

The Better utilisation of Scots Pine

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Wood processing project dissemination

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Content

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

Pine Quality

- An assessment of the quality of Scots pine from the Grampian and Cairngorm regions of Scotland
- The project objective
 - To provide a foundation for business improvement for owners and processors of Scots pine in the Northern regions of Scotland
- This would be achieved by
 - By assessing the quality of Scots pine from a number of selected sites and identifying potential markets to maximise its value (and the volume used)

Pine sources

- Three sites in the Cairngorm region
 - Grantown-on-spey
 - Glenmore
 - Alvie & Dalraddy Estates
- Three sites in the Grampian region
 - Dunecht
 - Balmoral
 - Andrew Nicol

Typical Scots pine site



Assessments

- All of the material was graded according to BS EN 1611-1:2000, Sawn timber - Appearance grading of softwoods – Part 1: European spruces, firs, pines, Douglas fir and larches
- In addition, all of the medium dimension material was measured for distortional characteristics & moisture content

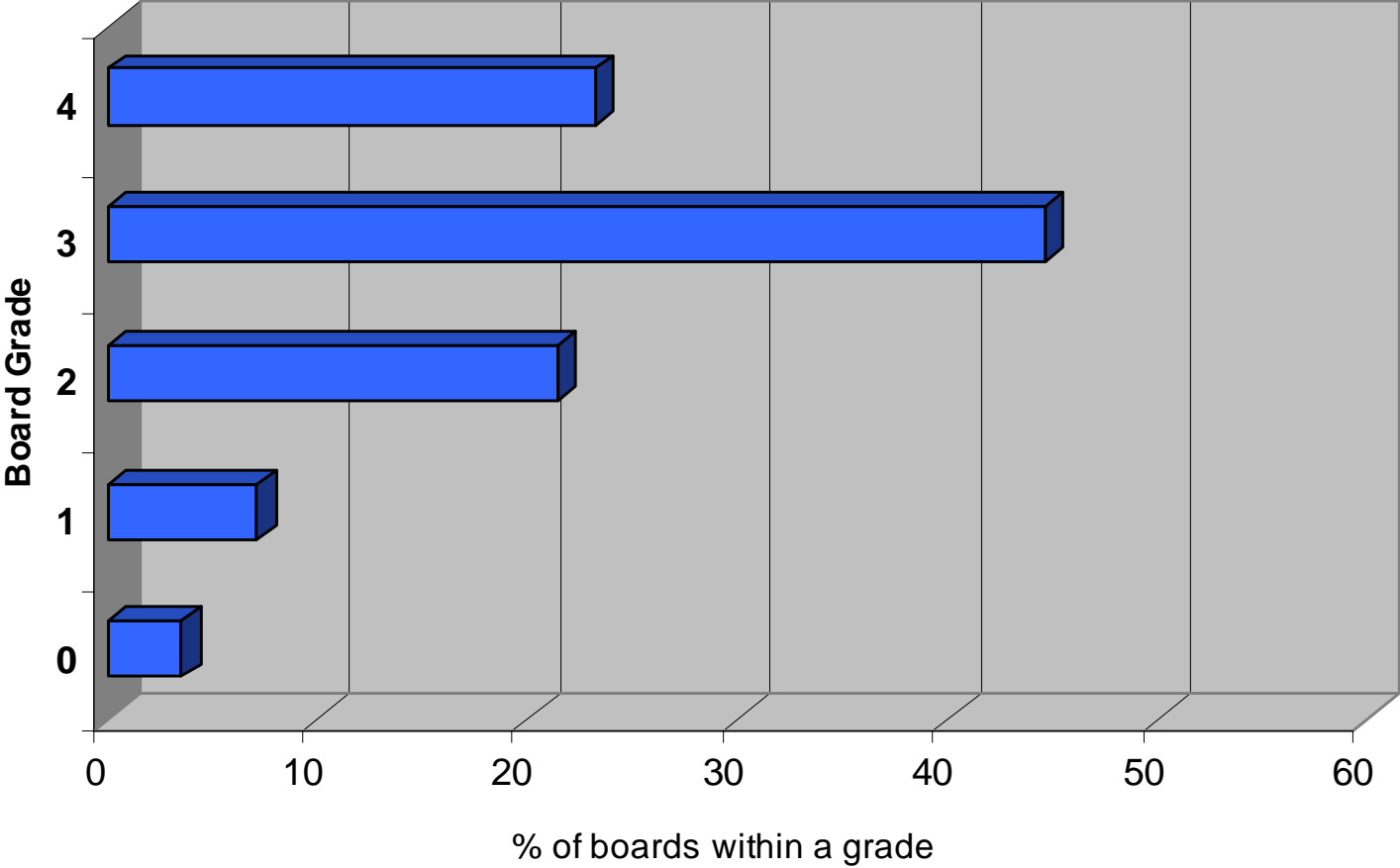
Rules for grading

- Five grades
 - G4-0
 - G4-1
 - G4-2
 - G4-3
 - G4-4
- Grade G4-0 being the highest grade
- Grade G4-4 being the lower grade



Results

Estate 1. falling boards



Higher value markets

- Board material
 - Cladding
 - Tongue and groove
 - Architrave
- Medium dimension material
 - Joinery
- Large section material
 - Heavy construction
 - Bridge material

What is it being used for !

- Board material
 - Cladding
 - Fencing
 - Pallet production
- Medium & large dimension material
 - General construction (Joists)
 - Carcassing
 - Decking

Improving the use of large section material

- Machine strength grade to a higher specification
 - Grade settings for Scots pine are only available up to C24
- When machine grading a large quantity of Scots pine from Findon (an FC spacing trial plantation, Age 67 years)
 - Grade C16 – reject All material C16
 - Grade C16 – C24 No rejects, 7.5% C16, rest C24

Alternative uses for board material

- Falling board material often goes to the lowest quality markets
 - Pallet production
 - Fencing
- When in fact, this material is the best cut from the log, being stronger, stiffer & clearer than centre material



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Maximising the potential of Scots Pine falling boards

Geoff Cooper & Barny Freke

Wood processing dissemination meeting

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Scottish Sitka spruce

- Results from laminating C18 falling board material (visually graded)

	Strength (N/mm²)	Stiffness (N/mm²)	Density (kg/m³)
Actual	23.97	10177	410.7
C24 Strength class (EN 338)	24	11000	420

Four main work tasks

- Define the resource
- Identify two test products and manufacture
- Evaluate demonstration products
- Review results on improving the measured performance

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)
- 75 mm boards not used

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

- 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
- Material graded above will also be compared to BS 4978: 2007 – Specification for visual strength grading of softwood

BS EN 1611-1:2000 grading rules

- Five grades
 - G4-0
 - G4-1
 - G4-2
 - G4-3
 - G4-4
- Grade G4-0 being the highest grade (clearer material)
- Grade G4-4 being the lower grade (larger more frequent knots)



G4 - 0

G4 - 1

G4 - 2

G4 - 3

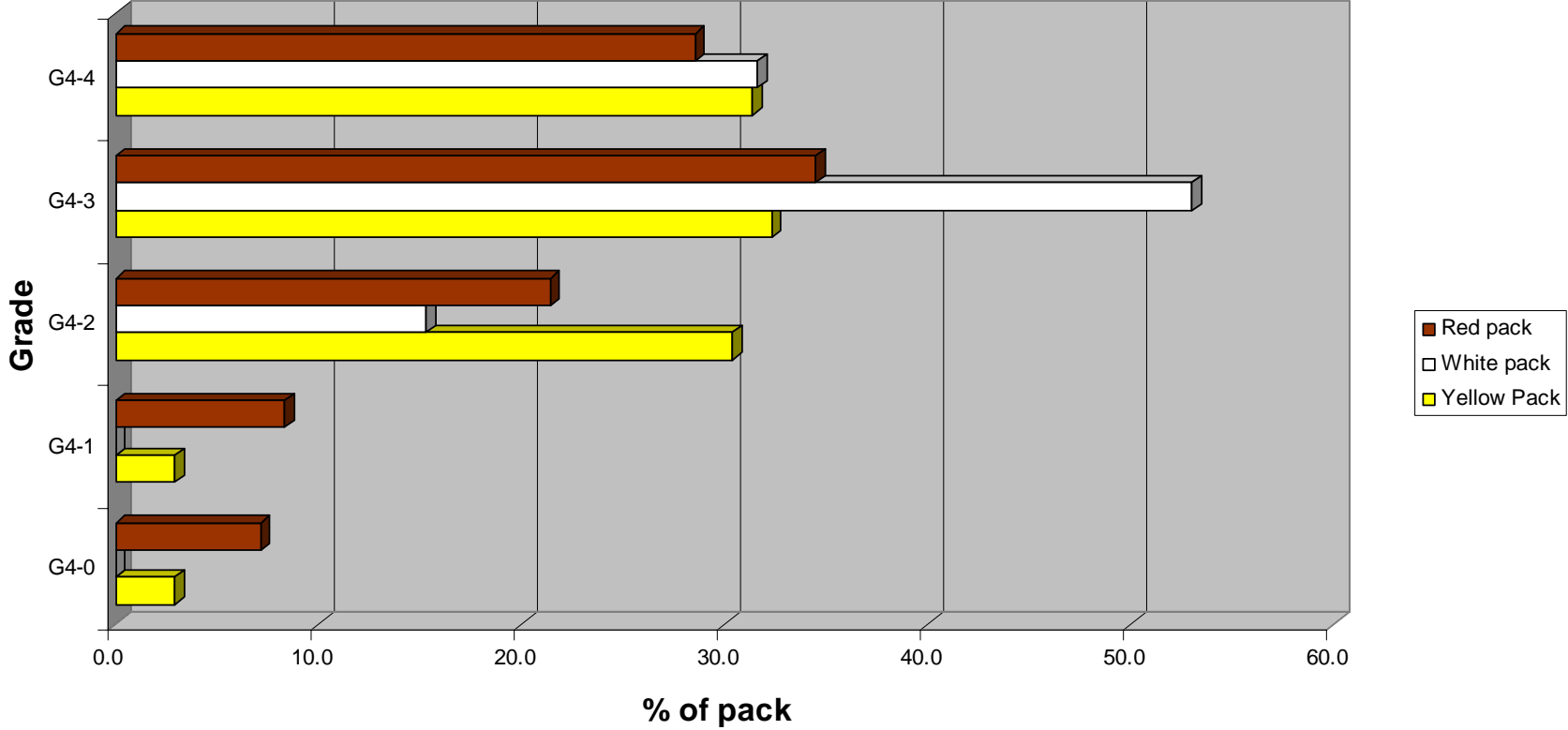
G4 - 4

BS 4978: 1996 grading rules

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

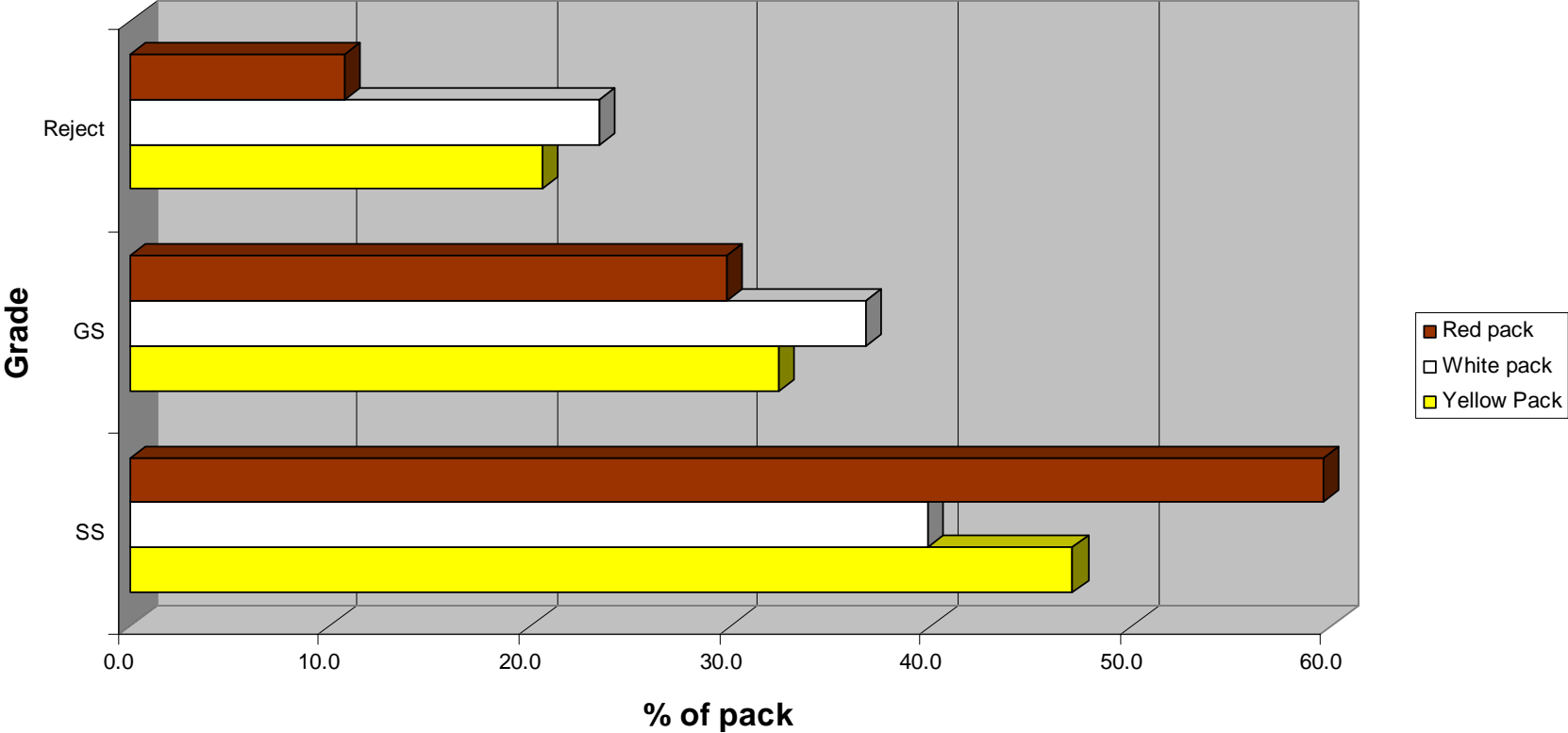
Board grades – BS EN 1611-1:2000

Appearance Grade Distribution



Board grades – BS 4978: 1996

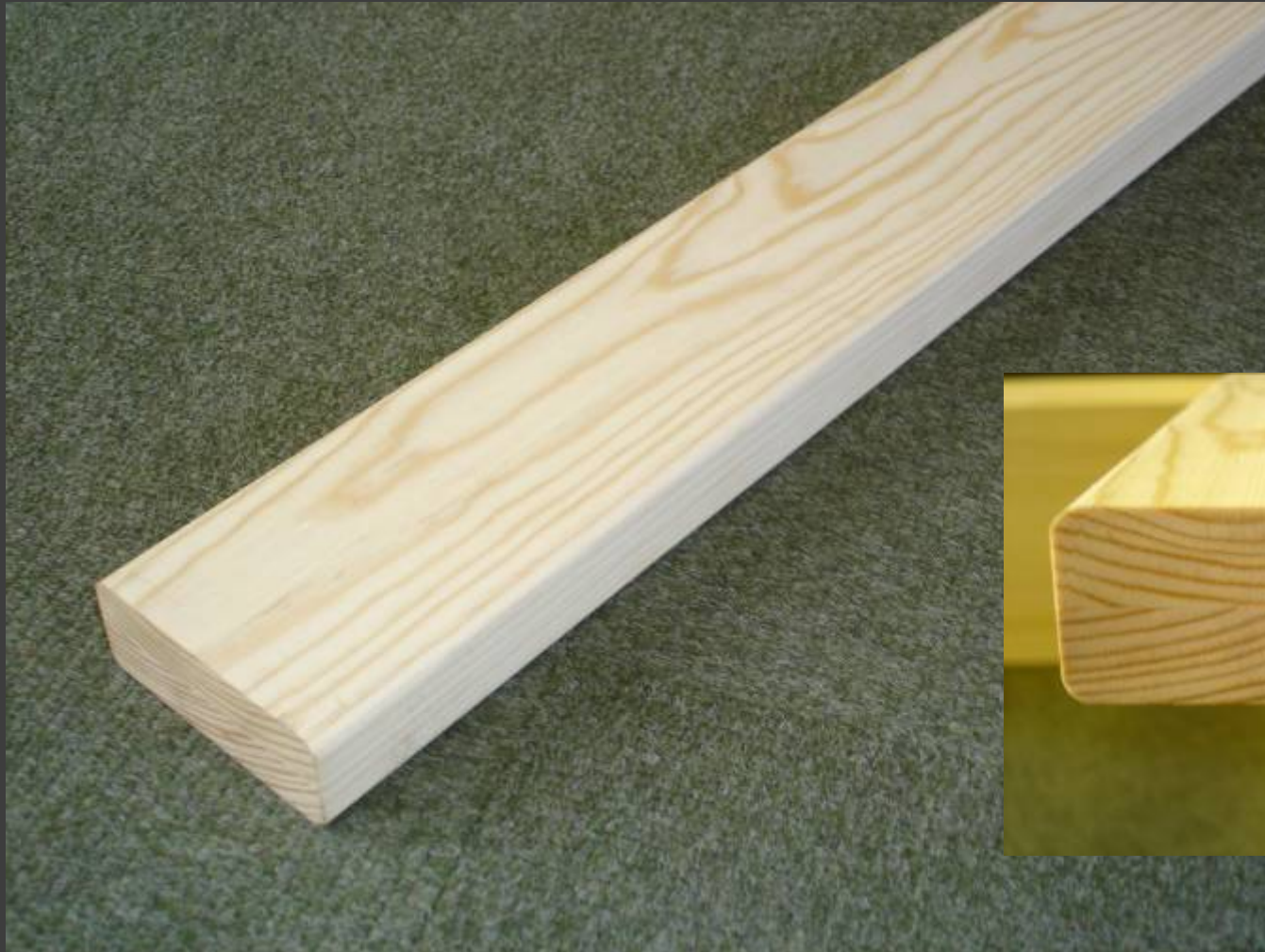
Structural Grade Distribution



Identify two test products

- Two products
 - A twin laminate re-engineered structural member (C24, TR26, C30 or better)
 - A traditional glulam style beam (100 mm x 200 mm x 4000 mm)

Laminated product examples

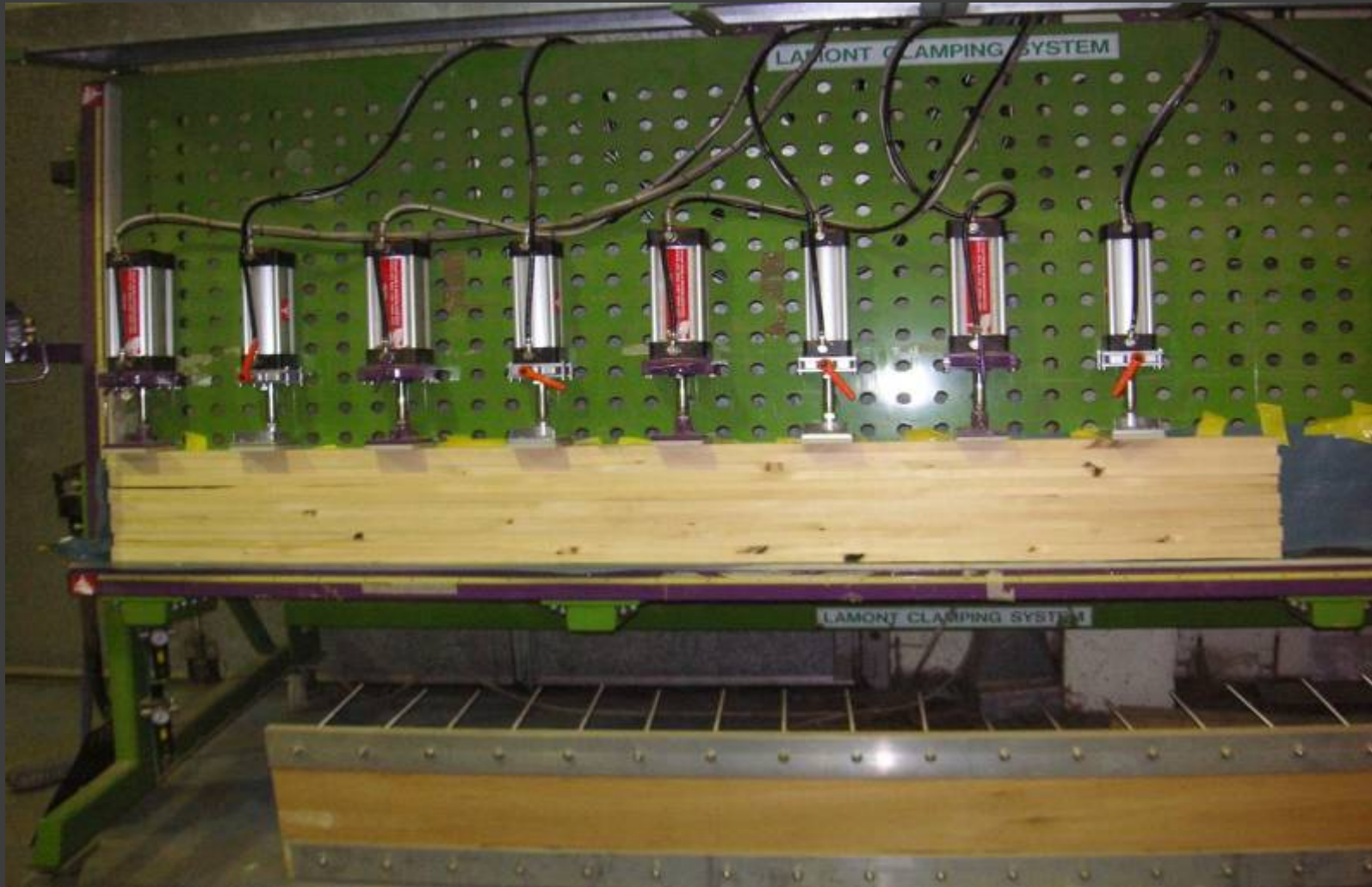


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Laminated product examples



Laminating rig



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Evaluation of demonstration products

- Both products produced will undergo testing according to EN 408 to establish
 - Bending strength
 - Stiffness
 - Density
- Products will be 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)

4-point bend test rig



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Initial findings – Twin laminate sections



		Strength (N/mm ²)	Stiffness (N/mm ²)	Density (kg/m ³)
GS	C14	14	7000	350
SS	C22	22	10000	410
GS				
SS				

Initial findings – Twin laminate sections



		Strength (N/mm²)	Stiffness (N/mm²)	Density (kg/m³)
GS	C14	14	7000	350
SS	C22	22	10000	410
GS		32.2	11767	511.5
SS		48.2	13963	562.1

Initial findings – Twin laminate sections



		Strength (N/mm²)	Stiffness (N/mm²)	Density (kg/m³)
GS	C14	14	7000	350
SS	C22	22	10000	410
GS	C30/ TR26	32.2	11767	511.5
SS	C40	48.2	13963	562.1

Multi-laminate beam



Multi-laminate beams



		Strength (N/mm ²)	Stiffness (N/mm ²)	Density (kg/m ³)
GS	C14	14	7000	350
SS	C22	22	10000	410
GS	C14	39.6	10584.3	516
SS	C22	57.3	13010.4	538

Comparisons

Product	Grade	Strength (N/mm ²)
Glulam to BS 5268	C14	19.5
	C22	30.6
Glulam to Eurocode 5	C14	17.4
	C22	27.4
Multi-laminate pine beams	GS	39.6
	SS	57.3

Remaining tasks

- Completion of twin laminate members
- Final testing of characterisation boards
- Complete testing of multi-laminate style beams
- Final report



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Higher machine grade setting for UK grown Scots pine

Chris Holland

Building Technology Group

Wood processing project dissemination

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Aims of the project

- **Explore the potential for higher machine settings for the UK as a whole.**
- **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**

Why higher machine settings for Scots pine?

- **Higher machine settings can open new markets for the resource – glulam or TR 26.**
- **Help compete against European competition.**
- **Of the four timber species that can be machine graded (Sitka spruce, Douglas fir , Larch and Scots pine) Scots pine offers the best technical / commercial possibility of success.**

Conversion and data recording at James Jones

- All material has been gathered from Scotland and England
- Northern Research Station has gathered all their data which took the main part of the first year.
- All the material has been passed through the GoldenEye X-ray grading machine to get the data
- All material has been received at BRE and testing work has commenced.
- 200 pieces have been through the BRE Cook-Bolinder grading machine and the data gathered. This material was then tested to determine strength, stiffness and density.

Results

Based on approximately 200 pieces in 3 sizes

- 47mm x 100mm
- 47mm x 125mm
- 47mm x 150 mm

Total population: Innate structural quality

Adjustments made:

- Strength at 5th percentile adjusted to 150mm depth
- Stiffness adjusted to 12% moisture content and to E-Cen
- Density to 12% moisture content

New data	Spruce	Old data
• Strength = 19.9 N/mm ²	(16.11)	(19.45)
• Stiffness = 15825 N/mm ²	(8754.12)	(12374)
• Density = 495.8 kg/m ³	(423.25)	(477)

Trial grading based on actual values

STRENGTH CLASS	YEILD (%)	PROPERTIES		
		STRENGTH N/mm ²	STIFFNESSS N/mm ²	DENSITY Kg/m ³
C24				
Actual achieved	87	23.8	10960	435
Target		21.42	10450	420
C27				
Actual achieved	64	25.75	11030	451
Target		24.1	10925	450
C30				
Actual achieved	36	29.35	113850	461
Target		26.78	11400	460
C35				
Actual achieved	10	31.9	12420	481
Target		31.35	12350	480

Current situation

- Testing to establish strength, stiffness and density has temporarily been suspended.
- Why?
- Because of the Brookhuis MTG timber grader.

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.

Why add this new device at this late stage?

- **This device will fill an important sector of the timber grading market, identified through this forum and our own experience of producers down in the Southwest.**
- **At the June 2007 meeting of the Pine Quality forum it was mentioned that the smaller producer should benefit from the work being carried out.**
- **Our experiences in the Southwest also suggests that there is need for a grading machine that can return better strength classes than visual grading and does not come at the huge price of a conventional grading machine.**
- **The MTG grader is believed to offer this potential and was worthy of investigation, all be it at the cost of some time.**

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.