Forintek Canada Corp.

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Western Division

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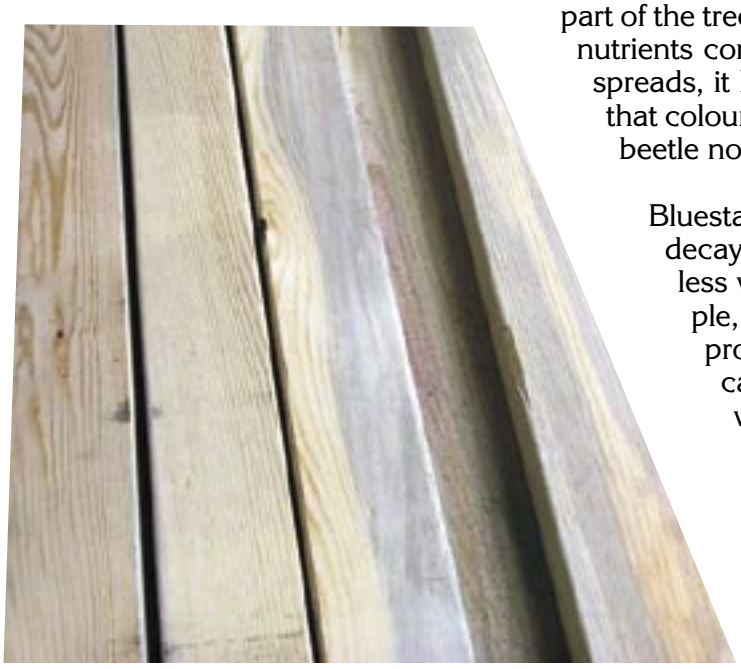
Properties of Lumber with Beetle-Transmitted Bluestain

Users of lumber are probably familiar with bluestain. Some may wonder if the amount and type of stain transmitted by the mountain pine beetle affects the wood in any way. Comprehensive testing recently confirmed that beetle-transmitted bluestain has no practical effect on strength properties or gluing characteristics. Neither does the bluestain affect the adhesion of furniture finishes. The stain causes some possibly beneficial changes to dimensional stability, checking and permeability.

Regular customers for western spruce-pine-fir lumber have probably seen some bluestain, a subtle streaking in the lumber. At the moment, bluestain is more prevalent than in the past, because British Columbia is currently experiencing a large natural outbreak of mountain pine beetle (MPB). Native to the forests of western North America, the MPB attacks several species of pine trees, including ones commonly used for construction lumber and panels. The beetle carries with it a staining fungus that weakens the tree's defences which allows the insect to lay eggs under the bark.

While the beetle stays just under the bark, the fungus can grow throughout the sapwood (the outer part of the tree) feeding on sugars, carbohydrates and other nutrients contained within the wood cells. As the fungus spreads, it leaves behind a permanent blue or grey stain that colours products made from this wood. Neither the beetle nor the fungus eats the wood structure itself.



Bluestain fungi are not mold, nor do they cause decay (rot) problems. They are considered harmless with respect to both wood products and people, and are typically dead by the time the wood products leave the manufacturer. The wood can be handled exactly as with non-bluestained wood. Because it looks slightly different, questions are sometimes asked about bluestained wood. Forintek performed a series of tests to address any possible marketplace concerns and to provide a scientific basis for the anecdotal evidence that bluestained wood is equivalent to non-bluestained wood.

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Property Tested	Results	Implications
Stiffness and breaking strength	No significant difference.	These are the most important strength properties for structural applications. Bluestained wood is as strong and as stiff as non-bluestained wood.
Impact resistance (toughness)	Slightly lower (5%) impact resistance for bluestain.	Toughness is not a critical strength property for most end-uses of wood but is one of the first properties affected by biological agents. The small reduction is much lower than previously reported for other types of wood and staining fungi and is of no practical significance in construction.
Truss plate grip capacity	Measurable (6%) increase in ultimate grip capacity but similar slip for bluestained wood as for non-stained wood.	Good plate grip capacity is critical for the design and manufacture of trusses. The measured increase is not of practical significance for truss design.
Dimensional stability and checking (in repeated wetting/ drying)	Bluestained wood was significantly less prone to warping when tested in our simulation of outdoor exposure. Cracks were significantly smaller in bluestained wood.	Bluestained wood seems to develop micro-checks (hairline cracks). This may have implications for kiln-drying practices, as well as potential benefit for the appearance and performance of wood in outdoor use. True outdoor testing is needed to clarify the implications.

Bluestained lumber may be a good candidate for decking material.

Property Tested	Results	Implications
Permeability and treatability with preservatives	Bluestained sapwood wets more readily with water. The heartwood resistance to treatment is unchanged.	Bluestained sapwood is more easily treated with wood preservatives and fire retardants. Note that the green tint of many preservatives reduces the colour contrast between bluestained and non-bluestained wood. The combined benefits of bluestain-masking, increased treatability and improved checking appearance indicate that bluestained lumber heavy-to-sapwood is probably a good choice for treated decking products. Increased permeability may have implications for air or kiln drying—bluestained wood may dry faster.
Glue joint integrity	No difference between bluestained and non-bluestained wood in joint durability and strength.	No changes required for use of either structural or non-structural adhesives with bluestained wood.
Finishes for masking bluestain	Best masking of bluestain for furniture grade products is achieved with stains, toners or glazes containing blue, red or charcoal tints.	Furniture manufacturers could use combinations of these tints to reduce the colour contrast between bluestained and non-bluestained wood without making the final product too dark.
Finishes for enhancing bluestain	Clear finishes are best at enhancing or highlighting the bluestain.	Some people find the bluestain visually appealing.
Finish adhesion	No difference between bluestained and non-bluestained wood.	No changes required in the use of stains, toners and glazes.

Test details

Over 500 8',10' and 12' pieces of lodgepole pine 2x4 or 2x6 lumber were collected from 14 B.C. interior sawmills for these tests.

The evaluation of mechanical properties involved clear wood tests, which are sensitive indicators of any potential impact of bluestain on performance of lumber. Full-size lumber may contain knots, sloped grain and so forth, all of which are more critical factors for mechanical properties outweighing any small effect of bluestain. Toughness (also known as impact bending strength), stiffness (bending modulus of elasticity - MOE), breaking strength (modulus of rupture - MOR), and the parallel-to-grain lateral resistance of the truss plate teeth in tension were all tested according to appropriate ASTM or CSA standards.

There is no standard test for dimensional stability and checking of lumber in service caused by repeated wetting and drying. Forintek has developed and regularly uses its own accelerated wetting/drying protocol and assessment procedure. Various measures of how far off "true" the lumber was (bow, crook, cup, twist), check length and check width were measured, and appearance of the checks was visually assessed and assigned a rating.

Permeability to liquid was tested in both simple soaking and pressure treatment. The wood preservative chromated copper arsenate (CCA) was used as a tracer, since permeability characteristics are important to the wood treatment process. An additional benefit of CCA as a tracer is that it stops moving into the wood immediately upon completion of the soak or pressure process. Uptake and retention were measured for all samples. Before and after weights were also measured.

The glue joint tests were conducted to determine performance for typical applications in both structural and non-structural uses. To simulate a non-structural application such as furniture, panels were made using radio frequency-curable polyvinyl acetate (PVA) adhesive. For an example of a structural application such as glulam, pieces were joined using phenol resorcinol formaldehyde (PRF). The integrity of the glue joints was tested using the vacuum pressure delamination test, and assessment of bonding quality was done using the block shear test by compression loading, in accordance with ASTM and other standards.

The finish tests were limited to furniture finishes that, unlike paints, do not completely hide the wood's natural appearance. A variety of stain, toner and glaze finishes were applied to the samples, alone and in combination. Finish adhesion was tested using ASTM standard industry tape tests. Appearance evaluations for the various finishes were subjective.

More Information

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This document is available in Japanese Translation.

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