size in parts of side width and in number on any 1-meter long piece on each side, no more than:									
	Dim.	Numb., ea	Dim.	Numb., ea	Dim.	Numb., ea	Dim.	Numb., ea	Dim.	Numb., ea
Face and edge	1/5	2	1/4	3	1/3	4	1/2	4	Allowed	
Edge: at sawn timber up to 40 mm thick	1/3	1	1/2	2	2/3	2	On all edges	2	Allowed	
Thickness of 40 mm and more	1 / 4, but not exceeding 15 mm	2	1/3	2	1/2	3	On all edges	3	Allowed	
Note. In the bars the number of knots is not standardized.										
1.2.	Allowed in the total number intergrown sound knots the size of a fraction of the									

<table>
<tr><td rowspan="2">Partially fused and unfused</td><td colspan="10">width and number in any 1-meter section of length on each side, no more than:</td></tr>
<tr><td>Dim.</td><td>Numb., ea</td><td>Dim.</td><td>Numb., ea</td><td>Dim.</td><td>Numb., ea</td><td>Dim.</td><td>Numb., ea</td><td>Dim.</td><td>Numb., ea</td></tr>
<tr><td>Face and rib</td><td>1/8</td><td>2</td><td>1/5</td><td>2</td><td>1/4</td><td>3</td><td>1/3</td><td>3</td><td>1/2</td><td>4</td></tr>
<tr><td>Edge: at sawn timber up to 40 mm thick</td><td>1/4</td><td>1</td><td>1/3</td><td>1</td><td>1/2</td><td>2</td><td>In all edge</td><td>2</td><td>In all edge</td><td>2</td></tr>
<tr><td>Thickness of 40 mm and more</td><td>10 mm</td><td>1</td><td>1/4</td><td>2</td><td>1/3</td><td>2</td><td>2/3</td><td>2</td><td>The same</td><td>3</td></tr>
<tr><td rowspan="2">1.3. Taint, rotten and snuff-colored</td><td colspan="2">Not allowed</td><td colspan="8">Allowed in the total number of partially intergrown and ununited healthy knots of the same size and no more than half their number</td></tr>
<tr><td colspan="10">Wood, environmental snuff-colored sticks, should not have signs of rot

In sawn timber for bearing structures all knots, placed on 200 mm piece, dimensions amount must not exceed allowed knots limit dimension</td></tr>
<tr><td>2. Cracks</td><td colspan="10"></td></tr>
<tr><td rowspan="4">2.1. Face and edge including came on end</td><td colspan="4">Allowed with length in parts of sawn timber pattern length no more than</td><td colspan="6">Allowed in condition of sawn timber pattern continuity retention</td></tr>
<tr><td colspan="2">Not deep</td><td colspan="2">Not deep and deep</td></tr>
<tr><td>1/6</td><td>1/4</td><td>1/3</td><td>1/2</td></tr>
<tr><td colspan="4">Deep</td></tr>
<tr><td>1/10</td><td colspan="3">1/6</td></tr>
<tr><td rowspan="2">2.2. Face through including came on end</td><td colspan="3">Allowed with length in mm no more then</td><td colspan="3">Allowed with total length in parts of sawn timber pattern length no more than</td></tr>
<tr><td>100</td><td>150</td><td>200</td><td>1/6</td><td>1/4</td></tr>
<tr><td rowspan="3">2.3. End (except shrinkage cracks)</td><td rowspan="3">Not allowed</td><td colspan="3">Allowed on one end with wide in parts of sawn timber pattern width no more than</td><td rowspan="3">Allowed in condition of sawn timber pattern continuity</td></tr>
<tr><td>1/4</td><td>1/3</td><td>1/2</td></tr>
</table>

					retention
Note. Allowed cracks dimensions are agreed for sawn timber with timber moisture content no more than 22%, in case of more moisture content value this cracks dimensions are decreased twice.					

Notes: Knots of less than half of the maximally permitted are not taken into account. For sawn timber with thicknesses of 40 mm or more (except for selected varieties) are allowed elongated stitch concept and twigs the size of the minor axis of 6 mm and a depth of 3 mm, without limiting the size of the major axis. Stepson permitted by rules unfused knots. In perfect grades they are not allowed. The size of a knot is determined by the distance between the tangents to the contour of the branch, conducted parallel to the longitudinal axis of the timber. The size of an oblong and stitch concept knot on faces of sawn timber and on all sides of bars and boards are taking half the distance between the tangent drawn parallel to the longitudinal axis of the timber. In sawn timber with length more than 3 m one knot with dimension specified in norms of adjacent lower grade is allowed. The area of timber length equal to its width, the maximum amount the size of knots lying on a straight line, crossing knots in any direction shall not exceed the size limit allowed by knots.

3.2 Finnish way by RT 21-10750-ru

The Finnish way could be reduced to an analysis of the defects on a sawn timber, sample 1-meter-long, of the least qualitative section. One of main indicators that affect on sawn timber grade is knottiness – size, amount and nature of the knots, see Table. 3.2.

Table 3.2 Allowable amount, size and nature of knots in timber of A, B and C grades. Timber that does not meet the requirements is presented in table illustrating the D grade (RT 21-10750-ru)

Main sorts		A	B	C
Maximum number of knots, allowable on sawn timber 1-meter long least qualitative section				
ON FACE, health and dead knots / of which overgrown are [1)]		4/2	5/3	8/4
ON EDGE, health and dead knots / of which overgrown are [1)]		2/1	3/2	4/3
Face knots sizes				
Sawn timber thickness, mm	Sawn timber width, mm	Health knot maximum diameter, mm		
16, 19, 22, 25	75, 100, 115	20	35	50
	125, 150	25	40	55
	175, 200, 225	30	45	60
32, 38	75, 100, 115	25	40	55
	125, 150	30	45	60
	175, 200, 225	35	50	65
44, 50	75, 100, 115	30	45	60
	125, 150	35	50	65
	175, 200, 225	40	55	70
63, 75	75, 100, 115	35	50	65
	125, 150	50	55	70
	175, 200, 225	45	60	75
Edge knots sizes				
Sawn timber thickness, mm		Health knot maximum diameter, mm		
16, 19		18	·	·
22, 25		20	·	·

32, 38	28	30	·
44, 50	30	40	·
63, 75	35	50	·
Other knots sizes on external face and edge			
Knot type [2)]	Knot maximum diameter in percents of above-mentioned health knot size, mm		
Group knot	70	70	80
Dead knot	70	70	100
Overgrown knot	50	60	80
Rotten knot		50	80

1) For B and C grades the amount of healthy or dead knots with a maximum diameter of 10 mm is not limited

   For B and C grades rotten knots are allowed, too

   For C grade holes and not overgrown knots with a maximum diameter of 15 mm are allowed, too

· Knot diameter equals to sawn timber thickness

2) For A and B grades no overgrown knots are allowed

Other parameters are taken into account when determining wood grade are cracks, wane (rough edge), pitch pockets, sprouts, marks from cutting and planing, fiber slope, top sharp bend, compression wood, soft rot and defects of wood shape.

During quality classification they base on supposition that timber is cut in accordance with Nordic countries sawing timber practice (RT 21-10750-ru, section «Timber sorts», subsection «Sorts»).

Sawn timber could be classified also according to different grades combinations, such as:

- grade AB: contains part of timber products accounted for grades A…B.
- grade ABC: contains part of timber products accounted for grades A…C.

Other combinations of grades are possible too. Produced sawn timber grades proportion in regions and enterprises of one region could be not stable (RT 21-10750-ru, section «Timber sorts», subsection «Sawn timber grade of quality and sphere of application»).

3.2.1 Determination of sawn pine grades

Certain types of sawn timber have a more detailed scheme of quality estimation. It can be considered for example on the bars of the grades of inner wall boards which are one of the most common types of sawn timber. Focus is on softwood - pine and spruce, as company Honka works mainly with it.

Sort indication includes 2 indexes: knot nature and wood species. Knot nature: E – special sort, knots are practically absence (there are only in unedged board from butt part of pine tree), V – with not numerous amount of knots, T – with health knots (from top part of pine tree / with big knots), O – knotty. Wood species indications: M – pine, K – spruce.

In practice products of pine have 4 quality classes (combinations): EM (5%), VM (15%), TM (35%) and OM (45 %) In brackets is indicated part of sawn timber, attributable to indicated quality class. Table 3.3 shows limit values of quality estimation parameters in case of pine material.

Table 3.3 Sliced wall boards and batten ends / pine. Requirements to sliced pine wall board visible surfaces quality (properties and defects). Wall boards which do not satisfy requirements listed in table could be used only for goals secondary according to appointment (RT 21-10750-ru)

Property or defect	Board sort			
	EM	VM	TM	OM
Cracks	Allowed separate	Allowed separate not-through capillary (hair) cracks. On ends short through cracks are allowed too.	Allowed separate not-through capillary (hair) cracks. On ends short through cracks are allowed too.	Allowed separate not-through capillary (hair) cracks. On ends short through cracks are allowed too.
Insects damages	Not allowed	Not allowed	Not allowed	Not allowed
Marks from cutting and planning and sprouts	Marks from cutting and planning and sprouts with size not more then 6 mm are allowed and included in amount of branches	Separate small marks from cutting and planning and sprouts are allowed in individual consignments.	Separate small marks from cutting and planning and sprouts are allowed in individual consignments.	Separate small marks from cutting and planning and sprouts are allowed in individual consignments.
Rot	Not allowed	Not allowed	Not allowed	Not allowed
Compression wood	Is allowed if does not effect on board fastening to	Is allowed if does not effect on board fastening to	Is allowed if does not effect on board fastening to	Is allowed if does not effect on board fastening to

	the frame	the frame	the frame	the frame
Knot rive	Not allowed	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.
Holes from fallen away loose knots	Not allowed	Not allowed	Not allowed	Not allowed
Knots [1]	2 not intergrown knots with size not more than 8 mm are allowed	2 not intergrown (dead) knots with size not more than 15 mm and 3 knots with size not more than 10 mm are allowed	Not intergrown knots with color of health knot which size is not more then 1/3 of board width. are allowed	Not intergrown knots with color of health knot which size is not more then ½ of board width are allowed.
Botches and inserts	Not allowed	Not allowed	Not allowed	Not allowed
Pitch pockets	Not allowed	Small pockets in not numerous amount are allowed. Through pockets are	Small pockets in not numerous amount are allowed. Through pockets are	Small pockets in not numerous amount are allowed. Through pockets are

		not allowed.	not allowed.	not allowed.
Blue timber	Not allowed	Not allowed	Not allowed	Not allowed
Finger joints	Not allowed	Not allowed [2]	Not allowed [2]	Allowed
Medullary sheath	Not allowed	Not allowed	Sheath which length does not exceed half of pattern length is allowed	Sheath which length does not exceed half of pattern length is allowed
Abnormal coloring	Not allowed	Not allowed	Not allowed	Not allowed

1) Table contents knots dimensions and amounts on most knotty 1-meter long area. Non intergrown knots could be health or dry.
2) In case when finger joints do not cause customer's objection it is need to be specified when placing an order.

On building site during timber batch acceptance specialist evaluates quality of few randomly selected patterns by methodic described above and assign class or sort to whole batch. Following pictures illustrate wall boards of 4 sorts of pine wood in practice:

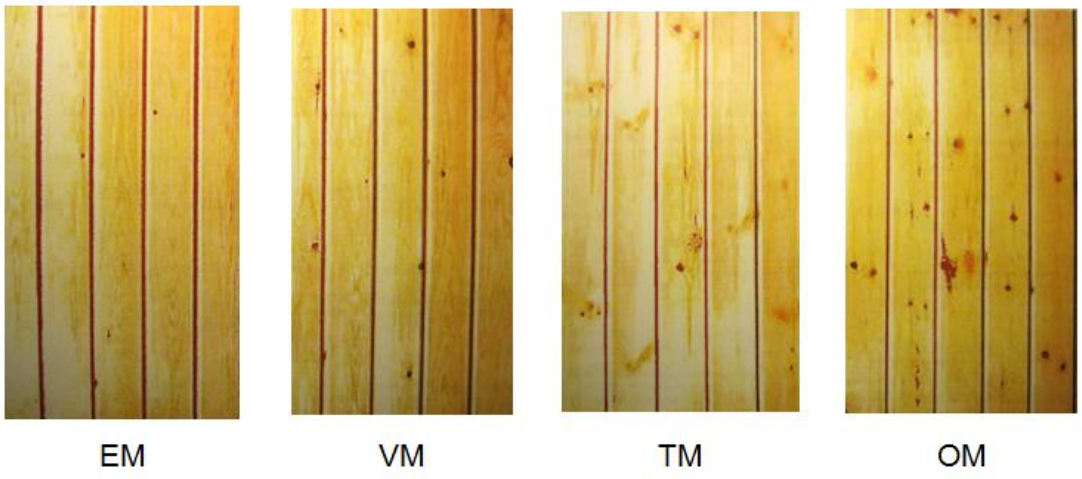


Figure 1. Examples of pine wood sorts

In practice combining sorts are common because wood is natural material absolutely anisotropic material and its inside structure could not be made artificial like in metal or concrete structures.

3.2.2 Determination of sawn spruce grades

In practice products of spruce have 3 quality classes: VK (15%), TK (45%) and OK (40%). In brackets is indicated part of sawn timber, attributable to indicated quality class.

Table 3.4 shows limits values of quality estimation parameters in case of spruce material.

Table 3.4 Sliced wall boards and batten ends / spruce. Requirements to sliced pine wall boards visible surfaces quality (properties and defects). Wall boards which do not satisfy requirements listed in table could be used only for goals secondary according to appointment (RT 21-10750-ru)

Property or defect	Board sort		
	VK	TK[3]	OK
Cracks	Allowed separate	Allowed separate	Allowed separate

	not-through capillary (hair) cracks. On ends short through cracks are allowed too.	not-through capillary (hair) cracks. On ends short through cracks not exceeded by length pattern width are allowed too.	not-through capillary (hair) cracks. On ends short through cracks are allowed too.
Insects damages	Not allowed	Not allowed	Not allowed
Marks from cutting and planning and sprouts	Not allowed	Not allowed	Separate small marks from cutting and planning and sprouts are allowed in individual consignments.
Rot	Not allowed	Not allowed	Not allowed
Compression wood	Is allowed if does not effect on board fastening to the frame	Is allowed if does not effect on board fastening to the frame	Is allowed if does not effect on board fastening to the frame
Knot rive	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.	Separate pieces with size not more then 8 mm are allowed. Are not allowed on work face ribs.
Holes from fallen away loose knots	Not allowed	Not allowed	Not allowed
Knots [1]	2 not intergrown (dead) knots with size not more than	Health knot which size is not more then 1/3 of board	Knot with size not more then ½ of board width are

	15 mm and 6 knots with size not more than 10 mm are allowed	width are allowed and separate not intergrown (dry) knots with size not more than 20 mm	allowed. Knots must be not intergrown.
Botches and inserts	Not allowed	Not allowed	Not allowed
Pitch pockets	Small pockets in not numerous amount are allowed. Through pockets are not allowed.	Small pockets in not numerous amount are allowed. Through pockets are not allowed.	Small pockets in not numerous amount are allowed. Through pockets are not allowed.
Blue timber	Not allowed	Not allowed	Not allowed
Finger joints	Not allowed [2]	Not allowed [2]	Not allowed
Core sheath	Sheath which length does not exceed 1/3 of product length is allowed	Sheath which length does not exceed 1/3 of product length is allowed	Sheath which length does not exceed half of product length is allowed
Abnormal coloring	Not allowed	Not allowed	Not allowed

1) Table contents knots dimensions and amounts on most knotty 1-meter long area. Non intergrown knots could be health or dry.
2) In case when finger joints do not cause customer's objection it is need to be specified when placing an order.
3) As a rule delivered with thickness 14 mm.

Following pictures illustrate wall boards of 3 sorts of spruce wood in practice:

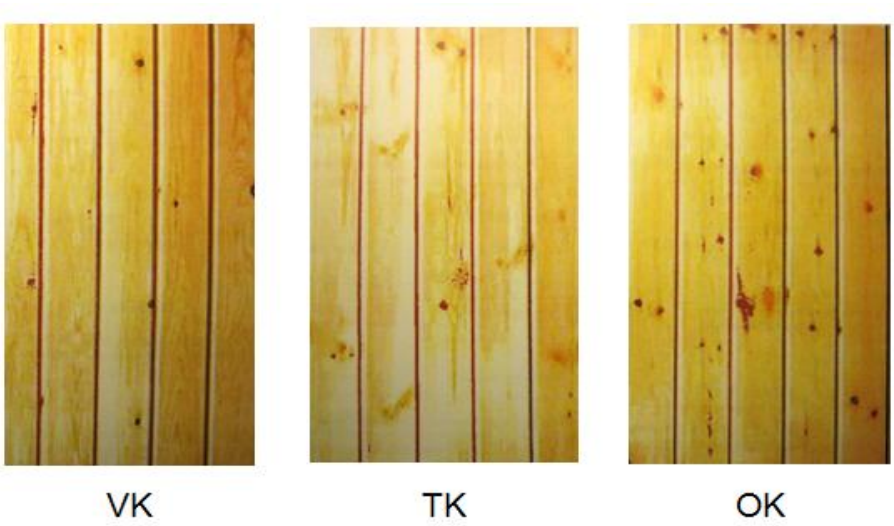


Figure 2. Examples of spruce wood sorts

So Russian and Finnish systems of timber quality grades are similar by algorithm but defer by limit values, that makes a lot of problems when sawn timber came from Finland to Russia and Russian specialists juristically could not simply convert European sorts in Russian sorts and have do all similar procedure of quality estimation from the beginning.

4 PRACTICAL METHODS OF MAIN DEFECTS MEASURING

For practical apply of theoretical systems clear algorithm of estimation of each defect is need. In this part it will be given some instructions from normative literature how to measure main wood defects and estimate damage from it. Knot is one of most common defect in spruce and pine timber, so measuring algorithm will be considered on knot measuring example.

GOST 2140-81 gives following instructions for knots measuring. In sawn timber defects are measuring in linear measure or in parts of appropriate pattern dimensions.

Round, oval, oblong (spike), branched (paw-shaped) knots not coming to rib are measuring by distance between tangent to knot contour, lined parallel to pattern

longitudinal axis (Figure 3, dimensions a_1, a_2); or by knot crosscut minimal diameter (Figure 3, dimensions d_1, d_2).

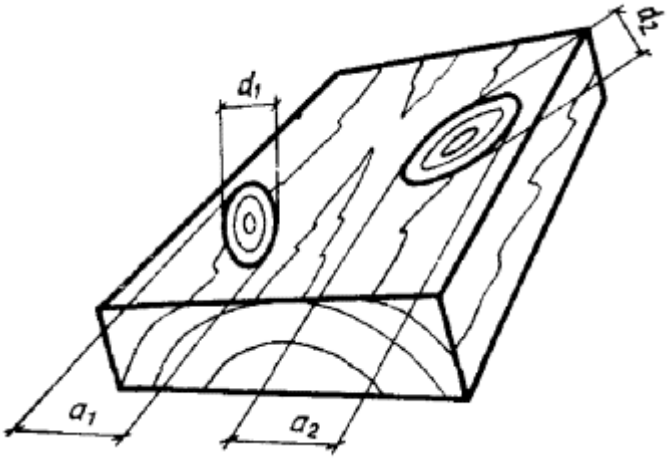
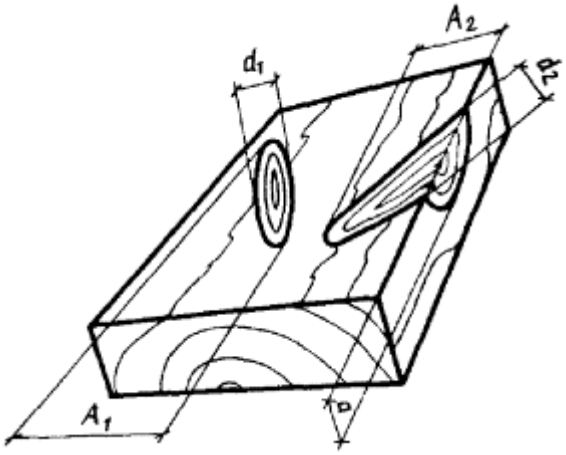


Figure 3. Round and oval knots measuring

Stitched knots like came to rib oblong (spike) and branched knots are measuring by distance between rib and tangent to knot contour, lined parallel to rib with measuring on pattern side where knot crosscut comes (Figure 4, dimension a); or by knot longitudinal cut section minimal diameter (Figure 4, dimensions d_1 and d_2).

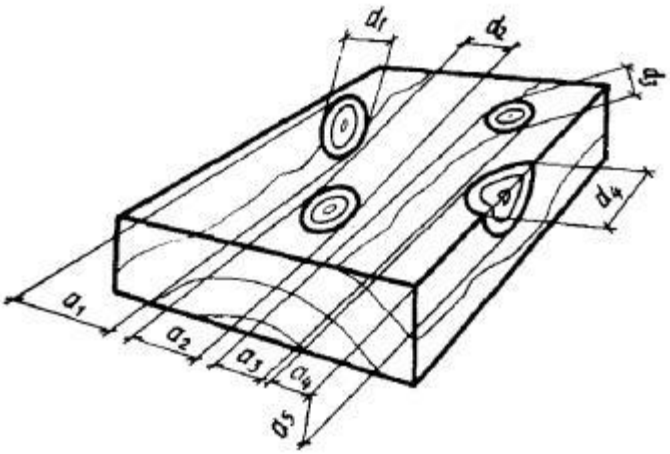


$z_a = a$; $z_b = d_1 + d_2$; $z_A = A_1 + A_2$

Figure 4. Oblong (spike) and branched knots measuring

If it is conditioned by pattern specific character it is allowed to measure oblong (spike) and branched knots came to rib by distance between rib and tangent to knot contour, lined parallel to rib with measuring on pattern side where knot longitudinal cut section comes (Figure 4, dimension A_2). If it is conditioned by pattern specific character it is allowed to measure branched knots by constituent knots dimensions sum with measuring each of them by method, corresponded to its type by shape (Figure 8, dimensions z_a, z_b, z_A).

Round and oval knots not coming to rib are measuring by distance between rib and tangent to knot contour, lined parallel to rib (Figure 5, dimensions a_4 and a_5); or by knot length on rib (Figure 5, dimension d_4).



$z_a = a_1 + a_2 + a_3 + a_4$; $z_b = d_1 + d_2 + d_3 + d_4$

Figure 5. Rib and group knots measuring

Group knots are measuring by dimensions sum of all knots came to one size of pattern with measuring of each knot using method corresponded to its type by shape (Figure 9, dimensions z_a и z_b). Knots surrounding by bark are measuring with bark by method corresponded to its type of each knot.

5 ON SITE MEASURINGS

This chapter contents report about practical measurings on building site and following quality estimations by Russian and Finnish methods. There were 3 patterns of sawn timber production for detect are there difference between results of research or they are insignificant or they are not.

5.1 Quality estimation of inner wall pine boards in both ways

First pattern was pine inner wall board with thickness 12,5 mm, total width 96 mm and length 2,1 m like one of most common type of sawn and planed timber. Pattern was randomly selected in batch (Really it was difficult to take for example pattern with a lot of different defects because there were not bad quality boards in storage).

First it was found worse 1 meter length piece of pattern by sight. In this procedure etch side of pattern was taken into account. Second side of board was marked: faces by capital letters A and B, edges by small letters a and b and ends by Arabic numerals 1 and 2. Third all defects – only knots took place in this case – was measured according to instructions from chapter 4 of this work «Practical methods of main defects measuring». Pictures 6 and 7 show steps of measuring.

Figures 6 and 7. Steps of measuring

Fourth following table 5.1 was made on site. It shows defects according to board sides, where they come.

Table 5.1 Table of defects. Pine inner wall board

Side	Defect	Dimensions	
		mm	parts of side width
Face A (showed on figures 6 and 7)	Fused health dark round knot on rib	6	0.06
	Fused health dark round knot	4	0.04
	Fused health bright round knot	19	0.20
	Fused health dark round knot on rib (is measuring on figure 7)	10	0.10
	Fused health bright Round knot	17	0.18
Face B	Fused health dark round	5	0.05

	knot on rib		
	Fused health dark round knot	4	0.04
	Fused health bright round knot on rib	20	0.21
	Fused health dark round knot on rib	11	0.11
	Fused health bright knot on rib	16	0.17
Edge a	-		
Edge b	-		
End 1	-		
End 2	-		

After measuring on site quality estimation takes place. First compare results with table 3.1 of this work «Standards of defects limitation in sawn timber for sorts» (GOST 2140-81). By subsection «Face and edge» of section 1.1 «Fused healthy, and in uneven bars and partially fused and unfused healthy» of section «Knots» taking Notes in account pattern could be classified like sample of 1st sort (2nd by order of 5): on face A there are 3 knots with dimensions less than ¼·96=0.25·96=24mm and 2 knots with dimensions less than ¼·0.5·96=0.25·0.5·96=12mm, on face B – 2 knots with dimensions less than ¼·96=0.25·96=24mm and 3 knots with dimensions less than ¼·0.5·96=0.25·0.5·96=12mm.

Second compare results with table 3.3 of this work «Sliced wall boards and batten ends / pine» (RT 21-10750-ru). By line «Knots» pattern could be classified like sample of sort TM: 5 knots with dimensions less than 1/3·96=32mm on any face. TM for pine means sort with health knots, 3rd of 4.

5.2 Quality estimation of spruce batten ends in both ways

Second pattern was spruce batten end with cross section dimensions 40×125 mm and length 6 m. Algorithm of measurings was the same like in paragraph 5.1 of this work. Picture 8 shows worse 1 meter length piece of selected for measuring batten end pattern in batch. On storage timber moisture content is kept up on level 16-20%.

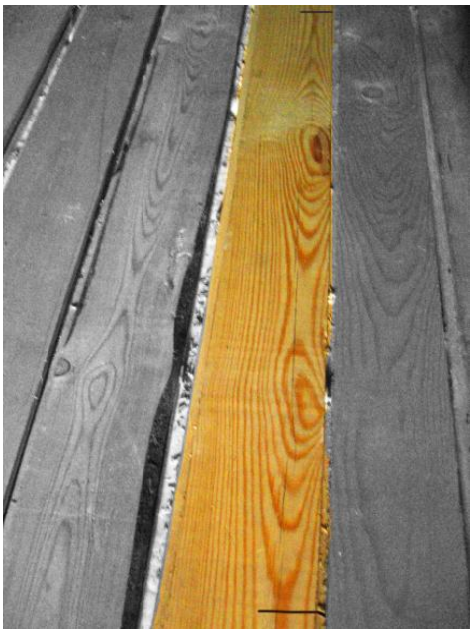


Figure 8. Worse 1 meter length piece

of selected spruce batten end pattern in batch

Following table 5.2 was made on site. It shows defects according to board sides, where they come.

Table 5.2 Table of defects. Spruce batten end

Side	Defect	Dimensions			
Face A (showed on figure 8)	Fused health dark oval knot	Length	Width	Length	Width
		mm		parts of side width	
		43	17	0.34	0.14
	Longitudinal separate not-	Maximum depth		Maximum length	Maximum opening

	through cracks, supposedly frost				displacement
		mm	mm	parts of side length	mm
		1.0	493	0.08	3.1
	Wanes	-			
Face B	Health dark oval knot	Length	Width	Length	Width
		mm		parts of side width	
		27	13	0.22	0.10
	Wanes	-			
Edge a	-				
Edge b	-				
End 1	-				
End 2	-				

After measuring on site quality estimation takes place. First compare results with table 3.1 of this work «Standards of defects limitation in sawn timber for sorts» (GOST 2140-81). By subsection «Face and edge» of section 1.1 «Fused healthy, and in uneven bars and partially fused and unfused healthy» of section «Knots» taking Notes in account pattern could be classified like sample of 2st sort (3nd by order of 5): on any face - one knot with dimensions less than 1/2·125=0. 5·125=62.5mm and «In sawn timber with length more than 3 m one knot with dimension specified in norms of adjacent lower grade is allowed» from Notes. Crack with depth 3.1 mm < 5 mm in sawn timber in accordance with Table 1.1 of this work «Comparison of definitions of defects from GOST 2140-81 and RT 21-10188» is not deep crack; by subsection «Not deep cracks» of section 2.1 «Face and edge including came on end» of section «Cracks» taking Notes in account pattern could be classified like sample of Perfect sort (1nd by order of 5). Consequently this pattern by Russian way can be classified like sample of 2st sort (3nd by order of 5) - lower grade from 2: by knots and by cracks.

Compare results with table 3.4 of this work «Sliced wall boards and batten ends / spruce» (RT 21-10750-ru). By line «Knots» pattern could be classified like

sample of sort OK: 1 knot with dimension 43mm<1/2·125=62.5mm. By line «Cracks» pattern could be classified like sample of sort VK: there are separate not-through cracks on face and short through cracks on ends. Consequently this pattern by Finnish way can be classified like sample of sort OK (3nd by order of 3) - lower grade from 2: by knots and by cracks. OK for spruce means knotty sort.

5.3 Quality estimation of spruce bars in both ways

Third pattern was spruce bar with cross section dimensions 100×110 mm and length 2.1 m (cut). Algorithm of measurings was the same like in paragraph 5.1 of this work, but sides of board was marked: faces by capital letters A, B, C and D and ends by Arabic numerals 1 and 2. Picture 9 shows selected for measuring bar pattern. Unfortunately it was not allowed to mark worse 1 meter length piece because pattern was ready to mounting immediately after measuring. On storage timber moisture content is kept up on level 16-20%.

Figure 9. Selected spruce bar pattern

Table 5.3 was made on site. It shows the defects according to board sides, where they come.

Table 5.3 Table of defects. Spruce bar

Side	Defect	Dimensions	
		mm	parts of side width
Face A (wider on figures 9) Width: 110 mm	Fused health bright round knot	19	0.17
	Fused health bright round knot	17	0.15
	Fused health bright round knot	5	0.05
Face B Width: 100 mm	Fused health bright round knot on rib	10	0.10
Face C Width: 110 mm	Fused health bright round knot	16	0.15
	Fused health bright round knot	4	0.04
	Fused health bright round knot	13	0.12
Face D (narrower on figures 9) Width: 100 mm	Wanes	-	
End 1	-		
End 2	-		

After measuring on site quality estimation takes place. First compare results with table 3.1 of this work «Standards of defects limitation in sawn timber for sorts» (GOST 2140-81). By subsection «Face and edge» of section 1.1 «Fused healthy, and in uneven bars and partially fused and unfused healthy» of section «Knots» taking Notes in account: on face A - 2 knots with dimensions less than 1/5·110=0.2·110=22mm and 1 knot with dimensions less than 1/5·0.5·110=0.2·0.5·110=11mm, it corresponds Perfect sort. On face B - 1 knot with dimension less than 1/5·100=0.2·100=20mm and not more than

1/5·0.5·100=0.2·0.5·100=10mm, it corresponds Perfect sort. On face C - 1 knot with dimension less than 1/5·110=0.2·110=22mm and 1 less than 1/5·0.5·110=0.2·0.5·110=11mm, it corresponds Perfect sort. On face D there are not significant defects except wanes. Consequently this pattern by Russian way can be classified like sample of Perfect sort (1^{nd} by order of 5).

Compare results with table 3.4 of this work «Sliced wall boards and batten ends / pine» (RT 21-10750-ru). By line «Knots» pattern could be classified like sample of sort TM: on face A - 3 knots with dimensions less than 1/3·110≈37mm and less than 20 mm, it correspond sort TK. On face B - 1 knot with dimension less than 15mm, it correspond sort VK. On face C - 3 knots with dimensions less than 1/3·110≈37mm and less than 20 mm, it corresponds sort TK. On face D there are not significant defects except wanes. Consequently this pattern by Finnish way can be classified like sample of sort TK (1^{nd} by order of 5) - lower grade from grades by sides. TK for pine means sort with health knots, 2^{nd} of 3.

6 SUMMARY

Study showed that Russian and Finnish systems of sawn and planed timber patterns quality estimation are similar for the fist by close lists of defects and their definitions because of resemblance of geographic and climatic conditions of trees growing in Finland and in North-Western region in Russia; for the second by principles of patterns classification by sorts which is based on comprehensive analysis of worse 1 meter length piece of pattern; and for the third by algorithm of practical methods of main defects measuring. But there is difference in limit values given in main normative documents.

On example of practical measuring and quality estimation of sawn and planed timber pattern it is seen that 4 special Finnish sorts for pine sliced timber products: special sort EM, VM with not numerous amount of knots, TM with health knots and knotty OM could not be simply equal to 5 Russian sorts: perfect, 1^{st}, 2^{nd}, 3^{rd} and 4^{th}. Quality revaluation of timber patterns came from Finland to Russia is need because of lot of differs between limit values of number and dimensions of defects given in tables of GOST 2140-81 and RT 21-10750. So specialists juristically could not simply convert European sorts in Russian sorts and have produce all similar procedure of quality estimation from the beginning. In future documentation for practical guiding of process of quality estimation of sawn and planed timber, comes from Finland to Russia, will be developed for Honka inside using.

Simplification of procedure of any production quality revaluation in conditions of international trading needs juridical document developed and adopted at the top level of both countries. It must take into account technological possibilities and national industries features and of course economically satisfy parts of agreement. History of international trading shows that in case of increasing of reciprocal deliveries value in certain market segment, creation of united juridical space in this sector could bring significant economic benefits to partners.

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