

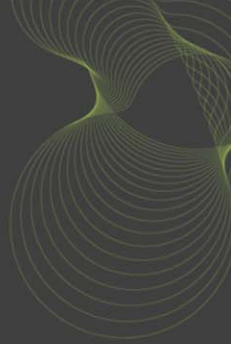
Improving the utilisation of UK grown Scots Pine falling boards

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2nd October 2009

Content

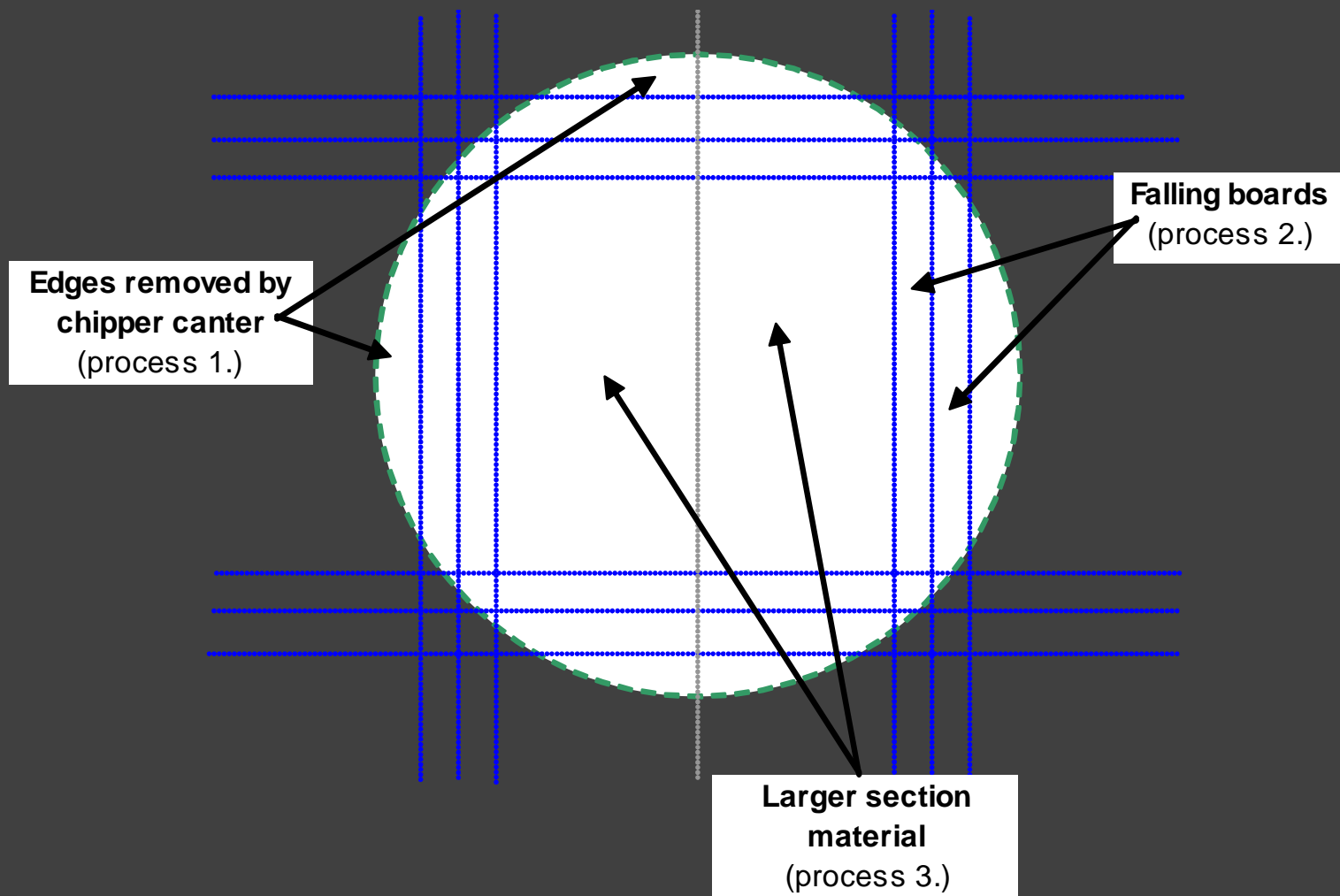
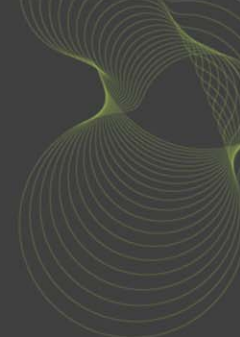


- Maximising the potential of UK grown Scots pine falling boards
- Higher machine grade setting for UK grown Scots pine

Four main work tasks

- Define the resource
- Identify two potential demonstration products
- Manufacture and evaluate products
- Review results

Maximising the potential of Scots Pine falling boards



Material requirements

- Over 200 logs (from 9 locations)
- 200 - 250 mm max top-diameter under bark
- Log length approx 3600 mm
- Board dimensions (19/22 mm x 75/100/125/150 mm)

Material

- The material was sourced from sites around Scotland, and one from England.
 - Balmoral – Aberdeenshire
 - Alvie and Dalraddy – Aberdeenshire
 - Moray Estate – Moray
 - Seafield Estate – Strathspey
 - Strathcarron – FC site 40 miles north of Inverness
 - North Strome - FC site 60 miles west of Inverness
 - Black Isle – FC site north of Inverness
 - Deeside (Supplied by James Jones)
 - Thetford – FC site East of England

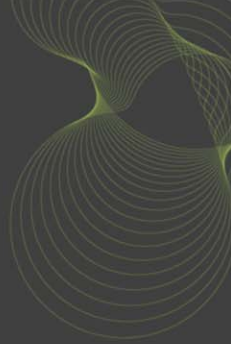
Defining the resource

- Board material was appearance graded according to BS EN 1611-1:2000, Sawn timber - Appearance grading of softwoods – Part 1: European spruces, firs, pines, Douglas fir and larches
- The same material was also visually graded according to BS 4978: 2007 – Specification for visual strength grading of softwood

Appearance grades according to BS EN1611-1: 2000

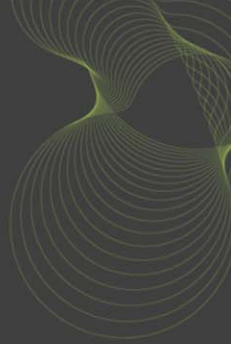


BS 4978: 2007 - Specification for visual strength grading of softwood



- Two visual strength grades
 - GS (general structural grade)
 - SS (special structural grade)
- These grades equate to a structural grade of:
 - GS – C14
 - SS – C22
 - Reject

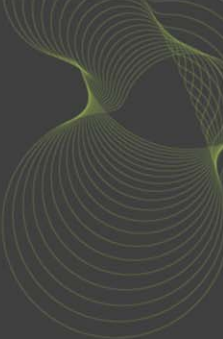
EN 1912: 2004 softwood strength classes



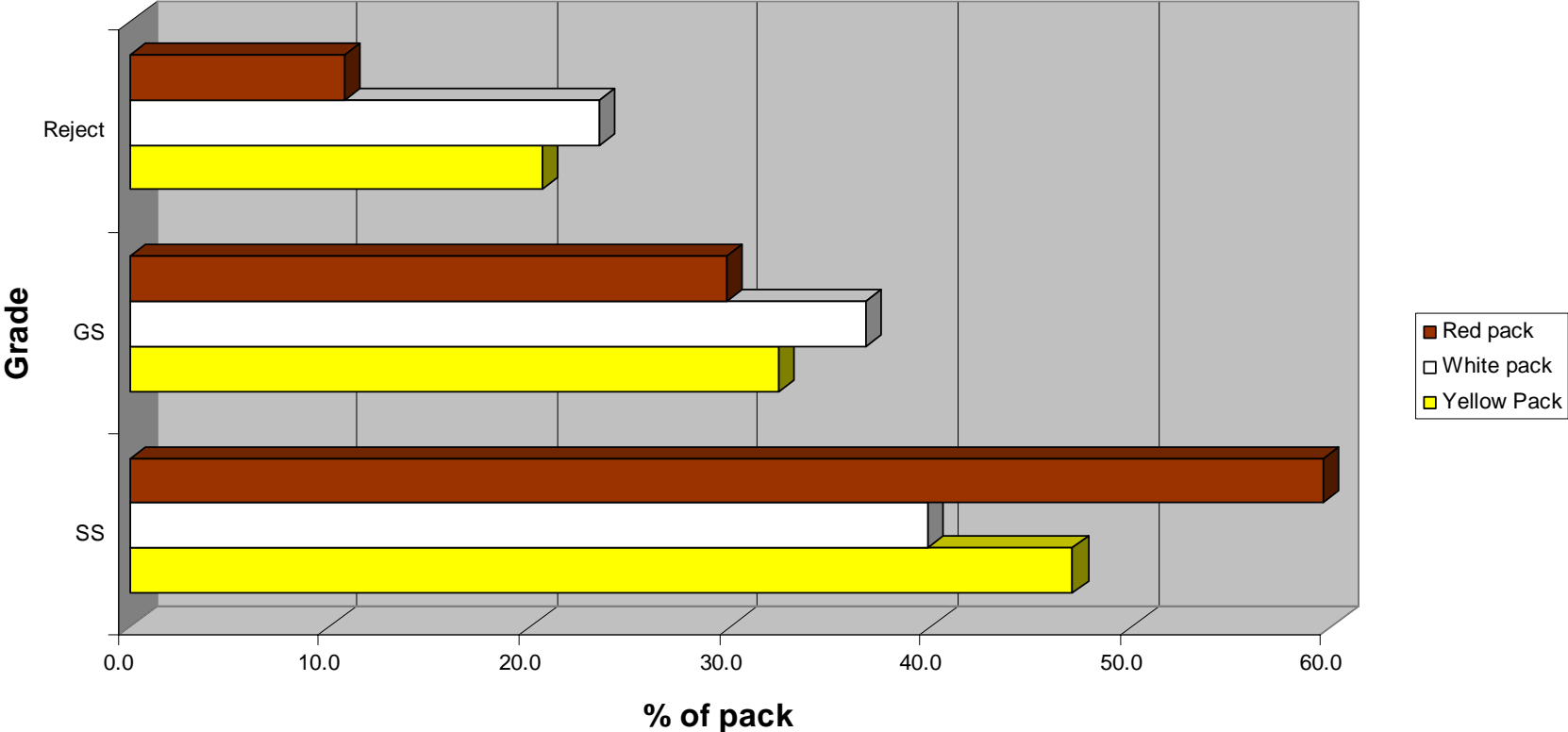
- Softwood structural grades
 - C14
 - C16
 - C18
 - C20
 - C22
 - C24
 - C27
 - C30
 - C35

 - C40
 - TR26

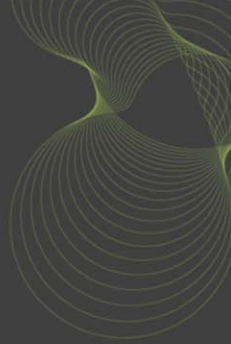
Board grades – BS 4978: 2007



Structural Grade Distribution



Single Board Characterisation



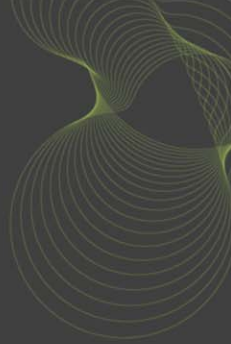
- Single boards tested to EN 408 and graded to EN 338
- Results compared to expected strengths defined from visual grading and EN 1912

| | EN 1912 Strength Grade | EN 338 Strength Grade | Strength (N/mm ²) | Stiffness (N/mm ²) | Density (Kg/m ³) |
|----|------------------------------|-----------------------------|----------------------------------|-----------------------------------|---------------------------------|
| GS | C14 | C16 | 16.3 | 9188 | 525 |
| SS | C22 | C20 | 19.75 | 10764 | 548 |

Test products

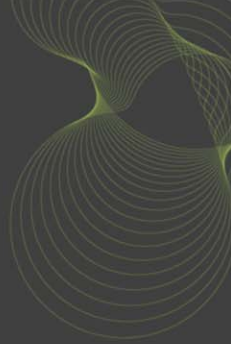
- A twin laminate re-engineered structural member
- A traditional glulam style beam (100 mm x 200 mm x 4000 mm)

Twin laminate section

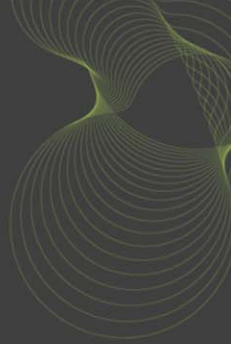


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Multi-laminate beam

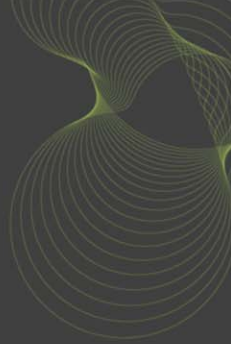


Evaluation of demonstration products



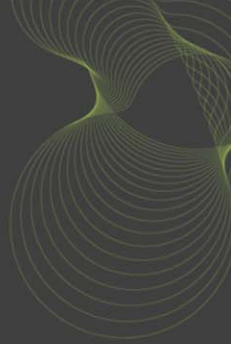
- Both products produced underwent testing according to EN 408 to establish
 - Bending strength
 - Stiffness
 - Density
- Products were compared to strength classes in EN 338 to demonstrate compliance with the prediction of performance (Glulam product compared to design methods BS 5268, EN 1194 & Eurocode 5)

Twin laminate results



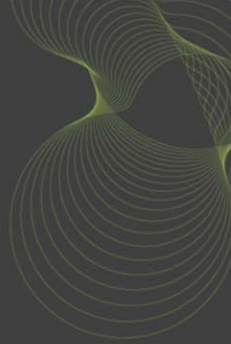
| | | Strength (N/mm²) | Stiffness (N/mm²) | Density (kg/m³) |
|----|-----|--|---|-----------------------------------|
| GS | C14 | 14 | 7000 | 350 |
| SS | C22 | 22 | 10000 | 410 |
| GS | | | | |
| SS | | | | |

Twin laminate results



| | | Strength (N/mm ²) | Stiffness (N/mm ²) | Density (kg/m ³) |
|----|-----|----------------------------------|-----------------------------------|------------------------------|
| GS | C14 | 14 | 7000 | 350 |
| SS | C22 | 22 | 10000 | 410 |
| GS | | 33.4 | 11767 | 545.6 |
| SS | | 42.0 | 12724 | 543.5 |

Twin laminate results

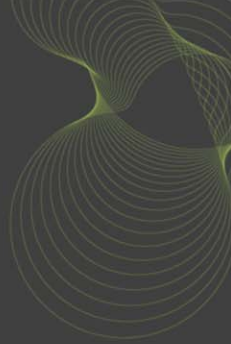


| | | Strength (N/mm ²) | Stiffness (N/mm ²) | Density (kg/m ³) |
|----|--------------|----------------------------------|-----------------------------------|------------------------------|
| GS | C14 | 14 | 7000 | 350 |
| SS | C22 | 22 | 10000 | 410 |
| GS | C27/ TR26 | 33.4 | 11767 | 545.6 |
| SS | C35 | 42.0 | 12724 | 543.5 |

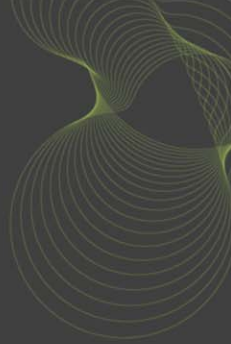
Potential markets

- The potential of UK grown material to exceed C27 has not been widely considered
- The proposed market must provide the correct financial returns proportional to grade of material produced
- Potential markets
 - I-beam & press metal web beam flanges
 - Bottom cords for attic truss rafter components
 - Ring beams
 - Solid wood panelling
- New markets

Multi-laminate beam



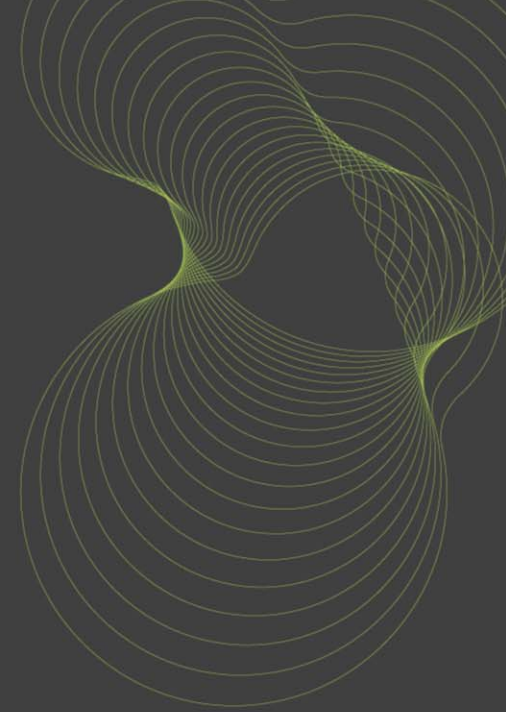
Deep section results



| | Strength (N/mm ²) | Stiffness (N/mm ²) | Density (Kg/m ³) |
|----|----------------------------------|-----------------------------------|------------------------------|
| GS | 41.2 | 11112 | 520 |
| SS | 57.6 | 13010 | 538 |

- Strength adequate for C30 and C40 grades
- Stiffness below C30 and C40 grade boundaries
- Beams usually designed specifically for end purpose

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Higher machine grade setting for UK grown Scots pine

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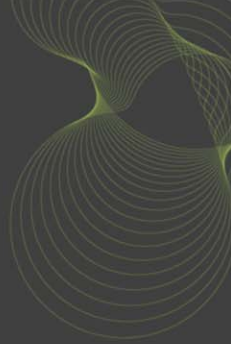
Building technology group, Building Research
Establishment

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Aims of the project

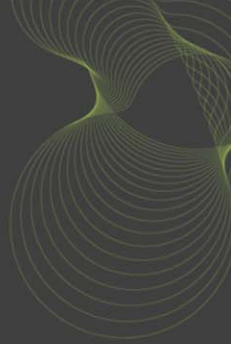
- Explore the potential for higher machine grade settings for Scots pine UK wide.
- Derive machine settings for the GoldenEye X-ray grader and higher strength classes for bending type machines.
- Start the repositioning of the UK based timber industry to be more competitive in response to European harmonisation of the structural timber codes

Where are we at



- All material has been passed through both types of grading machine (nearly)
- All material has been tested for strength, stiffness and density (nearly)
- Data has been submitted to TG1 grading committee for verification of new grades and inclusion into the standard
- Committee has requested that an addition be made to material supplied from England
- New grades from C16 to a possible grade of C35
 - C27
 - TR26
 - C30
 - C35

Brookhuis MTG timber grader



- This is a new Stress wave grading machine.
- Very small and portable – a departure from conventional machines
- Relatively cheap (approximately £6000)
- Currently approved for several European species and the intention is to make Scots pine the first UK species (work on Douglas fir is on-going).

The machines benefits

- Size – Hand held (single hand operation – self cocking internal hammer), down loading to a laptop, optional scales to increase the accuracy of the results (The weight is used to calculate density of each piece rather than use an assumed standard density).
- Cost
- Ease of application
- Portable – use on site or at sawmill

Dimensions



In the context of a conventional grading machine



Drawbacks

- Moisture content, limited to around 20%
- Limitation on dimension – cannot grade material much larger than conventional grading machines (although larger sections sizes will be assessed in a subsequent project).
- TG1 have set a 10% penalty on settings because it is hand held. This means that yields will be slightly less than conventional grading machines.