PACIFIC HEMFIR TIMBERS

PACIFIC HEMFIR

WOOD THAT WORKS

www.PacificHemFir.com

PACIFIC HEMFIR
WOOD THAT WORKS

Pacific HemFir is produced from one of the most plentiful tree species in British Columbia. Known for its versatility and performance, HemFir is a wood wonder offering extraordinary value to a wide range of applications. Like the region it represents, Pacific HemFir is beautiful, sustainable and strong. That's why they call it **wood that works.**

Beautiful. Sustainable. Strong.

Table of Contents

OVERVIEW

Introducing Pacific HemFir. **Wood that works.**

Pacific HemFir has it all: superior technical performance; a sustainable and plentiful supply; incredible versatility; treatability; and a beautiful appearance thanks to its straight grain and consistent, light colour. These attributes make Pacific HemFir an excellent choice for everything from structural and industrial applications like framing lumber, heavy timbers and engineered components to joinery and appearance applications known for their 'wow' factor.

Pacific HemFir is a combination of Western hemlock (*Tsuga heterophylla*) and Amabilis fir (*Abies amabilis*), two of the most important and popular coniferous species in British Columbia. Growing intermixed, these high value species are nearly identical in appearance and performance, and are harvested, manufactured and marketed together as Pacific HemFir.

Trees of both species are large, commonly reaching heights of 35m to 55m and diameters up to 90 cm or more. They grow tall, branch-free trunks, a natural growth characteristic that produces large amounts of clear and factory lumber from the log. The wood fibre has high strength and stiffness, combined with even density. It seasons well, hardening as it dries and ages to give excellent durability throughout its lifespan, remaining true to its original freshly milled, pale pastel colour. This desirable softwood is porous and accepts stains well, naturally delivering added richness, utility and value.

Plentiful, workable and versatile.
Choose Pacific HemFir for your next project.

Images Courtesy of Western Forest Products

B.C. LEADS IN SUSTAINABILITY GLOBALLY:

85%, OR 47 MILLION HECTARES, OF INDEPENDENTLY CERTIFIED FORESTS

A FRACTION OF 1%, OR 0.35%, OF FORESTS HARVESTED ANNUALLY

200 MILLION SEEDLINGS PLANTED ANNUALLY

Photo: Shakzu/Getty Images

SUSTAINABILITY

Pacific HemFir. The **sustainable, renewable** choice.

From sapling to sustainable end product, Pacific HemFir is a renewable building material that provides environmental benefits throughout its lifecycle. Grown and harvested within the context of British Columbia's leading sustainable forest management regime, Pacific HemFir is a natural solution that helps mitigate climate change, locking in carbon over the wood product's lifetime.

Pacific HemFir is responsibly harvested to sustain and protect forests and their ecosystems. It is sourced directly from the coastal and interior regions of B.C., which adhere to the most stringent forest management standards and practices in the world.

B.C.'s globally-recognized sustainable forest management regime includes strict forest laws, skilled forestry professionals, comprehensive monitoring, compliance and enforcement. Practices protect key environmental values including soil conservation, water quality, fish habitat, critical wildlife habitat and reforestation.

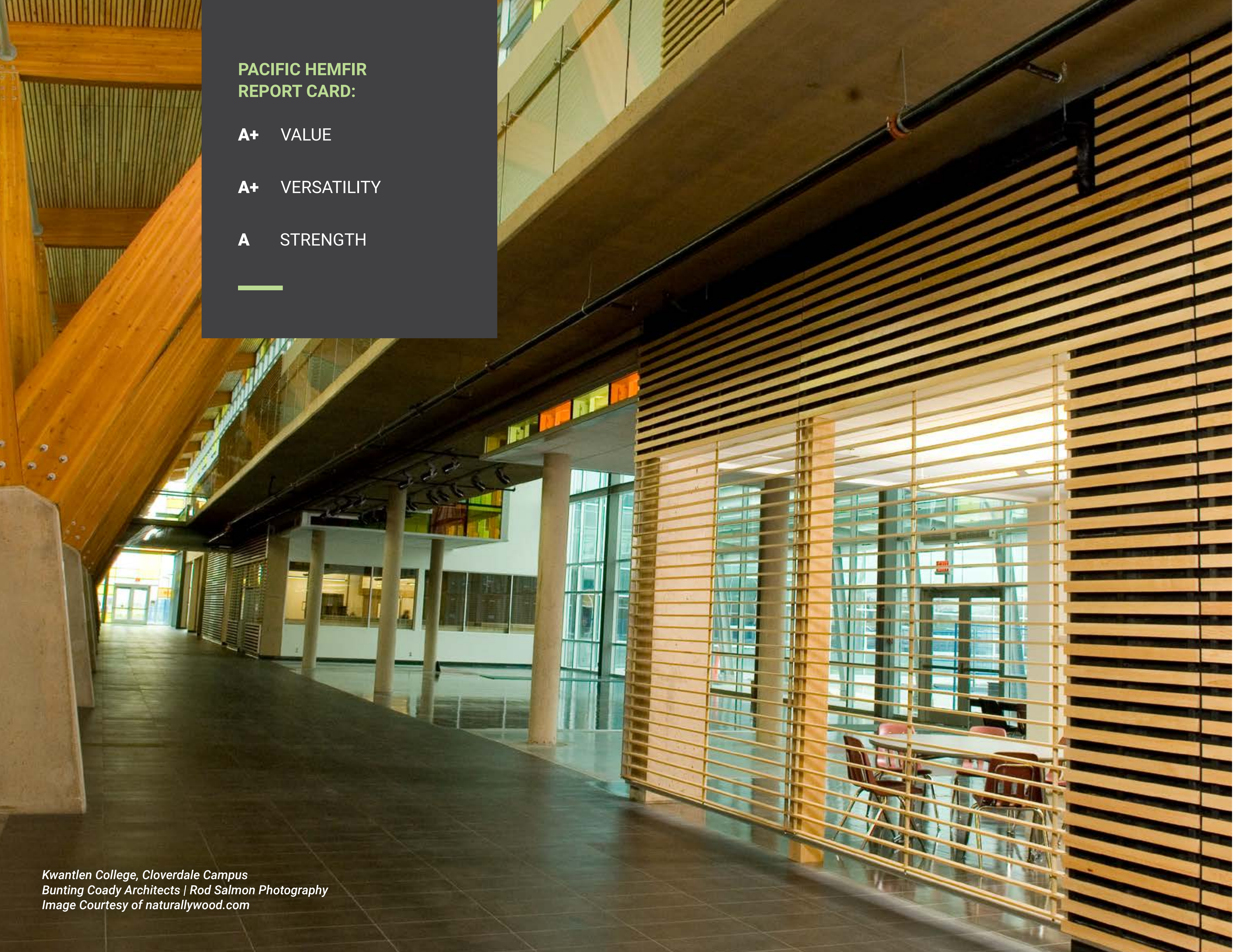
At home and abroad, government, industry and consumers alike are recognizing that wood products sourced from sustainably managed forests are critical in protecting this renewable natural resource and tackling climate change. B.C.'s established track record as a reliable supplier of quality products from sustainably managed forests positions Pacific HemFir as a leading solution for building products.

Not only can healthy forests help in the fight against climate change, sustainably grown and harvested wood products have further lifecycle benefits through their carbon-locking capabilities.

Plus, science shows that it is possible to construct zero-carbon buildings—and even make them a carbon sink—by using renewable materials such as wood. This means that B.C. forest products—particularly fast-growing Pacific HemFir—are the eco-friendly choice, especially compared to non-renewable, carbon intensive materials such as steel or concrete.

Building with sustainable, renewable Pacific HemFir supports a low carbon future, meeting the environmental, social and economic needs of current and future generations.

Images Courtesy of naturallywood.com



PACIFIC HEMFIR REPORT CARD:

A+ VALUE

A+ VERSATILITY

A STRENGTH

Kwantlen College, Cloverdale Campus
Bunting Coady Architects | Rod Salmon Photography
Image Courtesy of naturallywood.com

PERFORMANCE

Pacific HemFir. The **smart** choice.

There's a reason why Pacific HemFir is called wood that works. Strong, stiff, dense and durable are just some of the attributes that make Pacific HemFir a high value wood with superior technical performance. When combined with its plentiful supply and sustainability benefits, it's clear why Pacific HemFir is the smart choice.

Pacific HemFir is prized for its high strength to weight ratio, ideal for structural applications particularly where appearance is key. Its beauty is captured in warm, honey-coloured paneling and impressive ceiling spans. The wood will bend but not break which—with its even density and resulting high nail and screw holding ability—offers added safety benefits, especially in areas that are seismically sensitive.

A preferred choice where pressure treated wood is required, Pacific HemFir offers dependable performance thanks to its even density which allows for easy drying and the uniform penetration of preservatives during the treatment process. This property makes it well suited to outdoor applications like decking and landscape features and gives Pacific HemFir durability and excellent wear resistance on high-traffic areas.

Its strength together with its stiffness make Pacific HemFir a preferred material for use in horizontal components and longer spans—one reason Pacific HemFir is pressure treated and used in industrial applications such as bridges and piers.

In fact, HemFir's strength values have recently been updated in the Canadian Standards Association's CSA O86, Engineering design in wood standard. This new standard for timbers makes it much easier for engineers, architects, regulators and other users to specify Pacific HemFir in industrial applications where structural calculations are required.

Together these qualities make Pacific HemFir an exceptional fit for most structural, appearance and industrial uses. It can meet many of the structural load bearing and load carrying requirements of residential, light commercial and heavy construction.

Images Courtesy of Western Forest Products and naturallywood.com

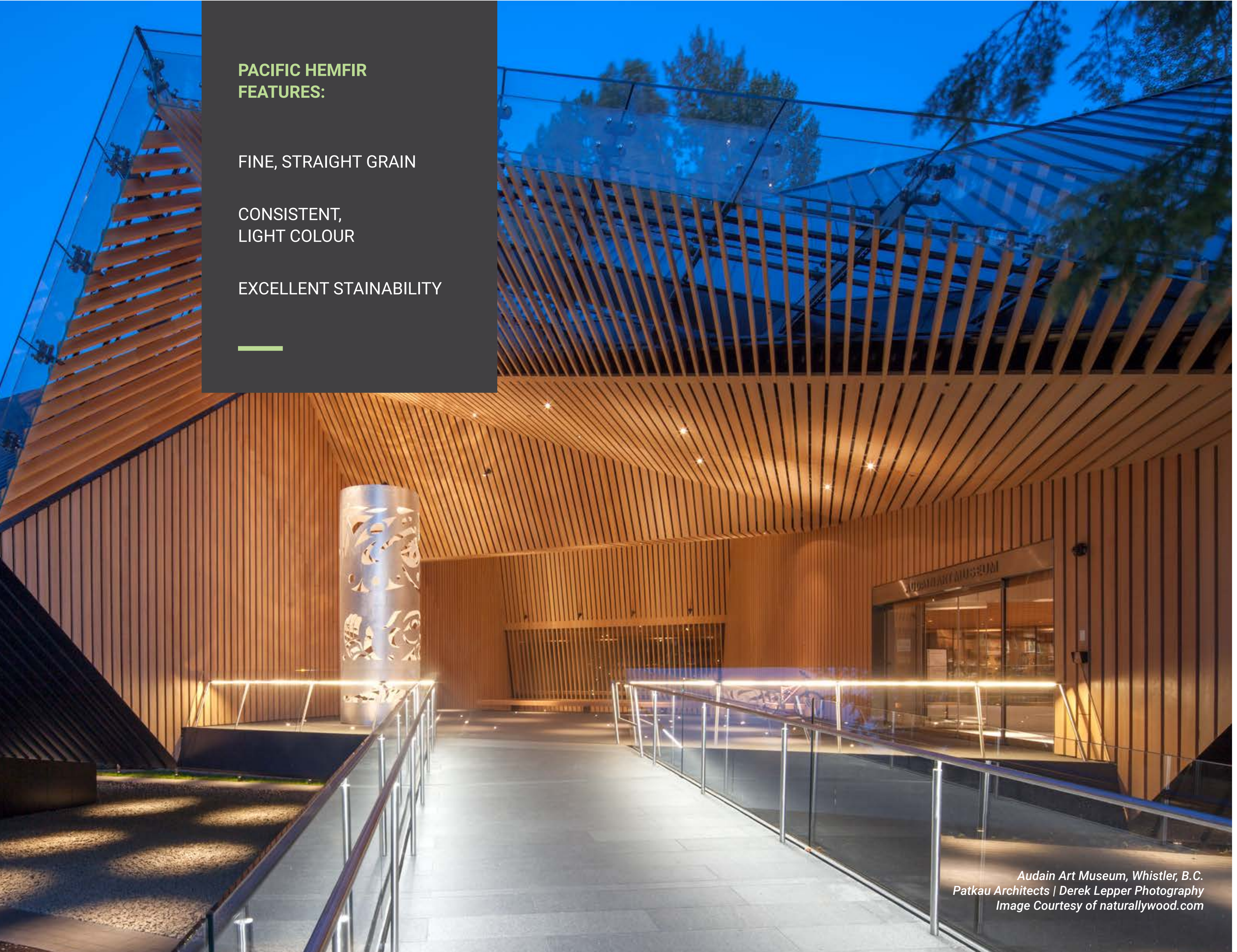
Beautiful, sustainable and strong. Put Pacific HemFir to work on your next project.

PACIFIC HEMFIR FEATURES:

FINE, STRAIGHT GRAIN

CONSISTENT, LIGHT COLOUR

EXCELLENT STAINABILITY



Audain Art Museum, Whistler, B.C.
Patkau Architects | Derek Lepper Photography
Image Courtesy of naturallywood.com

DESIGN ATTRIBUTES

Pacific HemFir. The **beautiful** choice.

Pacific HemFir is a natural beauty with its fine grain, pale golden colouring, lack of pitch and fashion savvy stainability. Not only does this make Pacific HemFir an excellent choice for appearance and joinery applications, but its innate strength and other notable attributes make it ideal for structural applications where aesthetics are key.

Pacific HemFir has beautiful, consistent, light-coloured tones ranging between creamy, nearly white to a warm, light straw. Some Pacific HemFir may have a slight lavender cast—which gives it a natural appeal—especially around the knots and in the transition area between the spring and summerwood's growth rings. The heartwood is not distinct. Sometimes small, delicate dark grey or black streaks appear in the wood.

Pacific HemFir is non-resinous and because of its light color, freedom from pitch, excellent machining properties and fine, straight grain, it takes any stain, finish or preservative like a pro. This combination of light colour and excellent stainability also means that Pacific HemFir can easily be made to look like many other high value wood species such as teak or oak.

Its even texture gives Pacific HemFir a refined appearance and enables it to sand smoothly and glue easily.

Does your project need performance *and* extraordinary beauty?
Look no further than Pacific HemFir.

Nature and Art Become One

Enveloped by evergreens, the Audain Art Museum prominently features Pacific HemFir throughout, providing a seamless transition from the surrounding natural landscape.

The project's architect, David Shone, Patkau Architects, says the firm carefully selected appearance grade Pacific HemFir for its warmth, beautiful aesthetic qualities and fabrication capabilities.

Openings in the matte black metal exterior are overlaid with inviting, luminous Pacific HemFir casing. Public spaces in the interior, which are visible from the exterior, continue to feature the honey-hued wood. Together this creates a charming effect, giving visitors the sense that the wood is glowing out of the black cladding, mimicking a larger-than-life lantern in the forest. At night and in winter, this impression is particularly stunning as the building radiates warmth.

The use of native Pacific HemFir "resonates with the powerful alpine landscape in which the museum sits and reinforces a connection to the region that inspired much of the art collection within," says Shone.

The Audain Art Museum—a building truly in harmony with nature.

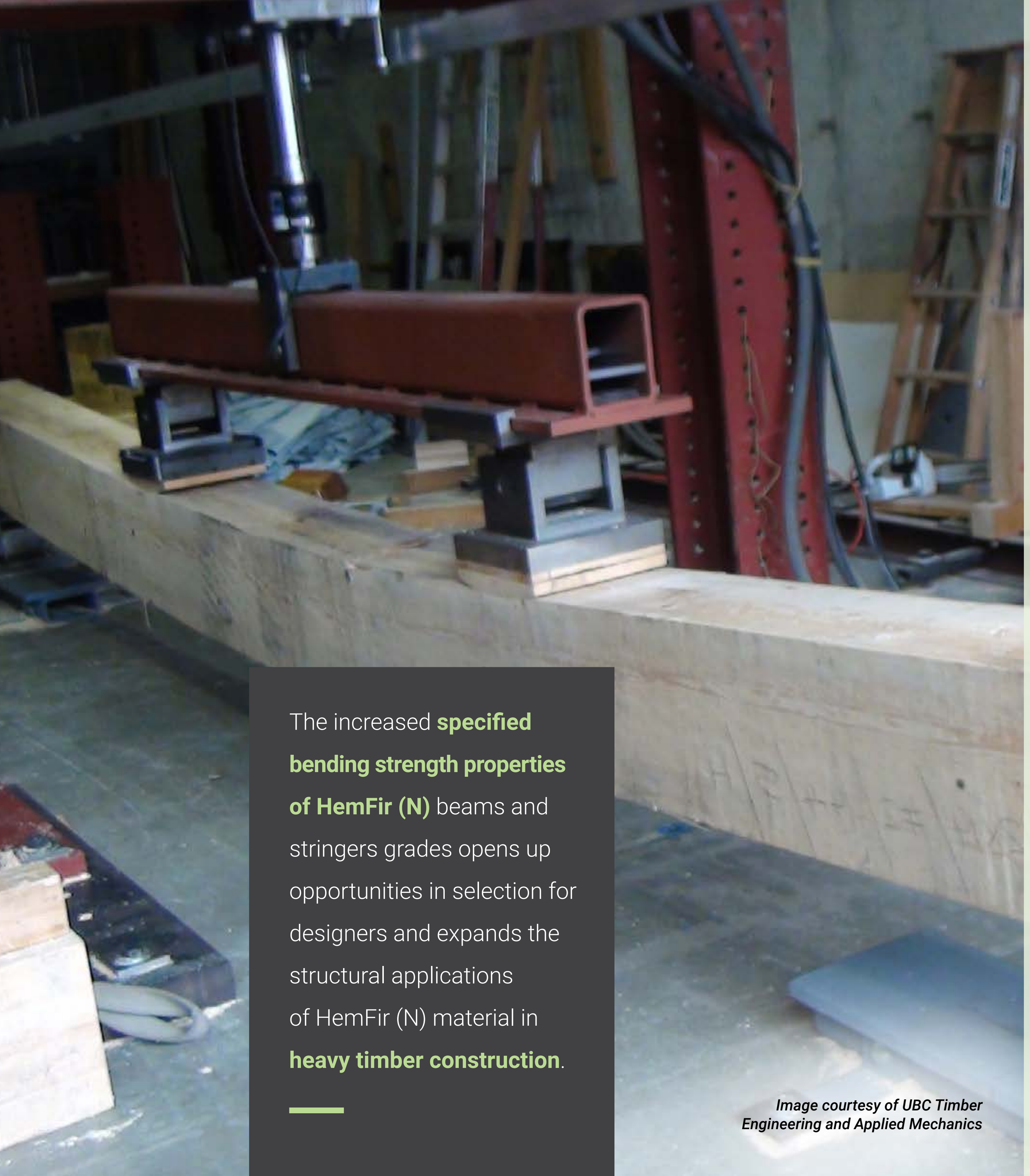
LEARN MORE

Comparative Physical Properties of Pacific HemFir

	HIGH RANGE ◆	LOW RANGE ●	HEMFIR AMABILIS FIR	HEMFIR WESTERN HEMLOCK
Physical Properties				
Density (12%-kg/m^3)			445	480
Specific Gravity (12% m.c.)			0.39	0.43
Bending Strength (MOR)(MPa)			68.9	81.1
Stiffness (MOE)(x103MPa)			11.4	12.3
Compression parallel to grain (MPa)			40.8	46.7
Compression perpendicular to grain (MPa)			3.6	4.5
Shear (MPa)			7.5	6.5
Cleavage (N/mm)			36.8	37.5
Dimensional stability			9.2	7.8
(Shrinkage % green to O.D.)			4.4	4.2
Hardness (N)			1820	2740
Durability				
Natural durability (approx. life in contact with ground)	>10 yrs	≤ 10 yrs	●	●
Treatability (preservatives or fire)	permeable – moderately resistant	resistant – extremely resistant	◆	◆
Drying				
Drying rate	rapid – moderate	fairly slow – very slow	◆	◆
Tendency to check during drying	absent or easily controllable	controllable with some care	◆	◆
Tendency to distortion during drying	absent – slight	moderate	◆	●

Images Courtesy of naturallywood.com

	HIGH RANGE ◆	LOW RANGE ●	HEMFIR AMABILIS FIR	HEMFIR WESTERN HEMLOCK
Workability				
Machining (planing/turning/moulding/ mortising/boring, etc.)	good – excellent	fair	◆	◆
Blunting	very little/slight – little/slight	moderate	◆	◆
Nailing/resistance to splitting	well – excellent	poor – satisfactory	◆	◆
Screw/nail holding	good – excellent	satisfactory	◆	◆
Gluing	w/out difficulty – exceptional	difficult – satisfactory	◆	◆
Finishing				
Natural colour: whitsh[1], lt. buff[2], yellwsh-brn[3]			1,2,3	1,3
Paint finishing	good – excellent	poor – satisfactory	◆	◆
Stain finishing	good – excellent	poor – satisfactory	◆	◆
Tendency to resin exudation	absent or infrequent after drying	acceptability depends on finish to be used and visual standards required	◆	◆
Miscellaneous Properties				
Tendency to corrode ferrous metals	likely	unlikely	●	●
Becomes stained in contact with ferrous metals	likely	unlikely	●	●



The increased **specified bending strength properties of HemFir (N)** beams and stringers grades opens up opportunities in selection for designers and expands the structural applications of HemFir (N) material in **heavy timber construction**.

Image courtesy of UBC Timber Engineering and Applied Mechanics

TIMBER IN-GRADE TEST PROGRAM: BACKGROUND AND RATIONALE

Before the 1980s design values for structural lumber products in Canada were derived from small clear wood testing procedures on different species of wood. Adjustment factors were applied to account for the effects of grade, member size, moisture content etc. to convert small, clear test results to design values for lumber of a specific grade, size and species group. In the mid-1980s, implementation of the in-grade testing philosophy allowed for more direct evaluation of the strength properties of lumber products. This resulted in a more realistic assessment of their structural performance to meet the reliability-based design principles of the CSA 086 Engineering Design in Wood.

METHODOLOGY

Timber In-grade Test Program

For larger dimension timber products, with member thickness greater than 100 mm, very limited in-grade data exist on strength properties. In the early 1980s the University of British Columbia conducted an in-grade testing program on Douglas fir "Beam and Stringer" timber of Select Structural and No.1 grades. Characteristic bending strength properties were established, based on proof testing of material from a participating mill. From this database, specified strengths for bending strength and modulus of elasticity (MOE) of Douglas fir-Larch "Beam and Stringer" timber were modified in the code CAN/CSA-086.1-M89.

The HemFir (N) species group comprises two species: Western hemlock (*Tsuga heterophylla*) and Amabilis fir (*Abies amabilis*).

As in-grade data on the bending strength properties of HemFir (N) and Spruce-Pine-Fir were not available, specified strengths for these species were derived by relating the small, clear strength properties of these species' groups to those of Douglas fir-Larch.

In 2012 the National Lumber Grades Authority and Coast Forest Products Association commissioned an in-grade testing program on HemFir (N) timbers. Representative samples of over 1,400 pieces of HemFir (N) timber in three grades (Select Structural, No.1 and No.2) and nine sizes from a minimum of three B.C. mills were obtained. **Table 1 shows the test matrix.**

Table 1: Number of specimens tested for each cell

	Grade	10 × 10	10 × 12	10 × 14	12 × 12	12 × 14	6 × 10	6 × 12	6 × 6	8 × 12
Rough Green	No.1	11	13	3	30	3	11	4	15	10
	No.2	55	55	16	56	55	60	56	53	55
	S.S	54	55	8	54	42	58	53	59	53
Rough Dry	No.2	-	-	-	55	-	51	-	-	-
	S.S	-	-	-	54	-	55	-	-	-

Note: Cells which reached or exceeded target sample size 53

The sampled material was obtained over a time period to add temporal variability. All sampled material was delivered to the University of British Columbia Timber Engineering and Applied Mechanics (TEAM) Laboratory (IAS accredited) for testing. Graders onsite determined the grade and genus of each piece. A name consisting of the mill code, size, grade, production date, specimen number, and the genus was written on each piece by the grader in the format of: Mill code / size / grade / year-month / piece number / genus. This unique name was used as the identity of every specimen throughout the following test and report. The Grading Controlling Characteristics (GCC) and Maximum Strength Reducing Characteristics (MSRC) were also identified and marked by the grader for most of the specimens.

METHODOLOGY

The test material was evaluated in 'as received' conditions at the UBC TEAM Laboratory. Before the static bending test, the following physical measurement information was collected:

- the piece identification
- the moisture content by a 2-pin Delmhorst Moisture Metre
- the number of growth rings along a 76 mm (3 in) line
- the cross sectional dimensions
- the GCC and MSRC of each piece
- the acoustic speed in the timber by the HITMAN HM200
- the overall weight of each piece

A static bending test was conducted to establish the bending strength and MOE of each piece. The testing followed the third-point loading method specified in Section 7 of ASTM D198 – 14. The load bearing blocks were located at one-third of the span from the reactions, with a span to nominal depth ratio of 18:1. The deflection of the centre point, relative to the two ends on the neutral axis, was measured by a yoke deflectometer and a LVDT (Linear Variable Differential Transformer) transducer. The test setup for MTS Flextest GT Structure Test System is shown in Figure 1.

The timber was loaded at a constant rate of 15 mm/min, in accordance with Section 9 of ASTM D198 – 14. When the displacement of the LVDT reached 25-30 mm (10 mm for 6×6), the loading was paused to allow the LVDT and the yoke to be taken off, then the loading resumed until the piece failed (defined by the load dropping below 75% of the peak). The data acquisition was sampled at a rate of 4 Hz.

Figure 1:
Static bending test setup

Image courtesy of UBC Timber Engineering and Applied Mechanics

After completion of the static bending test, the failure characteristics were identified and coded. A photo of the failure section and a photo of the cross section near the failure (tension side marked with a "T") were also taken.

A slice (35-45 mm thick) free of defects was cut from the tested specimen for weight and dimension measurements. The slice was oven-dried afterwards for moisture content and specific gravity measurements. For every third piece in the sequence of testing, a section of 1.3 m (50 in) was cut and then machined to two 63.5 mm × 63.5 mm (2.5 in × 2.5 in) defect-free pieces. This material was conditioned in a constant climate room (20°C, 65% relative humidity) until equilibrium. Small clear tests were conducted in accordance with ASTM D143 - 14. The tests included static bending, compression perpendicular to grain, and shear parallel to grain. This data allowed comparison of the measured small, clear data with existing data to confirm the resource quality.

RESULTS

In total 1,212 full size specimens were tested in static bending and 921 small, clear specimens were tested in the small, clear tests. The third-point loading static bending test provided the data to calculate the modulus of elasticity (MOE_B) and modulus of rupture (MOR). The average moisture content was in the range of 31-68% for the green timber cells and 13.7-14.9% for the dry. The average specific gravity was in the range of 0.35-0.41. "*Abies*" accounted for no more than 20% of the specimens in 28 cells out of 31 and 22-47% for the rest.

The Canadian Wood Council adjusted the bending strength data to a referenced moisture content of 15% following ASTM D1990-16 procedures. The bending strength test data of various test cells was further combined to a characteristic depth of 343 mm using a Weibull-based size adjustment coefficient for depth of 1/9. Both the moisture adjustment and size effect adjustment procedures were verified by the test data.

Reliability normalization evaluations were performed to convert the test statistics to specified bending strengths for the Canadian Code on Engineering Design in Wood of 16.8 MPa, 14.4 and 14.4 MPa for the grades of select structural, No.1 and No.2 HemFir Beams and Stringers timbers with a characteristic depth of 343 mm. Formal reliability analysis was also performed to confirm the normalization procedures yielded a reliability index of 2.7, which meets the target reliability index value from in-grade testing and reliability-based design of dimension lumber. Specified design values for Modulus of elasticity E and E_{05} were also established as 11500 and 8000 MPa for select structural; 11000 and 7500 MPa for both No.1 and No.2 grades, respectively.

Based on results of the in-grade test program, a code change proposal was prepared and accepted by the CSA CSA 086 Technical Committee on Engineering Design in Wood, the Canadian Standard. The changes are reflected in Table 6.6 of the Canadian Code on Engineering Design in Wood CSA 086:19 **(see Table 2; page 16).**

Compared to the 2014 version of the code CSA 086:14, there are significant increases in the specified bending strength properties of HemFir (N) Beams and Stringers grades **(see Table 3; page 17).** Increases in the specified bending strength fb of HemFir (N) ranged from 14% for the select structural grade to 53% in the No.2 grade. Similarly, increases in the specified modulus of elasticity of HemFir (N) ranged from 13% for the select structural grade to 27% in the No.2 grade. These large increases can be reflected by realistic evaluation of strength properties following the in-grade testing philosophy. Furthermore, lower grade material included material from fall-downs of higher grade due to checks and small unsound knots. The down-graded material tended to be high quality; hence, allowing the lower grade to be assigned high specified bending strength properties.

Based on results of the in-grade test program, a code change proposal was prepared and accepted by the CSA 086 Technical Committee on Engineering Design in Wood, the Canadian Standard.

Table 2:
Specified strengths and moduli of elasticity for Beams and Stringers, MPa from CSA 086:19

Species combination	Grade	Bending fb* MPa	Longitudinal shear fv MPa	COMPRESSION Parallel to grain fc MPa	COMPRESSION Perpendicular to grain fcp MPa	TENSION Parallel to grain ft MPa	MODULUS OF ELASTICITY E MPa	MODULUS OF ELASTICITY E_{05} MPa
Douglas Fir-Larch	SS	19.5	1.5	13.2	7	10	12000	8000
	No.1	15.8		11		7	12000	8000
	No.2	9		7.2		3.3	9500	6000
HemFir	SS	16.8	1.2	13	4.6	7.4	11500	8000
	No.1	14.4		12.4		6.3	11000	7500
	No.2	14.4		12.4		6.3	11000	7500
Spruce-Pine-Fir	SS	13.6	1.2	9.5	5.3	7	8500	6000
	No.1	11		7.9		4.9	8500	6000
	No.2	6.3		5.2		2.3	6500	4500
Northern Species	SS	12.8	1	7.2	3.5	6.5	8000	5500
	No.1	10.8		6		4.6	8000	5500
	No.2	5.9		3.9		2.2	6000	4000

(Source: Table 2, CSA 086:19, Engineering design in wood. © 2019 Canadian Standards Association. Please visit store.csagroup.org)

Table 3:
Comparison between specified bending strength properties of HemFir(N) Beams and Stringers in CSA 086:14 and CSA 086:19.

Species combination	Grade	CSA 086:14 BENDING fb MPa	CSA 086:14 MODULUS OF ELASTICITY E MPa	CSA 086:14 MODULUS OF ELASTICITY E_{05} MPa	CSA 086:19 BENDING fb MPa	CSA 086:19 MODULUS OF ELASTICITY E MPa	CSA 086:19 MODULUS OF ELASTICITY E_{05} MPa
HemFir	SS	14.5	10000	7000	16.8	11500	8000
	No.1	11.7	10000	7000	14.4	11000	7500
	No.2	6.7	8000	5500	14.4	11000	7500

(Source: Table 3, CSA 086:19, Engineering design in wood. © 2019 Canadian Standards Association. Please visit store.csagroup.org)

CONCLUSION

The National Lumber Grades Authority and Coast Forest Products Association commissioned an in-grade testing program on HemFir (N) timbers, which evaluated 1,212 full size specimens in static bending and 921 specimens in small, clear tests. Based on the in-grade test results, the Canadian Code on Engineering Design in Wood CSA 086:19 published new specified bending strength properties of HemFir (N) Beams and Stringers grades. Significant increases in the specified bending strength fb of HemFir (N) ranged from 14% for the select structural grade to 53% in the No.2 grade.

The increased specified bending strength properties of HemFir (N) Beams and Stringers grades opens up opportunities for structural application of the product. For example, comparing the specified strength properties of HemFir (N) to Douglas Fir-Larch Beams and Stringers, the No.2 HemFir (N) material (fb=14.4 MPa and E=11 GPa) exceeded the No.2 Douglas Fir-Larch material (fb=9.0 MPa and E=9.5 GPa) significantly. This offers more selection opportunities for designers and expands the structural application of HemFir (N) material in heavy timber construction.

Based on the in-grade test results, the Canadian Code for the Engineering Design in Wood CSA 086:19 published new specified bending strength properties of HemFir (N) Beams and Stringers grades. Significant increases in the specified bending strength fb of HemFir (N) ranged from 14% for the select structural grade to 53% in the No.2 grade.

PACIFIC HEMFIR SUPPLIERS

Where to Buy

Riverside Forest Products

T: (1) 604.580.4500

LEARN MORE

Skeena Sawmills

Lumber Sales
T: (1) 604-800-5990

LEARN MORE

Teal Jones

Whitewood
Lumber Sales
T: (1) 604-587-8700

LEARN MORE

Western Forest Products

Sales
T: (1) 604-648-4500

LEARN MORE

Image courtesy of UBC Timber Engineering and Applied Mechanics

PACIFIC HEMFIR PARTNERS

Partially Funded by
Financé partiellement par

Natural Resources Canada / Ressources naturelles Canada
Canada

Forestry Innovation Investment

In partnership with

Wood Preservation Canada
Préservation du bois Canada

Western Forest Products
DEFINING A HIGHER STANDARD

Canada Wood
Produits de bois canadien

Skeena SAWMILLS

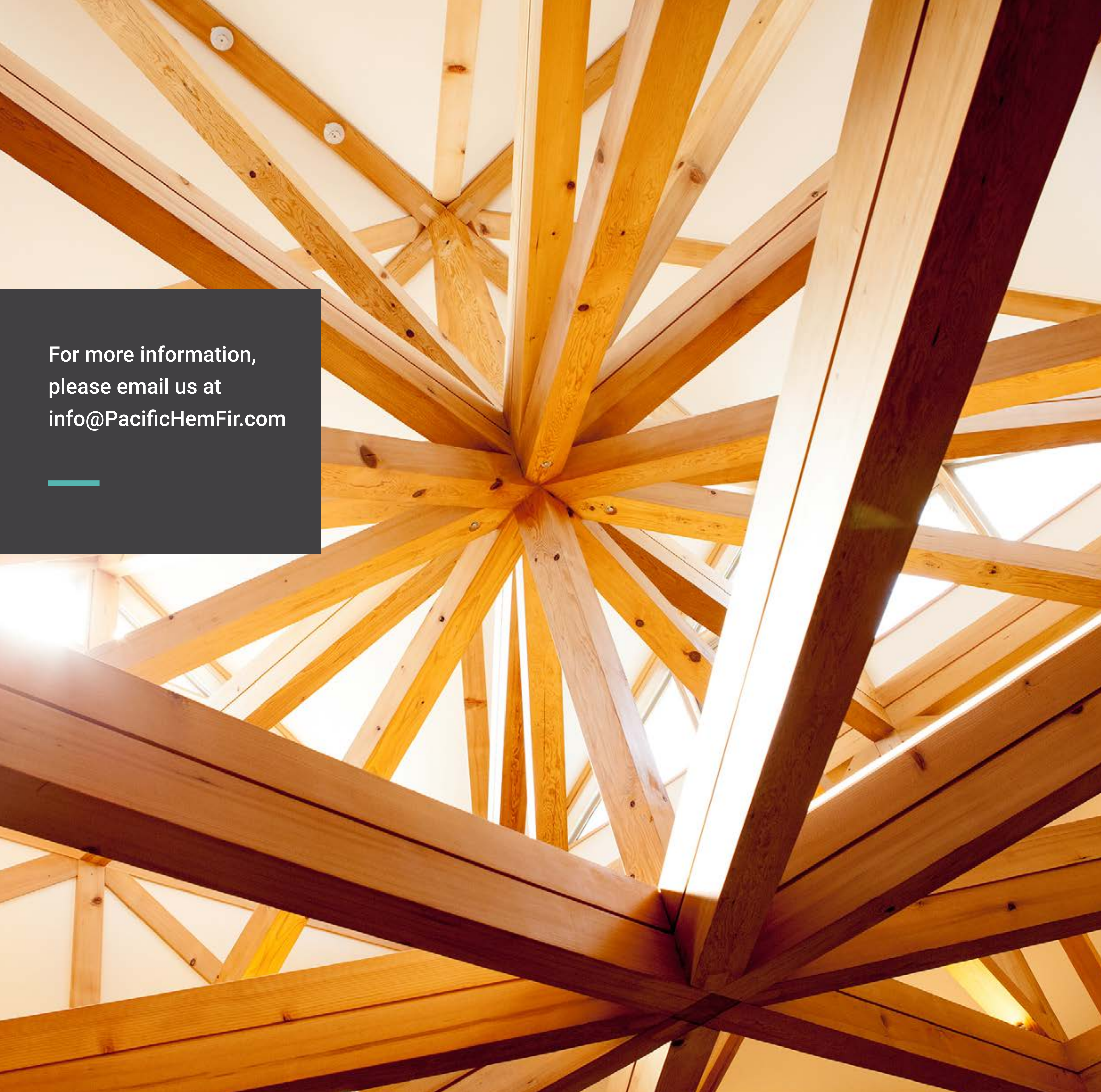
IWPA BC

BC WOOD

BC COUNCIL OF FOREST INDUSTRIES

RIVERSIDE
FOREST PRODUCTS INC

The Teal-Jones Group
A Family Of Fine Forest Products



For more information, please email us at info@PacificHemFir.com

Strong
Straight
Dense
Treatable
Versatile
Sustainable
Plentiful
Durable

PacificHemFir.com