British spruce (WPCS)

Grown in UK and Ireland (typical resource quality)

Sitka spruce (*Picea sitchensis*) (PCST)
Norway spruce (*Picea abies*) (PCAB)

SIRT
Strategic Integrated Research in Timber

Species outline:

The main commercial species group grown in the UK and Ireland is mostly Sitka spruce (~90%) with a relatively small amount of Norway spruce (~10%). It is therefore often referred to simply as Sitka. For practical purposes the two spruce species have the same properties and the sawn timber is effectively indistinguishable, although Sitka does have some small microscopic features that tend to be different from other spruces.

Pack weights: (approximate, actual weights will depend on moisture content variation)

Condition	Average kg per 1 m^3 of timber (volume at moisture content)		
	Low estimate	Middle estimate	High estimate
Fresh sawn, green †	600 (heartwood)	850	1100 (sapwood)
40% moisture content †	430 (less dense)	455	480 (more dense)
20% moisture content †	395 (less dense)	415	435 (more dense)
12% moisture content ‡	380 (less dense)	400	420 (more dense)

Shrinkage green to 12% moisture content is approximately: 5% in width and thickness (10% volumetric)
† Information quality: High (measurement and representative sampling)
‡ Information quality: Very High (extensive measurement and representative sampling)

Structural timber summary:

British spruce, grown in UK and Ireland, can be both machine and visually graded. Most current grading is done by machine, usually to C16/reject with very low machine reject. The grade limiting property is stiffness. Higher grades and other grade combinations are possible, and while it may not be economic on an industrial scale for primary processing, they may be viable for one-off projects. With the right grading machine, yields of about 25% C24 with 75% C16 and minimal machine reject are achievable. There are five special grades for British spruce grown in UK and Ireland: C16+, NapierSA, NapierSB, NapierSC and NapierSD.

Mechanical properties (ungraded timber, as if randomly sampled from resource):

	Lower 5th percentile	Mean	Upper 5th percentile
Structural sized timber (with knots and other defects to EN 408, with visual override removed) †			
Bending strength (N/mm^2)	18	33	51
Bending stiffness (kN/mm^2)	4.9	8.4	12.3
Density (kg/m^3)	333	400	481
Small dimension timber, battens (with knots and other defects to EN 408, with visual override removed) †			
Bending strength (N/mm^2)	12	34	57
Bending stiffness (kN/mm^2)	2.9	6.9	11.2
Density (kg/m^3)	338	415	498
Clear wood (no visible defects, small clears to BS 373) ‡			
Bending strength (N/mm^2)	44	61	79
Bending stiffness (kN/mm^2)	4.4	6.9	9.5
Density (kg/m^3)	338	413	496

At reference 12% moisture content, adjusted to EN 384 but without modification factor for size (k_h)
† Information quality: Very High (extensive measurement and representative sampling)
‡ Information quality: High (measurement and representative sampling)

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This version is dated 25/02/2020. Check http://blogs.napier.ac.uk/cwst/species/ for updates

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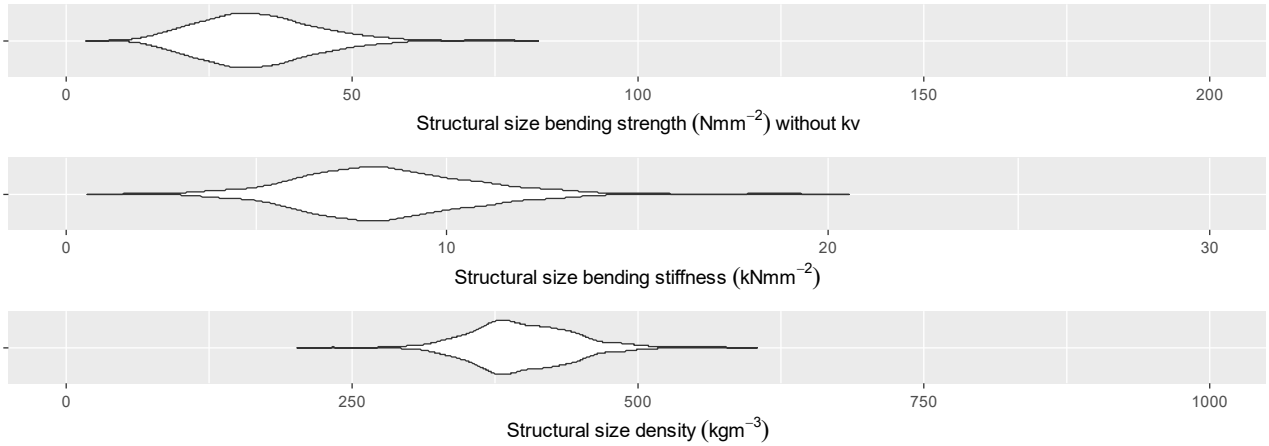
British spruce (WPCS) continued



Correlation matrix (R and [R-squared]) for structural sized timber (ungraded, but visual override removed):

From → With ↓	Bending strength †	Bending stiffness †	Density †	Resonance dynamic MOE †	Statistics †	
					Mean	CoV
Bending strength	1.00 [1.00]				33.4 N/mm^2	30 %
Bending stiffness	0.69 [0.48]	1.00 [1.00]			8.40 kN/mm^2	27 %
Density	0.39 [0.16]	0.46 [0.22]	1.00 [1.00]		400 kg/m^3	11 %
Resonance dynamic MOE	0.61 [0.38]	0.86 [0.73]	0.57 [0.33]	1.00 [1.00]	9.56 kN/mm^2	21 %

At reference 12% moisture content, adjusted to EN 384 but without modification factor for size (k_h)
† Information quality: Very High (extensive measurement and representative sampling)

Durability:

	Durability of Heartwood				Treatability		Sapwood width
	Fungi	Hylotrupes	Anobium	Termites	Heartwood	Sapwood	
Sitka spruce	Slightly durable to not durable	Durable	Not durable	Not durable	Difficult	Moderately easy to difficult	Generally no distinct differentiation
Norway spruce	Slightly durable (to not durable)	Not durable	Not durable	Not durable	Difficult to extremely difficult	Difficult and variable	No distinct differentiation

Information repeated from EN350:2016

Key references:

Moore, J. (2011) "Wood properties and uses of Sitka spruce in Britain", Forestry Commission Research Report.

Moore, J, Lyon, A, Searles G., Lehneke, S. & Ridley-Ellis, D. (2013) "Within- and between-stand variation in selected properties of Sitka spruce sawn timber in the UK: implications for segregation and grade recovery" Annals of Forest Science 70(4), DOI: 10.1007/s13595-013-0275-y

Ridley-Ellis, D., Adams, S., & Lehneke, S. (2018). "Some thresholds for grading British grown spruce to optimised strength classes using longitudinal resonance", World Conference on Timber Engineering 2018 (Seoul, Korea).