



Exposed Wood Structures

Deterioration due to aging cannot be eliminated, but good design, workmanship and appropriate maintenance will slow the rate of deterioration.

There is a long tradition of wood construction of residential buildings in British Columbia. Wood is valued for its strength, cost effectiveness and natural visual qualities. In addition to its use in structural framing, wood is used as a finishing and cladding material. Much of the wood used in buildings is concealed in walls and building interiors. However, in many buildings, wood elements are also used on the building exterior and are exposed to the environment. Examples of exposed wood elements include siding and trim, posts, decks, walkways, stairs, balcony guards and fences.



Exposed wood posts, trim, balcony guards and decks require regular maintenance to retain their appearance and function.

This bulletin provides guidance on the review and maintenance of exposed wood to help ensure that these components achieve their intended service lives and maintain their appearance.

Why Perform Maintenance?

Buildings represent a significant financial investment for society as a whole and for individual homeowners. The costs associated with buildings can be broken down into a number of categories. The costs of initial construction, review and maintenance, repair and eventually the costs of renewal or replacement of components are all part of the building life cycle costs. Costs incurred after the initial construction of the building are significantly affected by decisions made at the time of the original construction. While most owners have no control over these early decisions, they can minimize future repair and replacement costs through effective building management.

All elements of a building that are exposed to the weather are subject to deterioration over time. Deterioration due to aging cannot be eliminated, but good design, workmanship and appropriate maintenance will slow the rate of deterioration.

Maintaining your building envelope

This publication is one in a series of bulletins designed to provide practical information on the maintenance of the building envelope of multi-unit residential buildings, including townhouses, low and high-rise residential buildings.

What is a building envelope/enclosure?

The building envelope or building enclosure includes all parts of the building (assemblies, components and materials) that are intended to separate the interior space of the building from the exterior climatic conditions. It includes, for example, the foundation, exterior walls, windows, exterior doors, balconies, decks and the roof.

Who should read this bulletin?

Anyone who lives in or looks after a multi-unit residential building should read this bulletin, including residents/unit owners, strata councils, housing co-operatives, maintenance managers, property managers or building owners. Proper maintenance of the building envelope can help prevent damage and avoid costly repairs in the future.



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Things to Know About Wood

Knowledge of the characteristics of wood can assist in making good decisions regarding the maintenance and replacement of exposed wood components.

All wood is susceptible to decay, however, the rate of deterioration varies depending on the species. One of the most common types of wood used in exterior applications is cedar. Cedar has a natural resistance to decay, although over time, given specific conditions, it may decay. The durability of other wood species can be increased by means of chemical treatments.

Factory applied preservative treatment, as opposed to field applied treatment, provides the most reliable protection. Alkaline copper quat (ACQ), copper azole (CA) and chromated copper arsenate (CCA) type preservatives are suitable for exposed exterior conditions, while borate type preservatives are only suitable for situations protected from continuous exposure to liquid water. Only preservative treated wood that has been incised (small slots created in the sides of the wood so that preservative chemicals can penetrate more deeply) should be used when placed in contact with soil. Field cuts, notches and holes should be treated with preservatives specifically intended for field cuts as they are formulated to soak into the wood and penetrate well through the end grain.

The most common reason for the replacement of exposed untreated wood structures is decay. Decay, or rot, occurs due to the growth of specific fungi which feed on the fibres in the wood.



Open joints collect water and lead to deteriorated beams and columns at the connection.



Roof or canopy structures minimize wetting of wood posts and beams.

Exposure to fungal spores that develop into fungi cannot be avoided as the spores are found everywhere. These spores will germinate and grow if the following four requirements are present:

- oxygen
- mild temperatures
- moisture, and
- suitable food (the wood).

For exposed wood structures, control over oxygen and temperature is not possible. However, control over the other two requirements is possible. Eliminating either one of these requirements will eliminate the potential for fungal growth and decay.

Limiting Exposure to Moisture

Exterior wood elements come in contact with moisture through exposure to rain or ground water. A third possible form of exposure to moisture, ambient exterior humidity, does not cause exposed wood to reach the required high moisture content levels that would allow deterioration to occur.

Whenever possible, it is recommended that exposure to moisture be eliminated or minimized. Many exterior wood elements can be protected from wetting by roofs or metal flashings. Sloping of horizontal wood surfaces for positive drainage, and detailing that allows drying, are some other ways to limit the time that moisture stays in contact with the wood.

Exposure to moisture may also be limited by the application of coatings such as paints or



Metal cap flashing on exposed beam ends prevents water from collecting on the upper horizontal surfaces.

stains. However, their use must be carefully considered as some coatings will also restrict drying of the wood structure in the event that water unintentionally penetrates past the coating at some location. There are almost always breaks in the coating caused by the seasonal expansion and contraction of the wood with changes in humidity levels. If the wood is not coated before assembly there may also be portions of the structure that have not been reached during coating application, e.g. inaccessible surfaces at connections.

Painting will provide the greatest degree of protection. Species such as cedar can also be coated, but the use of stains and paints is more of an aesthetic issue as the wood is more durable and can be left exposed.

The sole use of protective coatings to extend the service life of exposed wood structures is not reliable and can be maintenance intensive compared to other measures to limit exposure. Further discussion of coatings is provided later in this bulletin.

Untreated wood exposed to ground moisture will decay rapidly. Treated wood and decay-resistant wood will have greater durability, but will eventually deteriorate after many decades. Exposure of wood to ground water can most easily be eliminated at the design stage. For example, wood posts can be mounted on top of concrete piers to avoid direct soil contact with wood. In situations where direct contact with the ground cannot be avoided, the use of free draining crushed stone, and sloping the top surface of the soil at grade away from the post, can limit the amount of water that remains in prolonged contact with the wood.

Insects

There are a number of insects that cause damage to wood. In British Columbia, moist wood or wood in close proximity to soil are most affected.

Carpenter ants are black in colour and distinctive for their large size, 6 to 10 mm long. They excavate into wet wood for shelter rather than food. Subterranean termites are also found in some areas of B.C. They are somewhat ant-like in appearance; those found inside wood are white in colour while those observed outside wood are orange or brown. They will consume moist wood.

Wood bugs, wood lice, sow bugs and pill bugs are different names for the same organism.

These bugs can only survive in moist conditions and do not consume sound wood. Their diet is mainly decaying matter. Strategies for reducing the possibility of insect damage are generally the same as those used for avoiding decay; the elimination or reduction of moist conditions and avoidance of wood in close proximity to soil.

Preventative Maintenance and Improvements

Most maintenance and renewal tasks are dictated by the original design and construction of the building. Owners usually do not have input into building or changing the components and materials used in the original construction. The exposed nature of some of these elements means that they are easy to access and, therefore, some of the techniques discussed earlier can actually be implemented as retrofit measures.

For example, it is possible to add roof overhang extensions, canopies or metal caps to limit the amount of moisture to which the wood is exposed. In addition, it is possible to improve some details through the use of sealant or improvement of drainage. Adding boron rods to an exposed wood structure will reduce decay potential in larger wood members. Note that the effectiveness of using boron rods is limited because the preservative will leach out of the wood over time, but they can be renewed in service.

A knowledgeable trade contractor or building professional will be able to provide advice on the maintenance and improvements in any specific situation.

Once these opportunities for improvements have been investigated, the ongoing maintenance efforts would largely focus on the inspection and maintenance of coatings.



Wood lice.



Deteriorated post in direct contact with soil.



Installation of boron rods at base of post will provide greater resistance to decay. Boron rod shown leaning against base of post and locations where installed are highlighted by white arrows.

Wood Coatings

Wood is usually coated for several reasons:

- to enhance appearance
- to minimize ultraviolet degradation, and
- to protect against moisture exposure and fungal degradation.

Coatings are generally composed of three components: solvent, pigment and binder. The solvent thins the pigment resin mixture to application consistency. Pigment provides the colour and gloss adjustment. The binder, or resin, binds the pigment particles together and adheres the film to a surface, giving the paint durability and adhesion.

Coatings are classified according to their binder, typically: alkyd, latex, acrylic, epoxy or urethane. The type of binder plays a large factor in the performance of the coating. However, the type and amount of pigment in a coating will also significantly affect its performance.

The performance and durability of coatings is dependent on many factors besides the basic paint composition and quality of application. Surface preparation and compatibility between substrate and coating are critical to the durability of the coating.

When repainting, the existing paint composition needs to be determined so that compatibility with the new coatings can be checked to ensure long-term adhesion.

There are other conditions that affect the effectiveness of coatings. Coatings always perform better on non-horizontal surfaces. Many clear coatings can provide excellent resistance to water, but some allow the transmission of visible light which degrades the underlying surface fibres of the wood. This can result in peeling of the coating layer even if ultraviolet light resistant coatings are used.

Coatings can also be applied to wood that has been pressure treated with waterborne preservatives.

Coating selection, surface preparation, and coating application require specialized knowledge and should include consultation with a professional. The condition of coatings should be checked annually, preferably by a qualified painter, for signs of aging and deterioration such as:

- faded colours
- cracks, and
- flakes and blisters.

A typical range of recoating frequency is two years for some clear coatings to seven years for some high quality paints.



Paint peeling from wood substrate.



Probe reveals deteriorated wood post masked by solid stain.

As a general rule, recoating should be done when the previous finish is just beginning to show signs of aging, and before it loses its ability to protect the component. However, if the finish on particular components or portions of the buildings begins to show signs of deterioration earlier than others (because of differences in exposure or orientation) it may be appropriate to develop different recoating schedules. If recoating of wood is left too long, permanent damage may occur, and recoating at that time may not rectify the damage that has occurred. The frequency at which recoating should occur is dependent upon many factors including coating type and exposure conditions. A typical range of recoating frequency is two years for some clear coatings to seven years for some high quality paints.

In addition to visual review of the coatings, spot probing of the integrity of the wood should also be performed as coatings can sometimes mask decay.

About Fasteners

Pressure treated dimensional lumber utilizes ACQ or CA as the preservative. Another product, CCA, is still used for shingles, permanent wood foundations and some plywood. ACQ and CA preservatives are highly corrosive to many metals. Hot-dipped galvanized or stainless steel fasteners should be used in exposed wood structures.

More information on this issue can be found in the HPO's bulletin *Builder Insight #8 – Compatibility of Fasteners and Connectors with Residential Pressure Treated Wood*.

Planning Replacement

Even with good maintenance, exposed wood structures will eventually require replacement. Replacement will be less disruptive, and less expensive, if it is planned in advance and integrated with other planned maintenance and renewal activities.

Yearly inspections will assist in being able to predict when replacement or renewal will be required. As with any renewals project, consideration should be given to all aspects of the project:

- design, including opportunities to improve aspects of the original design as presented earlier
- type of wood
- fasteners
- coatings
- contractor selection, and
- timing and sequencing of the work with other planned activities.

It is beneficial to seek assistance from a qualified consultant on these matters, particularly on larger scale projects. Where structural members are replaced, input from a structural engineer should be obtained.

Proper planning can save money in the short and long-term. Anticipate maintenance needs and future replacement work when planning replacement details.

The following checklists provide a few basic reminders of good inspection and maintenance practices applicable to most exposed wood structures. Of course, the best inspections are those done by knowledgeable contractors and building professionals who may notice things that the average homeowner may miss.



Corroded nails removed from deck boards.

Annual Inspection Checklist for Exposed Wood Structures

- Check for evidence of water collecting on wood surfaces, including moss and algae growth, aging coatings, and other building elements that do not allow water to readily drain.
- Check for localized deterioration of wood components.
- Perform random spot probes for decay. If a woodworking awl penetrates past the surface of the wood with hand pressure, it is a sign that deterioration has occurred.
- Check coatings for signs of aging.
- Check for exposure to moisture and proximity to soil.

Maintenance for Fences

- Wherever possible, keep soil away from the fence. Soil against the fence will increase the moisture level in the wood and facilitate decay.
- Promote good drainage in the area of the fence and away from fence posts.
- Direct irrigation sprinklers away from the fence.
- Maintain coatings.

Maintenance for Wood Walkways and Wood Decks

- Review the condition of deck boards, fasteners, connectors and support structures at sample locations. Check for deteriorated wood and corroded fasteners.
- Clean walking surfaces by scrubbing with biodegradable soap and water. Do not pressure wash as this may damage the wood.
- Remove debris and keep drainage and drying paths free of obstructions.
- Deteriorated wood components should be replaced with preservative treated wood or naturally durable wood, and appropriate fasteners and connectors.

Yearly inspections will assist in being able to predict when replacement or renewal will be required.



Fasteners.



Repairs and renewals should be designed and directed by a qualified trades contractor.



Extended canopy beam with fungi.

Maintenance for Exposed Structural Members

In addition to the wood elements previously discussed, buildings can have exposed wood structures that support portions of the building, for example, supports for balconies or roofs. Buildings can also have free standing column and beam structures supporting trellises or canopies. The following maintenance is recommended:

- Yearly inspections should include spot review and probes at the top surfaces and ends of individual wood components. These locations can be particularly vulnerable to undetected deterioration.
- Deteriorated wood components should be replaced with preservative treated wood and appropriate fasteners and connectors. A structural engineer should always be consulted if significant wood replacement is required.
- Consideration should be given to moisture protection (e.g. flashings) to exposed horizontal surfaces and joints.
- Borate rods can be inserted into large structural members at locations where they will intercept pathways for the intrusion of moisture.



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Disclaimer

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Action Plan Tips

- Keep records of all inspections and maintenance activities.
- Inspect exposed wood structures yearly, using appropriate checklists based on information in this bulletin. Inspections should be performed by a qualified tradesperson.
- Repairs and renewals should be designed and directed by a qualified trades contractor or building enclosure consultant. If structural elements are involved, a structural engineer should provide input.
- Ensure that exposed wood elements are included in the building's maintenance and renewals plan.

For More Information

1. *Builder Insight #8: Compatibility of Fasteners and Connectors with Residential Pressure Treated Wood*, published by Homeowner Protection Office (HPO) and available online at www.hpo.bc.ca.
2. For more information on design, construction and maintenance of wood structures for durability, including borate treatment and finishing exterior wood, visit www.durable-wood.com.



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