SAW-DRY-RIP QUALITY OF NORWAY SPRUCE
SAWN TIMBER FROM FINNISH AND NORTH-WESTERN RUSSIAN LOGS FOR VALUE-ADDED END-PRODUCTS

Erkki Verkasalo
Veikko Möttönen
Tapio Wall
Kari Kannisto
Pertti Kairila
Considerable increase in the volumes of imported saw and plywood logs during 1990’s up to 2005 – then decline but some increase during 2010’s with birch logs for plywood. IMPORTED LOGS COME MAINLY FROM NORTH-WESTERN RUSSIA. Source: Finnish Statistical Yearbook of Forestry 2014.
Considerable decrease in relative price competition ability of sawn timber from Finland vs. sawn timber from north-western Russia until 2010 – thereafter some spring-back. Source: Mutanen and Viitanen 2015.
Background – market share

Aims of the full project

• **Assess the key technical properties** of Norway spruce sawn timber processed from logs from Finland (three regions) or north-western Russia (two regions), from the viewpoint of
  - Structural products: physico-mechanical properties (bending), deformation and checking in drying and in-situ use
  - Joinery products: visual, physical and woodworking properties and potential for joinery drying and ripping

• **Optimise raw material source – end product match and improve potential for value-added further processing**
  - Planed goods for interior uses
  - Doors, furniture, staircases, flooring materials and other interior products
  - Exterior cladding
  - Stress-graded sawn timber for structural uses
  - Glulam, trusses, joists and other building components
Objectives of the paper

• Assess the variation in the technical quality of centre-yield sawn timber of Norway spruce of three dimensions after sawing, kiln drying (two steps) and ripping when aiming to selected value-added further-processed products – attention in geographic origin of logs in boreal regions of Finland and north-western Russia and the related factors of wood growth and maturation.

• Quality criteria: deformation (twist, bow, crook, cup) and pith checking, considering the targeted moisture content.

• Relative significance of drying to the moisture content of the end-products and the subsequent ripping to be discussed.

• Recommendations on the technical suitability of logs and sawn timber to the selected value-added wood products, the geographic regions and processing steps in the focus.
Log materials

* 1162 logs (220–281 per region, 44-55 per region and d-class (5 of them)
* Logs processed to sawn timber at an educational sawmill using Nordic cant sawing and applying set-up of 2EXLOG, and kiln-dried to a target MC of 20–24% (Hautamäki et al 2010).

Fig. 1. Approximate sampling areas in Finland and in Russia (W-F = western Finland, N-F = northern Finland, S-E F = eastern Finland) (Hautamäki et al. 2010)
Tested sawn timber

- **Sub-sample of center-yield sawn timber**, covering all regions of the before-mentioned sampling.

- **Three dimensions** of sawn timber that match selected end-products of spruce: *38*100 for interior panels (ripped); *50*150 for cladding (ripped), *63*200 for flooring boards or parquetry (ripped) or log-house beams or lamella logs (non-ripped). These represented the respective log diameter classes: 155–169 mm, 205–274 mm, 275–304 mm.

- **In total, 420 pieces of sawn timber**, 20 pieces per region and dimension, except 40 of them in the thickest dimension and in the region of the Republic of Karelia in the middle dimension.

- In this way, **both fast-grown and slowly-grown** wood were covered in the data
Material characteristics – regions

Growth ring width (at log ends)

Heartwood proportion

Air dry density

KAR knottiness value
Mill studies and measurements

- **Experiments at an industrial joinery mill**: Kiln-drying in a steam-heated drying chamber and ripping edgewise to 2-3 pieces.
- **Studying the occurrence and severity of twist, cup, bow, crook, and pith checking** in two-meter length of sawn pieces before and after drying, and after ripping. These features were measured according to the *standard EN 1310 (1997)* and the *grading rules of European Drying Group (1994)*.
- **Two sets of drying**: One for the thick dimension (63*200) and another for the two other dimensions (38*100, 50*150), the durations of processes were 169 and 96 hours, respectively.
- **Initial MC** of sawn pieces was 21–22% for all dimensions.
- **Final MC** was 10% for the dimensions of 38*100 and 63*200, and 12% for the dimension of 50*150.
- **One-way variance analysis** in the statistical data analysis.
Kiln drying schedules

Kiln-drying schedules used for different dimensions of sawn timber. $T_d = \text{dry bulb temperature, } T_w = \text{wet bulb temperature.}$

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<th>38 * 100 mm and 50 * 150 mm</th>
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Results – deformations by region

Twist, bow, crook, and cup of green (MC 21-22%), kiln-dried, and ripped sawn timber in the different regions. Twist, bow and crook are expressed per two-meter length of sawn piece.
Twist, bow, crook, and cup of kiln-dried and ripped sawn timber by the dimensions. Twist, bow and crook are expressed per two-meter length of sawn piece.
Results – pith checking by dimension and region

Pith checking of kiln-dried and ripped sawn timber by dimension in the different regions.
Conclusions

Tendencies to twist and pith checking are regarded as the most critical factors in assessing the eligibility of sawn timber for further processing. The results implied the following recommendations for end-uses of the materials in the study:

- **38*100 dimension**: ripped timber for interior panelling from logs and sawn timber from western Finland, northern Finland and Vologda region - low tendency to pith checking, bow and crook.

- **50*150 dimension**: ripped timber for cladding from logs and sawn timber from western Finland, based - low tendency to pith checking in contrast to logs and sawn timber from the Republic of Karelia with high tendency to crook.
Conclusions

• **63*200 mm dimension:**
  a) ripped timber for flooring boards or parquetry from logs and sawn timber from eastern Finland, northern Finland and Vologda region - low tendency to pith checking
  b) non-ripped timber for log-house beams, i.e., lamella logs from sawn timber of northern Finland are recommended - low tendency to twist.

• Overall management of the saw-dry-rip process is important for further processing of sawn timber, because different types of deformation and checking occur during different steps of the process, and the significance of different defects depends largely on the quality requirements of individual end-products.
Conclusions

• Management of timber drying, both to the moisture content of sawmill products (MC export grades), thereafter to the actual moisture content required in the end-product (MC joinery/carpenter grades) or combined, is in the key role to ensure a good basis for further processing, ripping of sawn timber among other things.

• In this study, ripping had a positive effect on the form of timber regarding twist, bow and cup (not crook) and the apparent pith checking. This was obviously due to a) successful preceding drying process, indicated by the smaller increase in the deterioration during it, b) proper storage of the materials between the operations in well-controlled environment for air humidity, and c) careful management of the ripping operation.
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THANK YOU FOR ATTENTION!