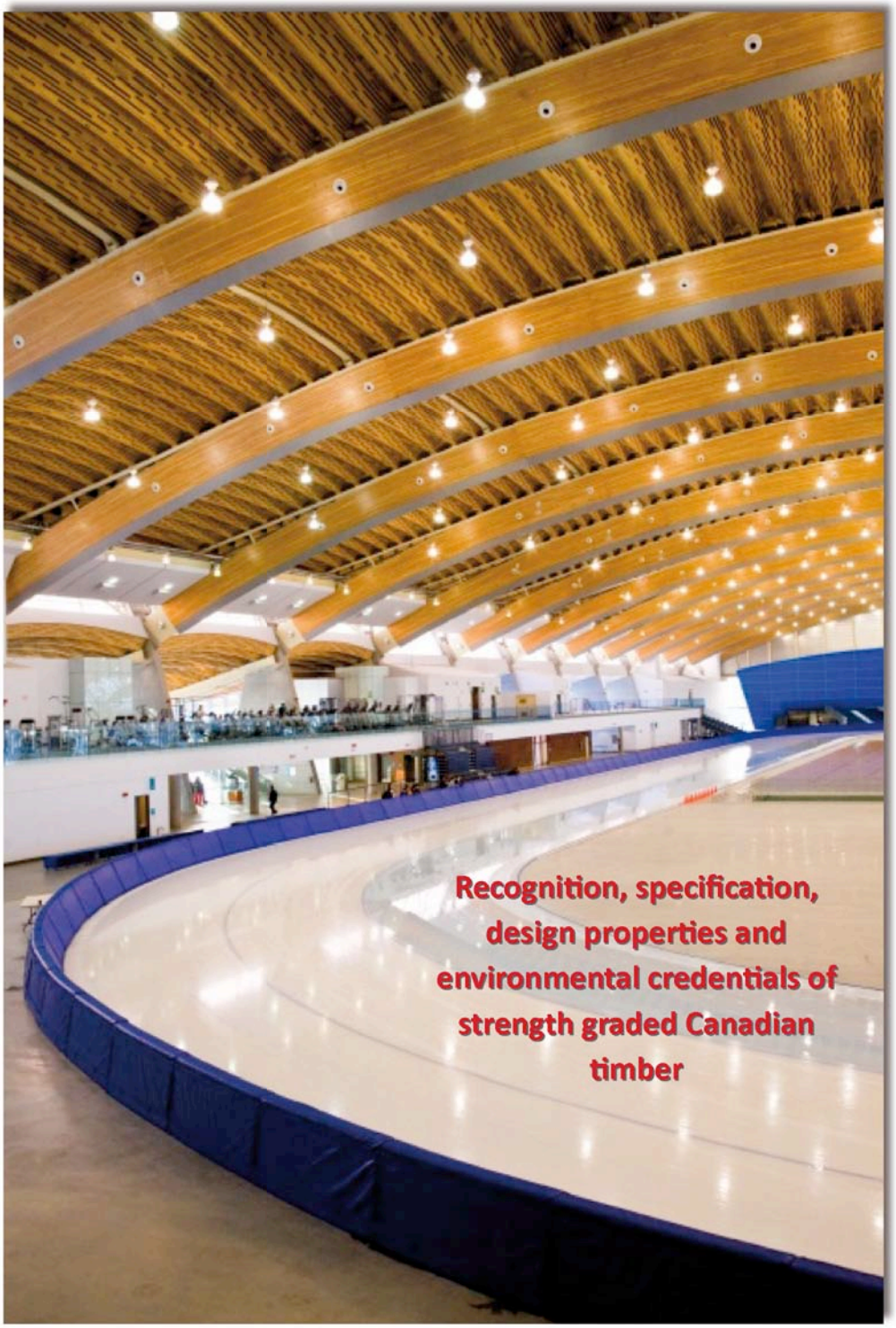
Canadian Structural Timber

for the EU - UK edtion



Recognition, specification, design properties and environmental credentials of strength graded Canadian timber

Canadian Structural Timber

for the EU

Recognition, specification and design properties.

UK edition

December 2010

This leaflet is the new source of information to assist in the understanding, recognition, specification and use of Canadian structural timber in European markets.

The **strength-class** system was adopted for simplification of both specification and supply but to take advantage of the optimum structural performance of timber, higher grades in particular, designers may use design values of named species and grades.

Strength-class allocations, in accordance with EN 338, are given in Tables 2, 3 and 7; individual grade/species combinations in Tables 5 and 6. In addition to characteristic values (Table 5) for designing to Eurocode 5, permissible stress design values (Table 6) for designing to BS 5268: Part 2 are included. Characteristic values for strength classes, which may be adjusted for size (see explanation below Table 6), can be found in BS EN 338.

Background

Customarily, within the EU most timber structures are designed in accordance with national timber design codes, BS 5268: Part 2, 'Code of Practice for permissible stress design, materials and workmanship' in the UK. Within this document is the design data for timber and wood products that have been approved by the national code committee as meeting the necessary requirements for use in construction.

In line with European policy, all national design codes have been officially replaced during 2010 with Eurocodes; for timber design this is Eurocode 5 – EN 1995-1-1 'Design of timber structures – Part 1-1: General – Common rules and rules for buildings'. The Eurocodes are 'limit state' codes and do not contain material data.

Under the Construction Products Directive, graded structural timber for incorporation into permanent construction works within the EU must now be produced in accordance with the requirements of: **EN 14081-1** *'Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements'.*

These requirements have been incorporated into Canadian grading rules for visual and machine graded lumber in the form of a European Union Export Annex, together with the required compliance statement.

EN 14081-1 is a 'Harmonised Standard' and so includes a requirement for CE marking. For ease of application the associated marking requirements have, together with those required for the North American market, been incorporated into a single grade mark. Details are provided overleaf.

Definitions

CLSAB

The Canadian Lumber Standards Accreditation Board was established in 1960 by the Canadian Standards Association and incorporated under Letters Patent by the Minister of Consumer and Corporate Affairs in 1982. The CLSAB is responsible for accrediting all Canadian lumber grading and inspection agencies and approval and enforcement of NLGA grading rules and product standards.

NLGA

The National Lumber Grades Authority, incorporated under Letters Patent by the Minister of Corporate and Consumer Affairs on January 12, 1971, is the organization responsible for writing, interpreting and maintaining Canadian lumber grading rules and product standards.

CLS

Adopted as the commercial identifier for Canadian structural timber with eased edges (rounded corners) - graded in accordance with the National Grading Rule for all North American dimension lumber, 2" to 4" thick (nominal), which has established standard lumber grades and grade names and is an assurance for users of uniform defined sizes and performance characteristics for all commercial species of Canadian lumber. In EU markets it is specified in equivalent (actual) metric dimensions.

Note: The terms 'timber' and 'lumber' are used interchangeably throughout this leaflet.

Table 1	**CLS Dimensions – dry sizes**					
2x3	**2x4**	**2x5**	**2x6**	**2x8**	**2x10**	**2x12**
38x64	38x89	38x114	38x140	38x184	38x235	38x286
When specified in accordance with EN 336, Canadian CLS dimension lumber meets the requirements of Tolerance Class 2						

Note: *Not all structural timber sold as 'CLS' is of Canadian origin. In such instances 'CLS' is used only to identify timber with similar cross-section characteristics.*

Strength Class

Allocation to EN 338 strength classes, of the visual grades of species and species combinations contained in Table 2, is also available in EN 1912. The allocation to EN 338 strength classes of SPS-2 MSR grades given in Table 3 is new to this leaflet; unlike the visual grades, they are not the allocations previously identified in BS 5268: Part 2.

Allocation of Canadian visual grades and species to strength class					
Table 2	EN 338 Strength Class				
Species	**C14**	**C16**	**C18**	**C20**	**C24**
S-P-F	Const Stud	No.1 No.2		1&Btr	Sel Str
D fir-L	Const Stud	No.1 No.2		1&Btr	Sel Str
Hem-Fir	Const Stud	No.1 No.2		1&Btr	Sel Str
WR Cedar	No.1 No.2		Sel Str		
Sitka spruce	No.1 No.2		Sel Str		

MSR

Machine graded lumber (MGL) produced by the 'output control' process in accordance with the requirements of NLGA Special Product Standard, SPS-2, which has incorporated within it clause revisions to meet the requirements of EN 14081-1.

Table 3	Allocation of msr grades to strength class				
EN 338 Strength Class					
C16	C20	C24	C27 [1.]	C30 [2.]	C35
1200fb - 1.2E	1450fb - 1.3E	1650fb - 1.5E	1800fb - 1.6E	1950fb - 1.7E 2100fb -1.8E 2400fb -2.0E	2700fb - 2.2E
Allocations apply to the following species combinations: *Douglas fir-Larch* *Hem-Fir* *Spruce-Pine-Fir* ***NOTE:*** 1. 38 x 64 1800fb - 1.6E is allocated to strength class C24 2. 38 x 64 1950fb - 1.7E is allocated to strength class C27					

For characteristic values of individual species MSR grades, see Table 5, especially advantageous in the higher grades.

BS 4978 Visual Grades

Canadian timber may also be graded, either in Canada or the UK, to GS and SS in accordance with BS 4978. Such timber should be clearly identified as Canadian; certain species variously grown in the EU can be expected to possess properties at variance with the same species grown indigenously. This is particularly relevant to Douglas fir, Sitka spruce and Western red cedar.

Table 7 includes permissible stress design values for GS and SS grades, together with strength class allocations, for designs only in accordance with BS 5268: Part 2. For designs in accordance with EC5, use appropriate strength class characteristic values.

TR26

Machine grade TR26 is not produced in Canada but MSR timber of both equivalent (1800f-1.6E/C27) and superior performance (see Table 3 and Table 5) is available.

Species

Species identification is now required to be by reference to the new EU species codes. Customary abbreviations will be retained in Canadian grade marks, the EU species codes, as Table 4, cross-referenced in the 'ACD' (see below)

Table 4	Species Identifiers and natural durability		
EU species code	Species / species combination	Canadian abbreviation	Durability Class
WPSM	Douglas fir-larch	*D fir-L*	3
WABA	Hemlock with fir species	*Hem-Fir*	4
WPCE	Spruce-Pine-Fir	*S-P-F*	4
PCST	Sitka spruce	*S Sitka*	4-5
THPL	Western red cedar	*WR Cedar*	2

Grade Marking

Grade marks, of necessity, are stamped in ink directly onto each piece of timber.

The minimum information required in the mark is:

- Producer identification (e.g. Agency logo and mill number)
- Species and grade
- Strength class (e.g. C24)
- NLGA
- 'KD-HT' or 'S-DRY' (surfaced dry); 'GRN-HT'; 'S-GRN-HT'.

Standard moisture content of Canadian kiln dried (KD) timber is maximum 19%. Timber dried to 15% moisture content is also available ('MC15' or 'KD15'). 'HT' - heat treated (an international phyto-sanitary requirement); 'GRN' - graded when not dried.

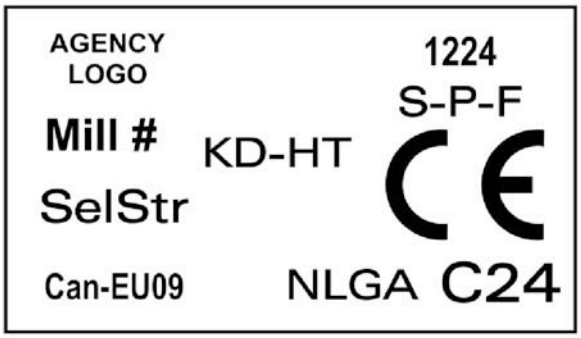
Visual grade mark

CE Marking

With the introduction of CE-marking, additional requirements are now necessary. Grade marks on timber produced in accordance with EN 14081-1 are required to include:

- '1224' – Identification number of the Notified Body.
- 'Can-EU09' (number may vary) – accompanying commercial document (ACD) reference; also identifies the year of first application of CE marking at the mill.
- 'Dry Graded' or equivalent (KD-HT) when graded after drying.
- 'CE'

Visual grade - CE mark



Machine grade – CE mark

The machine grade CE mark will contain the same basic information as the visual mark but with grades as Table 3 plus the letter 'M' to indicate machine graded.

The above layouts are not indicative of the appearance of all Canadian grade marks but in all cases the individual items as identified above must be present.

ACD - Accompanying Commercial Document

As the name suggests, the ACD must accompany all CE-marked, graded structural timber at every change of ownership and should be available for inspection on site. It contains additional information in support of the details appearing in the grade mark applied directly to the timber.

General design criteria

Care should be taken to ensure appropriate use of design values, most particularly that Characteristic Values are used only for design in accordance with Eurocode 5 and permissible stress values only for design in accordance with BS 5268: Part 2.
Similarly, the choice of **either** *the values for a strength class* **or** *the values for individual species and grade* is one or the other and not a combination of these.

For designs based on strength class, material specifications should itemise the required strength class or classes, whether softwood or hardwood and, if the choice of material is governed by factors other than strength, highlight the particular species required.

In all cases, tabulated design values are appropriate for service classes 1 and 2 (dry interior and covered exterior). For service class 3 (wet exposure) tabulated values should be multiplied by the appropriate modification factor from EC5 or BS 5268: Part 2.

Characteristic values for MSR grades of species groups

Table 5 **Characteristic Values** for Canadian MSR Lumber in accordance with EN 14081-1
Machine graded to NLGA SPS-2 + EU Export Annex
Note: The values in this table are for use only with Eurocode 5

Species Group	Grade	Kg/m³		Strength properties – N/mm²						Stiffness properties – N/mm²			
		Density		Bending	Tension		Compression		Shear	Modulus of elasticity			Shear modulus
		Char ρ_k	Mean ρ_{mean}	$f_{m,k}$	Par $f_{t,0,k}$	Perp $f_{t,90,k}$	Par $f_{c,0,k}$	Perp $f_{c,90,k}$	$f_{v,k}$	Mean $E_{0,mean}$	Min $E_{0,05}$	Perp $E_{90,mean}$	G_{mean}
Douglas fir - Larch	**1200fb -1.2E**	450	540	18.0	8.7	0.4	18.4	3.1	3.2	8 500	5 600	260	500
	1450fb -1.3E	450	540	22.1	11.6	0.4	20.1	3.1	3.6	9 500	6 400	300	560
	1650fb -1.5E	450	540	25.5	14.8	0.4	21.5	3.1	4.0	11 500	7 700	360	680
	1800fb -1.6E	450	540	27.9	16.7	0.4	22.4	3.1	4.0	12 500	8 300	400	750
	1950fb -1.7E	450	540	30.3	18.2	0.4	23.2	3.1	4.0	13 000	8 700	430	810
	2100fb -1.8E	490	580	32.9	19.8	0.4	24.1	3.4	4.0	14 000	9 300	460	870
	2400fb -2.0E	520	625	37.8	22.6	0.4	25.6	3.6	4.0	16 000	10 700	530	1000
	2700fb -2.2E	520	625	42.5	25.5	0.4	27.0	3.6	4.0	17 500	11 700	580	1090
Hem-Fir	**1200fb -1.2E**	420	500	18.0	8.7	0.4	18.4	2.9	3.2	8 500	5 600	260	500
	1450fb -1.3E	420	500	22.1	11.6	0.4	20.1	2.9	3.6	9 500	6 400	300	560
	1650fb -1.5E	420	500	25.5	14.8	0.4	21.5	2.9	4.0	11 500	7 700	360	680
	1800fb -1.6E	420	500	27.9	16.7	0.4	22.4	2.9	4.0	12 500	8 300	400	750
	1950fb -1.7E	420	500	30.3	18.2	0.4	23.2	2.9	4.0	13 000	8 700	430	810
	2100fb -1.8E	420	500	32.9	19.8	0.4	24.1	2.9	4.0	14 000	9 300	460	870
	2400fb -2.0E	420	500	37.8	22.6	0.4	25.6	2.9	4.0	16 000	10 700	530	1000
	2700fb -2.2E	420	500	42.5	25.5	0.4	27.0	2.9	4.0	17 500	11 700	580	1090
Spruce-Pine-Fir (S-P-F)	**1200fb -1.2E**	380	450	18.0	8.7	0.4	18.4	2.7	3.2	8 500	5 600	260	500
	1450fb -1.3E	380	450	22.1	11.6	0.4	20.1	2.7	3.6	9 500	6 400	300	560
	1650fb -1.5E	380	450	25.5	14.8	0.4	21.5	2.7	4.0	11 500	7 700	360	680
	1800fb -1.6E	380	450	27.9	16.7	0.4	22.4	2.7	4.0	12 500	8 300	400	750
	1950fb -1.7E	380	450	30.3	18.2	0.4	23.2	2.7	4.0	13 000	8 700	430	810
	2100fb -1.8E	420	500	32.9	19.8	0.4	24.1	2.9	4.0	14 000	9 300	460	870
	2400fb -2.0E	460	550	37.8	22.6	0.4	25.6	3.2	4.0	16 000	10 700	530	1000
	2700fb -2.2E	460	550	42.5	25.5	0.4	27.0	3.2	4.0	17 500	11 700	580	1090

Note:

1. *These values, based on NLGA SPS-2, relate only to CLS dimension lumber sizes (mm) 38x64; 38x89; 38x114; 38x140; 38x184; 38x235; 38x286 and are to be used only for design in accordance with EN 1995-1-1 (Eurocode 5).*
2. *Except where NLGA SPS-2 values are lower, values for tension strength, compression strength, shear strength, 5% modulus of elasticity, mean modulus of elasticity perpendicular to grain and mean shear modulus have been calculated using the equations given in Annex A of EN 338.*
3. *Values are for service class 1 and service class 2 applications.*
4. *Density values – characteristic density is to be used for joint design, mean density when calculating dead loads.*
5. *The values in this table must not be adjusted for width or depth of member.*

Designing in accordance with BS 5268: Part 2

Although replaced by Eurocode 5 in 2010, national timber design codes will undoubtedly remain in use well beyond the official EC5 adoption deadline. Table 6 provides permissible stress design values for Canadian species group MSR grades, Table 7 permissible stress design values for Canadian species groups graded to GS and SS in accordance with BS 4978, both for use with BS 5268: Part 2.

Permissible stress values for MSR grades of Canadian species groups

Table 6	**Permissible Stress Design Values** for Canadian MSR Lumber in accordance with EN 14081-1 Machine graded to NLGA SPS-2 + EU Export Annex **Note: *The values in this table are for use only with BS 5268: Part 2***							
Species Group	**Grade**	**Bending**	**Tension**	**Compression**		**Shear**	**Modulus of elasticity**	
		Parallel to grain N/mm²	Parallel to grain N/mm²	Parallel to grain N/mm²	Perpendicular to grain N/mm²	Parallel to grain N/mm²	Mean N/mm²	Min N/mm²
Douglas fir-Larch	**1200fb -1.2E**	7.5	4.5	7.7	2.6	1.19	8 500	5 600
	1450fb -1.3E	9.3	5.6	8.5	2.6	1.19	9 500	6 400
	1650fb -1.5E	10.7	6.4	9.0	2.6	1.19	11 500	7 700
	1800fb -1.6E	11.7	7.0	9.3	3.0	1.19	12 500	8 300
	1950fb -1.7E	12.7	7.6	9.6	3.0	1.19	13 000	8 700
	2100fb -1.8E	13.8	8.3	10.1	3.0	1.19	14 000	9 300
	2400fb -2.0E	15.8	9.4	10.7	3.3	1.19	16 000	10 700
	2700fb -2.2E	17.8	10.6	11.3	3.3	1.19	17 500	11 700
Hem-Fir	**1200fb -1.2E**	7.5	4.5	7.7	2.1	0.98	8 500	5 600
	1450fb -1.3E	9.3	5.6	8.5	2.1	0.98	9 500	6 400
	1650fb -1.5E	10.7	6.4	9.0	2.1	0.98	11 500	7 700
	1800fb -1.6E	11.7	7.0	9.3	2.4	0.98	12 500	8 300
	1950fb -1.7E	12.7	7.6	9.6	2.4	0.98	13 000	8 700
	2100fb -1.8E	13.8	8.3	10.1	2.4	0.98	14 000	9 300
	2400fb -2.0E	15.8	9.4	10.7	2.4	0.98	16 000	10 700
	2700fb -2.2E	17.8	10.6	11.3	2.4	0.98	17 500	11 700
Spruce-Pine-Fir (S-P-F)	**1200fb -1.2E**	7.5	4.5	7.7	1.8	0.95	8 500	5 600
	1450fb -1.3E	9.3	5.6	8.5	1.8	0.95	9 500	6 400
	1650fb -1.5E	10.7	6.4	9.0	1.8	0.95	11 500	7 700
	1800fb -1.6E	11.7	7.0	9.3	2.1	0.95	12 500	8 300
	1950fb -1.7E	12.7	7.6	9.6	2.1	0.95	13 000	8 700
	2100fb -1.8E	13.8	8.3	10.1	2.1	0.95	14 000	9 300
	2400fb -2.0E	15.8	9.4	10.7	2.4	0.95	16 000	10 700
	2700fb -2.2E	17.8	10.6	11.3	2.4	0.95	17 500	11 700
Note:	1. *These values relate only to CLS dimension lumber sizes (mm) 38x64; 38x89; 38x114; 38x140; 38x184; 38x235; 38x286 and are to be used only for design in accordance with BS 5268: Part 2.* 2. *The permissible stress values in this table must not be adjusted for width or depth of member.* 3. *Values are for service class 1 and service class 2 applications.* 4. *Joint design in accordance with BS 5268: Part 2 is based on prescribed strength class values and not specific species density.*							

Width/Depth modification factor for size – explanation of when and when not to make adjustments

MSR grades have the same strength for all sizes. This is different from the European system where the values in the strength classes are for timber with a depth of 150mm. In order to be compatible with European strength classes, MSR grade values have been adjusted to 150mm before being allocated to strength classes (Table 3). This enables Canadian MSR grades to be simply incorporated into the strength class system and designed similarly with all appropriate modification factors, including adjustments for width or depth. Designers wishing to take advantage of the higher individual grade values in both Table 5 and Table 6 (rather than the frequently lower strength class values) may do so but these values must not be adjusted for width or depth.

Permissible stress values for BS 4978 grades of Canadian species groups

Table 7	**Permissible Stress Design Values** for Canadian species graded to **BS 4978** in accordance with EN 14081-1 ***Note: The values in this table are for use only with BS 5268: Part 2***								
Species/ Group	Grade	Strength Class EN338	Bending	Tension	Compression		Shear	Modulus of elasticity	
			Parallel to grain N/mm²	Parallel to grain N/mm²	Parallel to grain N/mm²	Perpendicular to grain [1.] N/mm²	Parallel to grain N/mm²	Mean N/mm²	Min N/mm²
Douglas fir-Larch	GS	(C16)	5.3	3.2	6.8	2.2	0.85	10 000	6 500
	SS	(C24)	7.5	4.5	7.9	2.4	0.85	11 000	7 500
Hem-Fir	GS	(C16)	5.3	3.2	6.8	1.7	0.68	9 000	6 000
	SS	(C24)	7.5	4.5	7.9	1.9	0.68	11 000	7 500
Spruce-Pine-Fir (S-P-F)	GS	(C16)	5.3	3.2	6.8	1.6	0.68	8 500	5 500
	SS	(C24)	7.5	4.5	7.9	1.8	0.68	10 000	6 500
Sitka spruce	GS	(C14)	4.7	2.8	6.0	1.5	0.66	8 000	5 500
	SS	(C18)	6.6	4.0	7.0	1.7	0.66	10 000	6 500
Western red cedar	GS	(C14)	4.1	2.5	5.2	1.6	0.63	7 000	4 500
	SS	(C18)	5.7	3.4	6.1	1.7	0.63	8 500	5 500

Note:

1. *Stresses applicable to timber 300mm deep or wide; for other section sizes refer to BS 5268: Part 2.*
2. *When specifications specifically exclude wane at bearing areas the SS grade compression perpendicular to grain stress may be multiplied by 1.33 and used for both grades.*
3. *The S6 and S8 grades of the ECE 'Recommended standard for strength grading of coniferous sawn timber' may be substituted for GS and SS respectively.*
4. *For designs in accordance with EC5, use appropriate strength class values.*

Available dimensions

In addition to CLS dimension lumber (Table 1), customary sizes of general carcassing timber, visually graded to either NLGA rules or BS 4978, should also be available, together with MSR grades in thicknesses other than 38mm but availability, for the latter especially, should be confirmed before specifying.

Referenced documents

BS EN 1995-1-1 *Eurocode 5: Design of timber structures - Part 1.1 General: - Common rules and rules for buildings.*

BS 5268: Part 2 *Structural use of timber – Part 2: Code of practice for permissible stress design, materials and workmanship*

BS EN 336 *Structural timber – Sizes, permitted deviations*

BS EN 338 *Structural timber – Strength classes*

BS EN 1912 *Structural timber – Strength classes – Assignment of visual grades and species*

BS EN 14081- 1 *Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements.*

BS 4978 *Visual strength grading of softwood - Specification*

NLGA *Standard Grading Rules for Canadian Lumber* – Section 4 *'National Grading Rule for Dimension Lumber'*

NLGA **SPS-2** - *Special Products Standard for Machine Graded Lumber*

Canadian Structural Timber

Environmental credentials

The argument for wood

With an increasingly 'green' construction industry driven by government environmental agendas, architects and building designers are now charged with meeting these ever-more onerous requirements in addition to the already demanding requirements for integrity, functionality and serviceability of buildings! Wood, together with its structural and performance capabilities, natural beauty and astonishing variety, providing building designers with a wealth of possibilities for satisfying these and clients individual aesthetic requirements, also functions as a 'carbon store'. With the 'carbon foot-print' now being singled-out from the overall requirements for life-cycle analysis of buildings, wood affords the ideal opportunity, with carbon dioxide 'sequestration' alone or together with 'substitution', for building designers to reduce the carbon footprint of buildings.

Second-growth forest

Harvesting in second-growth forest

The argument for Canadian wood

Forest management of international renown

Canada's forest resource is vast! It is also exceptionally well managed under the Provincial Forest Practices Codes which, unlike forest certification systems, are statutory instruments. Comprehensive in scope and rigorously maintained in the field (forest!) they are your guarantee that Canadian structural timber and Canadian wood products generally, of course, are legal and from responsibly managed forests.

Certified legal and sustainable

Forest certification systems, whilst voluntary, have become ostensibly mandatory for primary wood producers (and down the supply chain supported by third-party chain-of-custody) as building designers themselves, or as required by clients, are increasingly demanding 'certified' timber – more correctly 'timber from certified forests'. The Canadian forest industry operates three certification schemes – SFI and CSA, with or without PEFC Chain of Custody, and FSC. Currently with over 145 million hectares of forest certified to one or other of the schemes, Canada has, by a large margin, more certified forests than any other primary wood-producing country. For comprehensive information on all subjects, see back cover for contact points for further reference.

'Starting over'

Offshore, Vancouver

Distance no object!

Commercially you can no longer go anywhere or bring something from somewhere without someone taking you to task for the potentially detrimental impact you are having on the climate with all that carbon dioxide you are generating! 'Wood miles' is the term now coined when considering how far wood has to travel ('food miles' similarly for food) from source to market. So, it is hardly surprising that, as it is quite a long way from Canada, particularly western Canada, this is frequently raised by building designers and particularly larger corporate clients. As a mode of commercial transport sea-freight is the most energy-efficient means of moving goods around the world and as the UK is not and never will be self-sufficient in wood we have to transport it here from somewhere: where better than from a vast and well managed forest resource? The 'wood miles'? Roughly speaking carbon dioxide generated transporting wood from Vancouver to the UK by sea is about one-third of the weight of the wood which 'eats-in' to the CO_2 sequestered by about 25% leaving 75% for reduction of 'carbon footprint' (cf. other imported construction materials!)

Canada Wood is an export market joint initiative between Canadian government and industry association partners.

Canada Wood UK partner associations:

CertiWood Technical Centre
The home of CANPLY -Canadian plywood

Coast Forest Products Association

COFI
Council of Forest Industries

Forest Products Association of Canada fpac.ca | Association des produits forestiers du Canada fpac.ca

Quebec Wood Export Bureau

Western Red Cedar Export Association
Real Cedar

For more information:

www.certiwood.com

www.coastforest.org

www.cofi.org

www.fpac.ca

www.quebecwoodexport.com

www.wrcea.org

www.nlga.org

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