

Mass Timber Systems utilizing home-grown species
Optimization of Glued-Laminated Timber in UK context

Strength grading of home-grown species

Machine grading yields of some UK-grown species

Centre for Wood Science and Technology

Species	Grading trades yield for class (single grade/reject)						
	C14	C16	C18	C20	C22	C24	C27
British spruce ¹	100%	100%	90%	73%	55%	26%	9%
			Remaining timber grade to C16				
UK-grown larch ²	100%	100%	100%	100%	90%	65%	≈35%
					Remaining timber grade to C14 or C16		

¹ Sitka spruce and Norway spruce combined from UK and Ireland

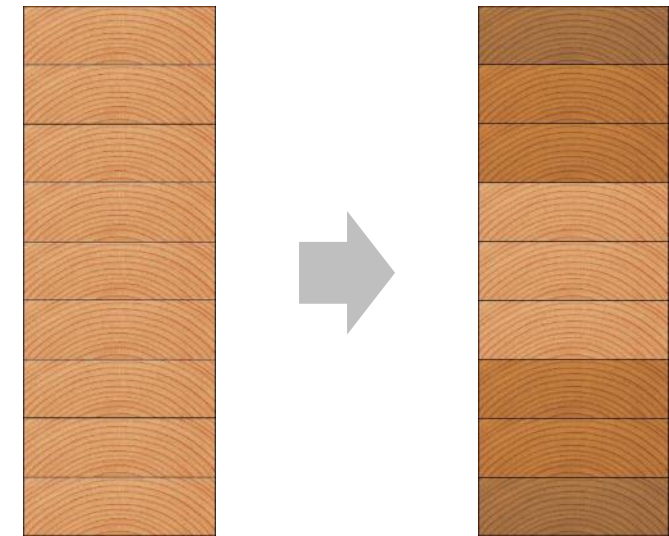
² Hybrid, Japanese and European larch

- Possibility to manufacture combined glued-laminated timber

Utilizing the local resource more efficiently

Get more value from the same volume of timber

- What are the most feasible lamellae configurations ?



Key



outer zone of laminations

possible intermediate zone of laminations

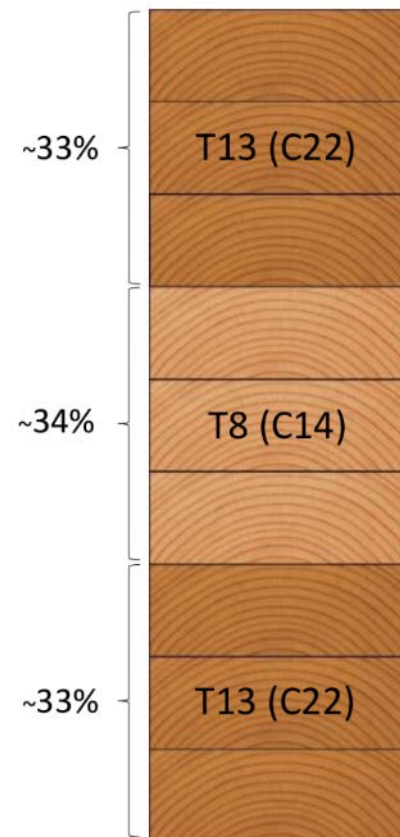
inner zone of laminations

possible intermediate zone of laminations

outer zone of laminations

Combined GLT utilizing only UK-grown species

Bending strength: 22 MPa
Modulus of Elasticity: 10 400 MPa
Mean density: 390 kg/m³



GL22c

BS EN 14080:2013

BSI Standards Publication

Timber structures — Glued laminated timber and glued solid timber — Requirements

Table 2 — Beam lay-up of combined glued laminated timber and minimum values for bending strength of finger joints in laminations in N/mm²

Glued laminated timber Strength class	Outer zones of laminations			Intermediate zones of laminations			Inner zone of laminations		
	Strength class	Proportion [%]	$f_{m,j,k}$ [N/mm ²]	Strength class	Proportion [%]	$f_{m,j,k}$ [N/mm ²]	Strength class ^a	Proportion [%]	$f_{m,j,k}$ [N/mm ²]
GL 20c	T13	2x33	21	-	-	-	T8	34	18
GL 22c	T13	2x33	26	-	-	-	T8	34	18
GL 24c	T14	2x33	31	-	-	-	T9	34	19
GL 26c	T16	2x33	34	-	-	-	T11	34	22
GL 28c	T18	2x25	37	-	-	-	T14	50	28
GL 28c	T21	2x17	36	-	-	-	T14	66	26
GL 28c	T21	2x17	38	-	-	-	T13	66	25
GL 28c	T21	2x25	35	-	-	-	T11	50	22
GL 28c	T21	2x20	35	T14	2x20	28	T11	20	22
GL 28c	T22	2x20	35	-	-	-	T13	60	25
GL 30c	T22	2x17	40	-	-	-	T15	66	27
GL 30c	T22	2x17	41	-	-	-	T14	66	28
GL 30c	T22	2x20	40	T14	2x20	30	T11	20	22
GL 30c	T22	2x17	42	T14	2x23	31	T11	20	22
GL 32c	T24	2x17	44	-	-	-	T18	66	31
GL 32c	T26	2x17	45	-	-	-	T14	66	26
GL 32c	T26	2x10	48	T18	2x20	32	T11	40	22

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Mean density: 390 kg/m³

British Spruce
Grading yield

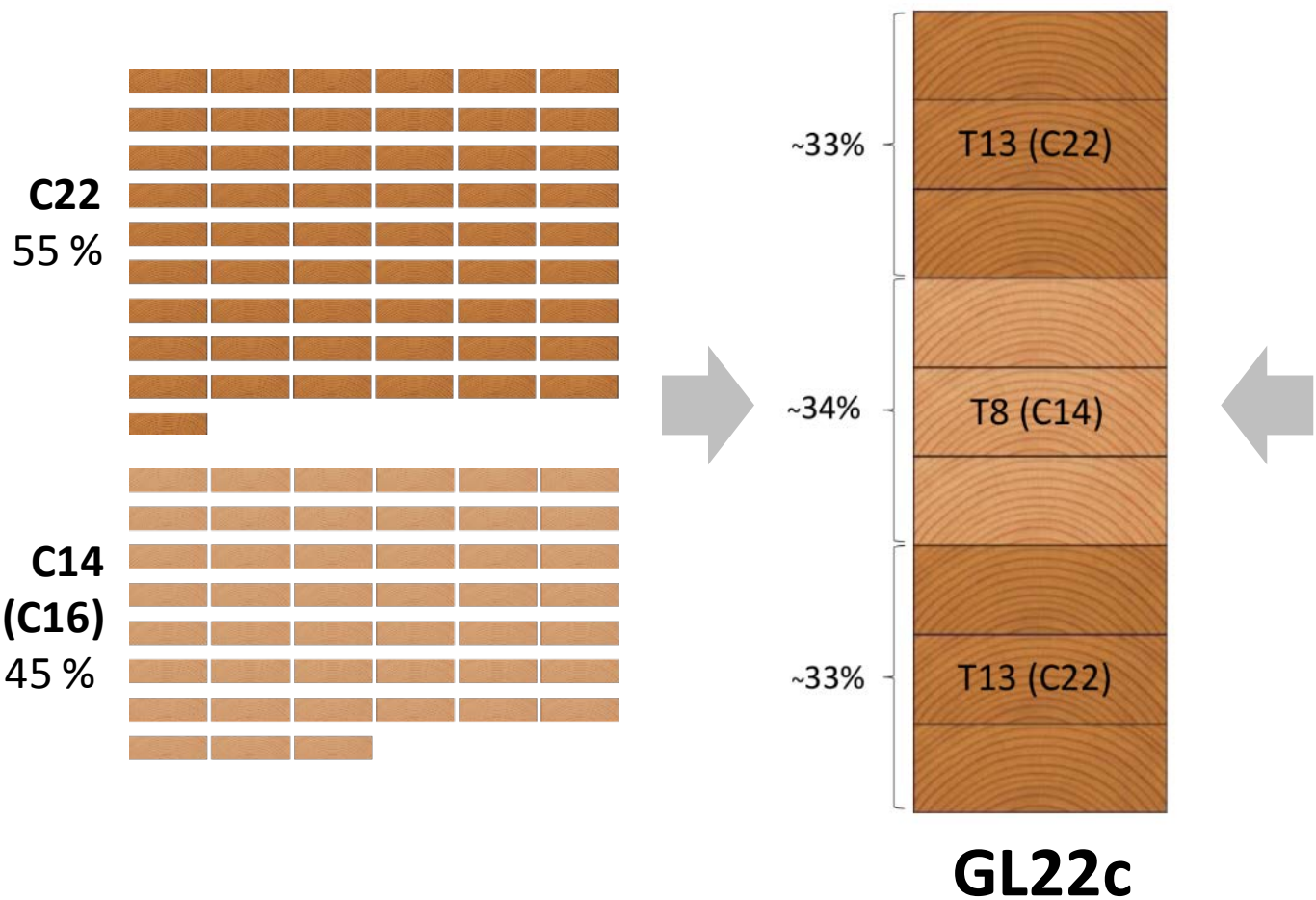
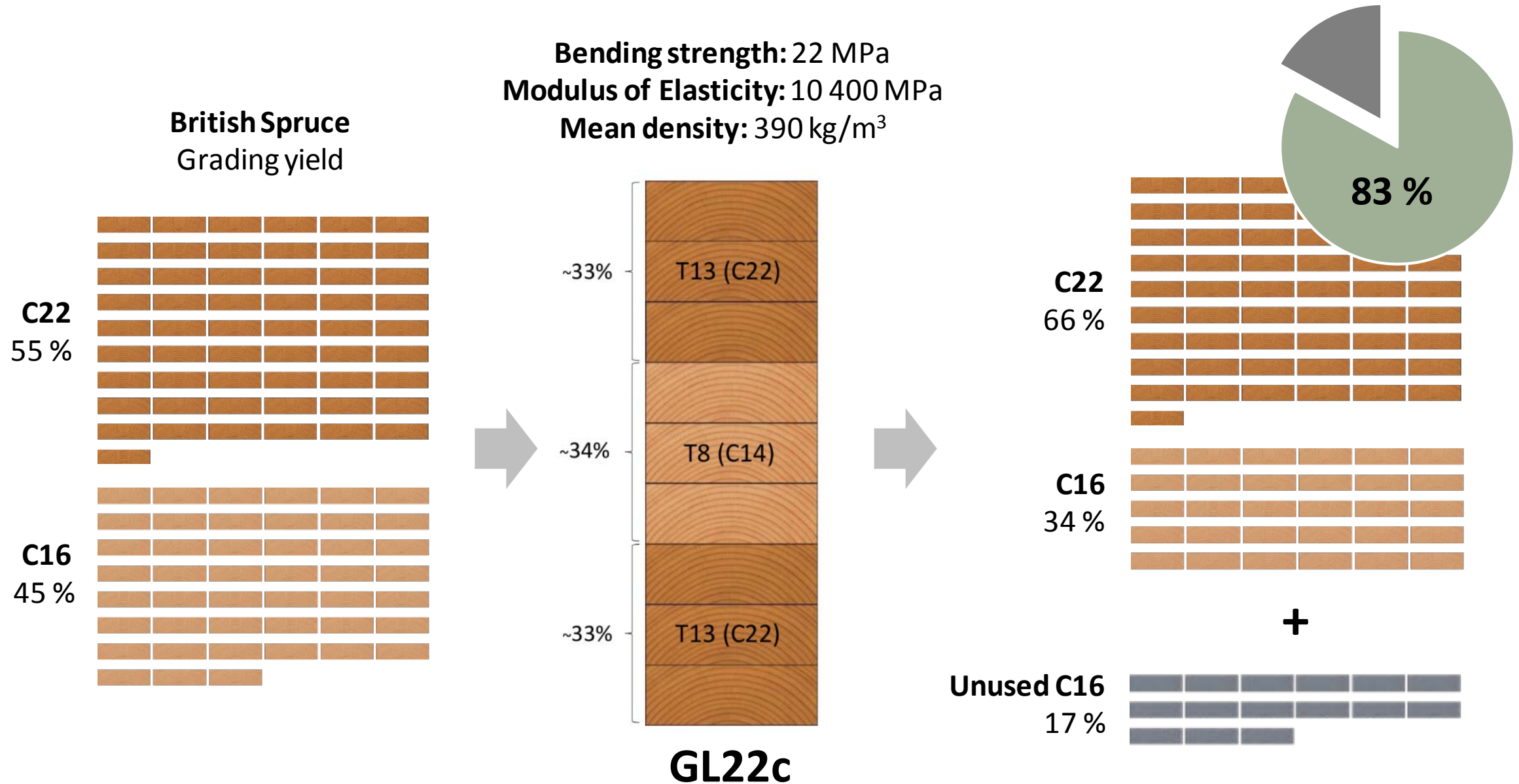


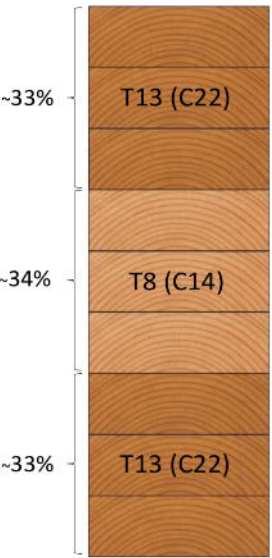
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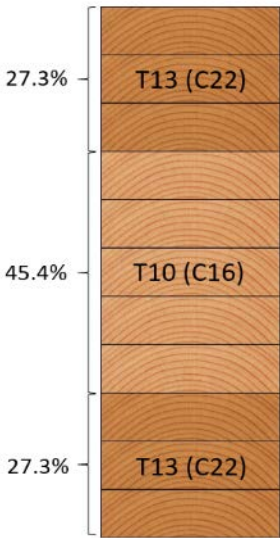
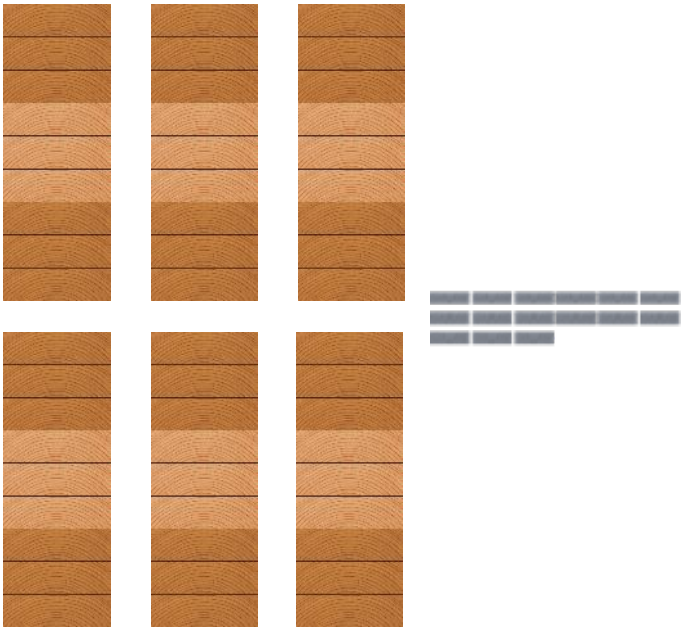
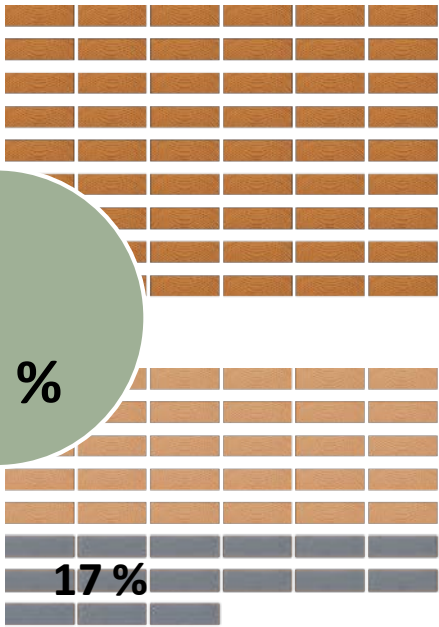
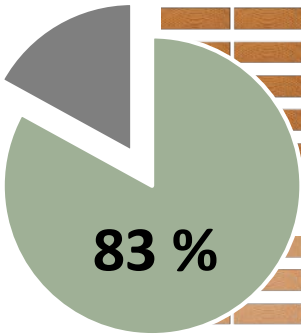
Combined GLT utilizing only UK-grown species



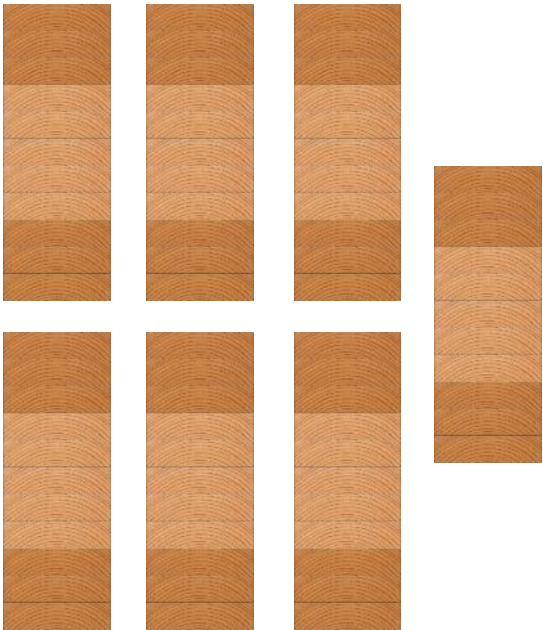
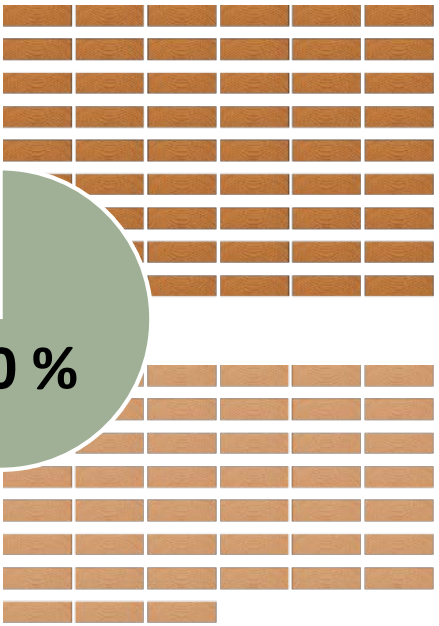
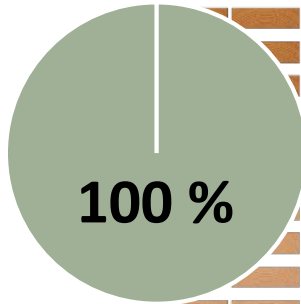
GL22c



Bending strength: 22 MPa
Modulus of Elasticity: 10 400 MPa



Bending strength: ?? MPa
Modulus of Elasticity: ?? MPa





Derive combined GLT properties from calculations

BS EN 14080:2013

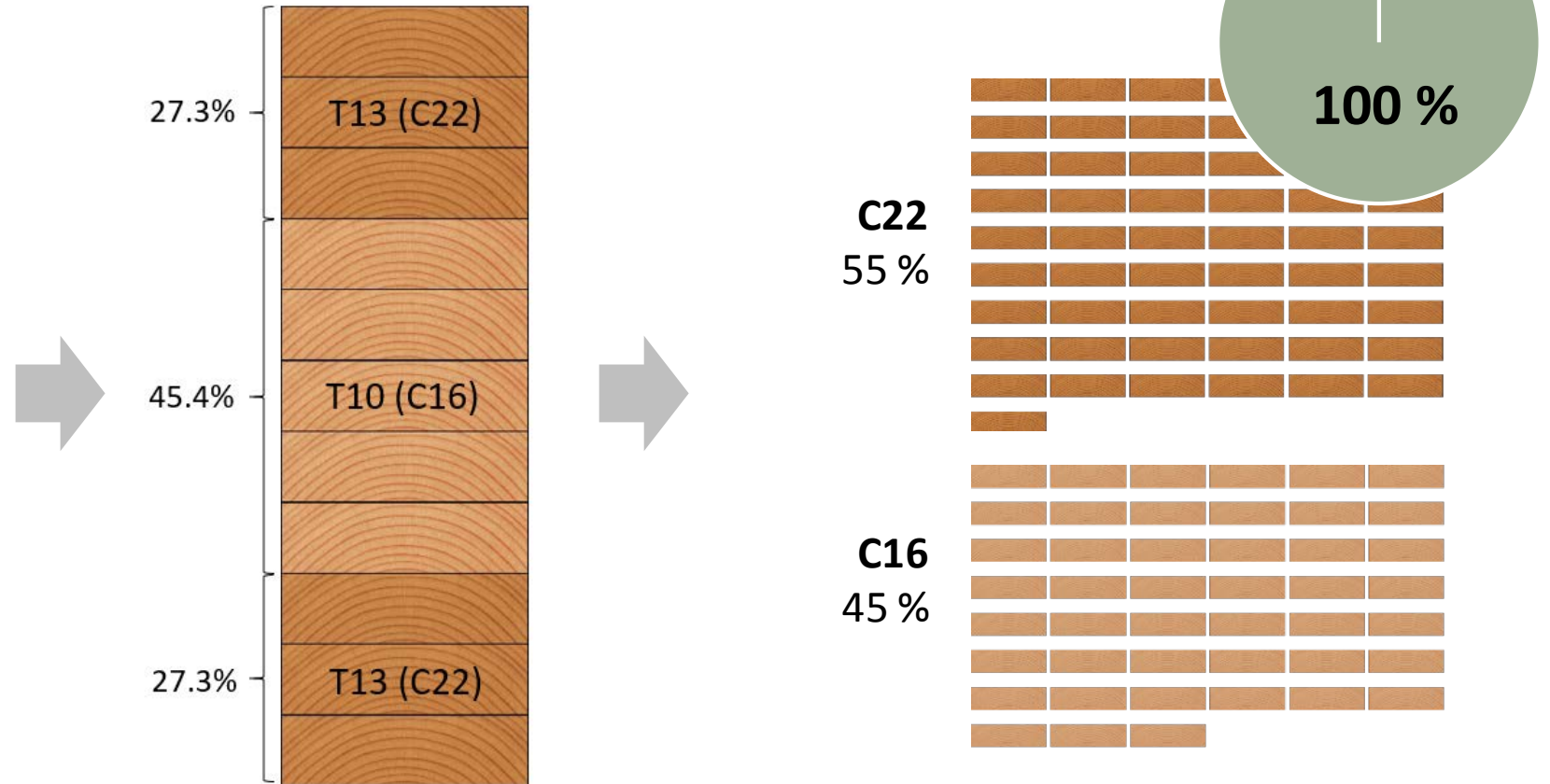
BSI Standards Publication

Timber structures — Glued
laminated timber and glued
solid timber — Requirements

EUROCODE 5

BS EN 1995-1-1:2004+A2:2014
EN 1995-1-1:2004+A2:2014 (E)

Annex B (Informative): Mechanically jointed beams



Derive combined GLT properties from calculations

BS EN 14080:2013

BSI Standards Publication

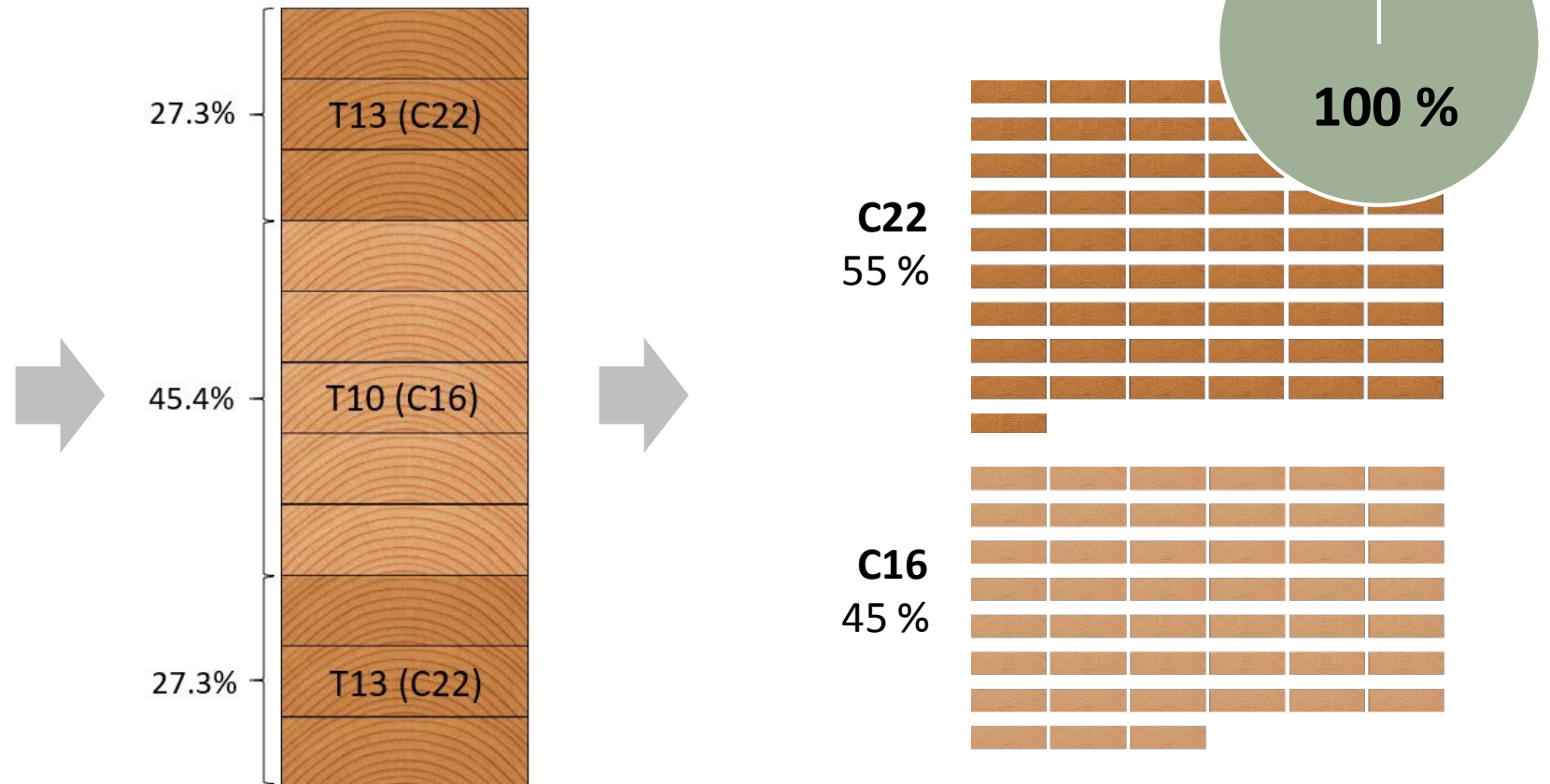
Timber structures — Glued
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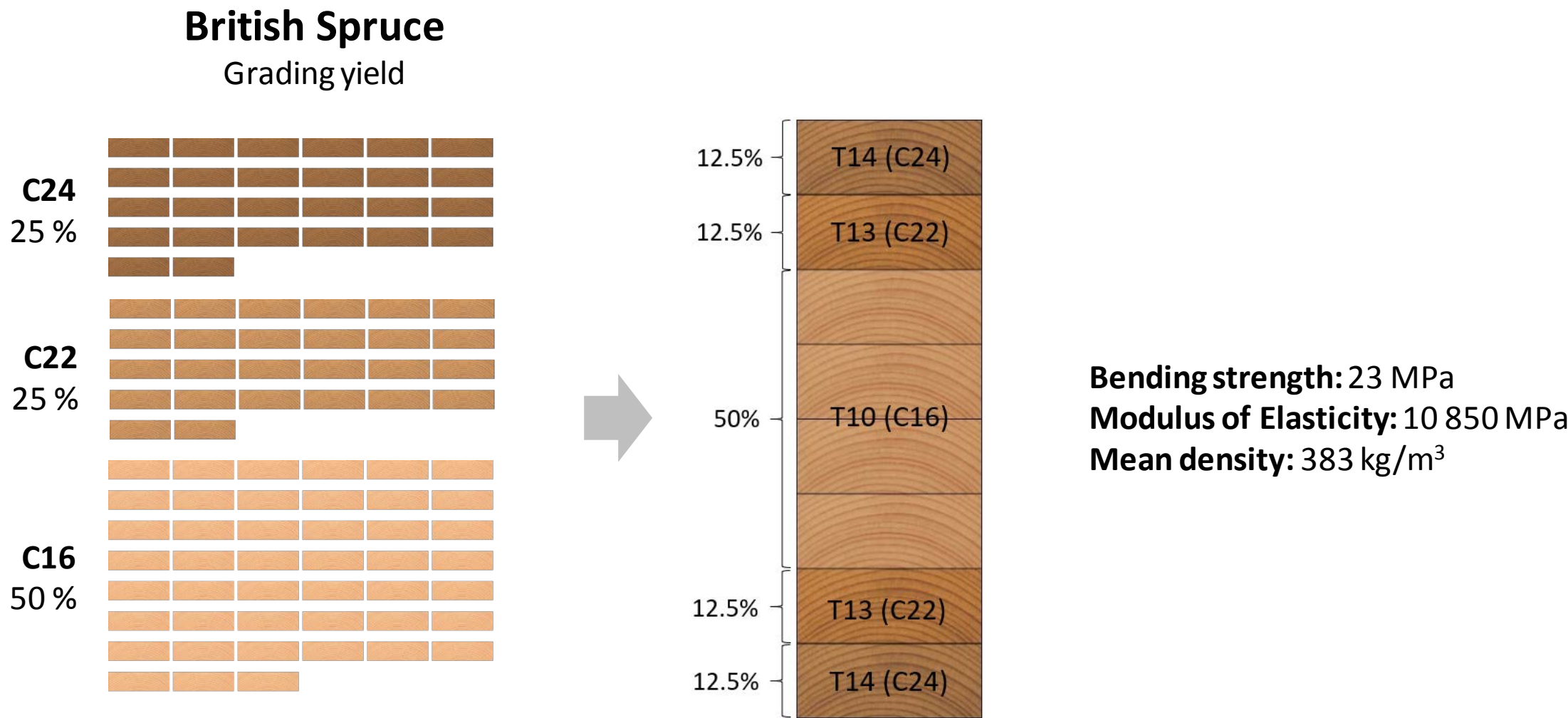
BS EN 1995-1-1:2004+A2:2014
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Annex B (Informative): Mechanically jointed beams

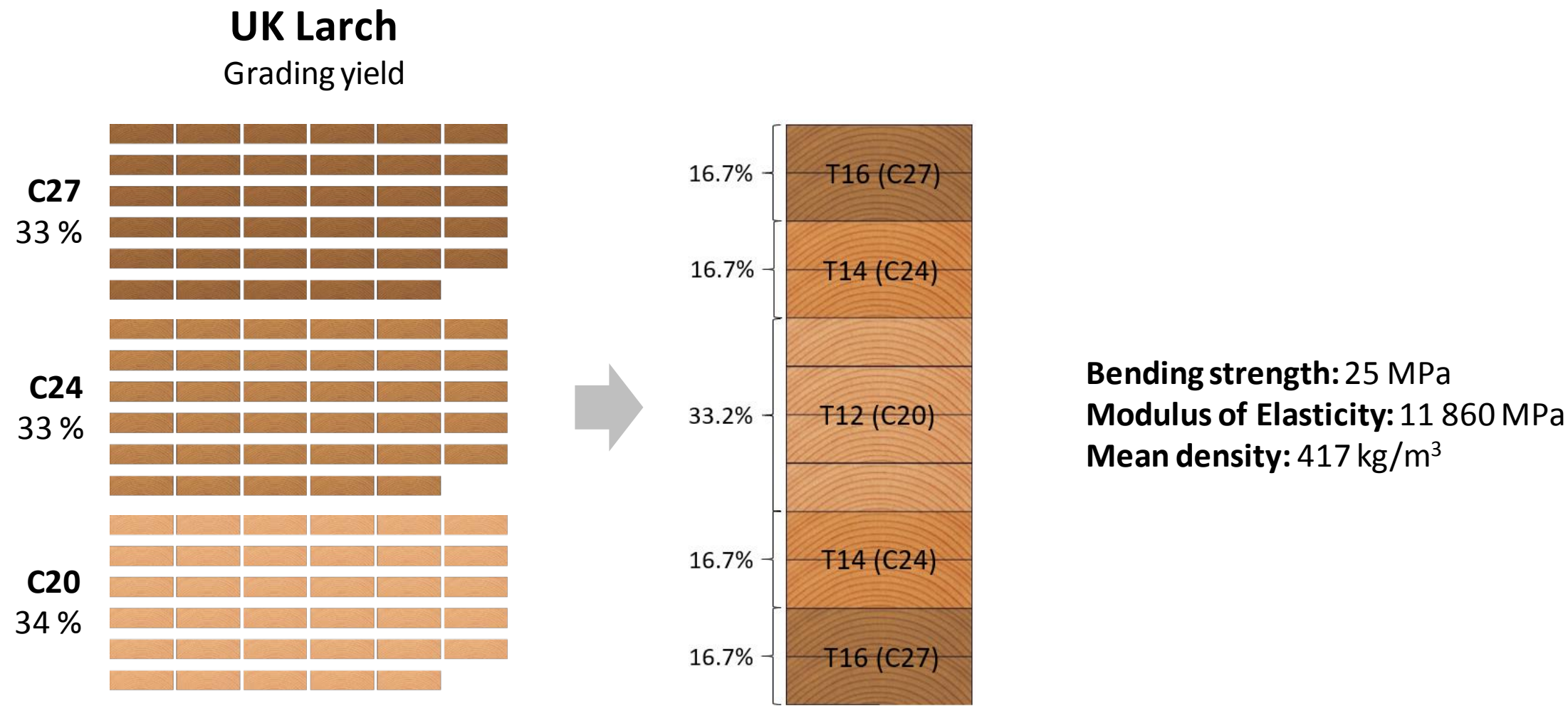
Bending strength: 22 MPa
Modulus of Elasticity: 10 300 MPa
Mean density: 383 kg/m³



Combined GLT manufactured from UK-grown species



Combined GLT manufactured from UK-grown species

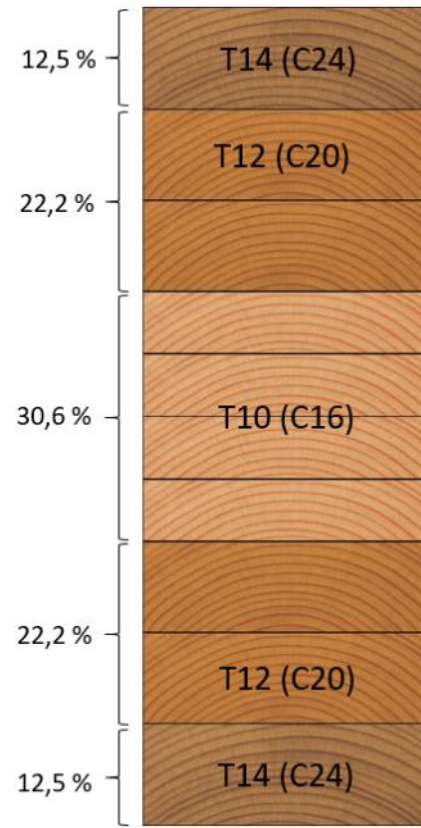


Combined GLT manufactured from UK-grown species

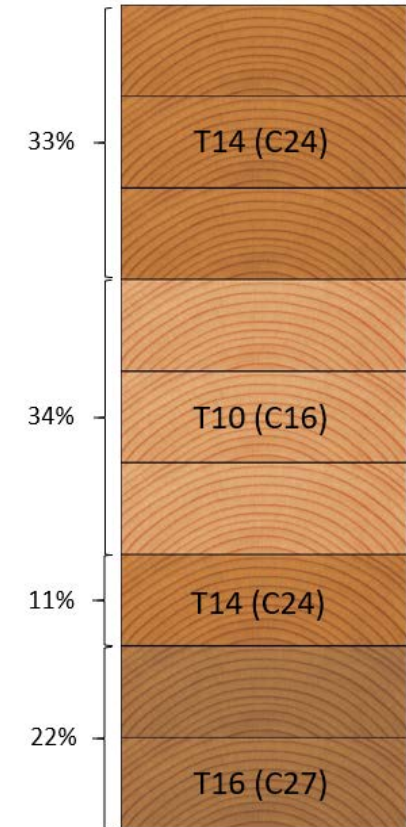
Widen the opportunities for UK-grown timber by investigating non-conventional lay-up configurations

- Adapt the lay-up configuration to the available material
- Adapt the lay-up for the intended application

Variable thickness of lamellae



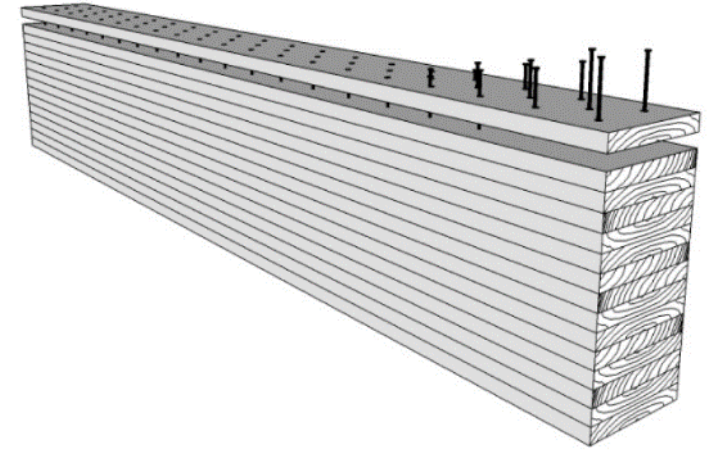
Asymmetrical layup



Other Mass Timber Systems under investigation

Cross-Laminated Timber

- Derive the mechanical properties of various lay-up configurations from calculations



Other Mass Timber Systems

- Doweled-Laminated Timber
- Nailed-Laminated Timber





Centre for
Offsite Construction +
Innovative Structures

Thank you for your attention