



FORESTRY EXTENSION NOTES

PROPER USE OF WOOD IN OUTDOOR APPLICATIONS

Wood can provide acceptable, long-term service in applications where it is exposed to the weather, if it is durable, stable, and easily maintained. Consider the following recommended guidelines to enhance the performance of exterior wood.

First, the right species or type of wood must be selected, and the proper grade must be specified. Second, the wood must be installed at the appropriate moisture content level for the intended use. Third, wood components must be fastened together with recommended types of corrosion-resistant fasteners and/or waterproof adhesives. Finally, the wood surfaces and joints must be finished properly.

Type of Wood

In most applications, the user has only limited choices in terms of species or type of wood. Wood exposed to the weather must be either naturally durable or must be treated with appropriate wood preservative chemicals to ensure long life. Most types of wood are subject to deterioration by wood-destroying fungi, insects, and weather factors. Only the heartwood of any species resists attack by fungi and insects. Heartwood is the inner portion of the cross-section of a tree generally characterized by a change in color and in many physical and chemical properties. Furthermore, only a relatively few species have naturally durable heartwood, and even

fewer are commercially available as construction lumber.

In most parts of the country, only *baldcypress*, *cedar*, or *redwood* are available as naturally-durable construction lumber, and the availability of baldcypress is limited in many areas. The most common species of cedar processed into construction lumber is *western redcedar*, although heartwood from other cedar species can certainly provide good service. Several other wood species have heartwood with a high level of natural durability, but these are not typically available as construction lumber. For example, black locust, black walnut, catalpa, and osage-orange are hardwood species with high resistance to decay but are not commonly available for use in construction applications.

Only *all-heartwood* grades of baldcypress, cedar or redwood lumber will have the required level of durability; grades with mixed sapwood and heartwood should not be used for exterior applications. Another advantage of these three woods is their dimensional stability when subjected to moisture content changes; minimal shrinking and swelling are characteristics of these species. Surfaces of these woods also tend to wear more uniformly than many other species which is considered a desirable attribute for outdoor woods.

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The other type of wood that is appropriate for outdoor use is lumber that has been pressure-treated with an appropriate wood preservative. Wood preservative chemicals may be dissolved in petroleum products or in water. An example of an oil-borne preservative would be a five percent solution of pentachlorophenol in light oil. However, oil-borne treatments are typically not appropriate where direct, regular contact with people is likely. For most outdoor applications, the appropriate choice is lumber commercially pressure-treated with water-borne preservatives.

Water-borne preservative treatments with a high level of resistance to leaching have only been commonly available since the early 1950's. These preservative chemicals bond to the wood during the treating process and become essentially insoluble in water. The most common type of water-borne preservative chemical used to pressure-treat lumber for outside applications is *CCA (chromated copper arsenate)*. Other wood preserving chemicals that have resistance to leaching are *ACA (ammoniacal copper arsenate)* and *Celcure (acid copper chromate)*, but by far the most common type used is *CCA*.

One caution is appropriate; wood pressure-impregnated with *CCA* must be exposed to certain minimum levels of temperature for adequate lengths of time to enable the chemicals to react with and become fixed in the wood. At 90 degrees F, fixation occurs in 24 to 48 hours, but it takes about three weeks for the necessary reactions to occur at 55 degrees F. Such chemical reactions essentially cease below freezing; leaching of the chemicals may occur in wood treated at low temperatures and used immediately. *CCA*-treated lumber should always be dried before using in outdoor applications.

Because of environmental concerns, some firms are currently actively involved in

developing and marketing wood preservatives that do not contain arsenic or chromium. These new formulations may well become the choice in the future.

CCA-treated lumber is pressure impregnated to three specific levels related to recommended applications. The lowest level of pressure treatment is identified for "Above-Ground" use, the middle level of chemical retention is labeled for "Ground Contact" applications, and the highest level is "FDN" or Foundation grade. Treatment level should be either stamped on the lumber or have a label attached. The Board of Review, American Lumber Standards Committee, accredits agencies for the supervisory and lot inspection of pressure treated wood products. Currently, nine different organizations are approved to provide this service.

The durability of wood can also be modestly enhanced by brushing or dipping with appropriate preservative chemicals. This course of action is only recommended where exposure hazard is low. Perhaps the most common type of wood preservatives used for such nonpressure treatments is a family of products labeled as *water-repellent preservatives*. These formulations combine a fungicide with a material that discourages the penetration of water. In addition, two oil-borne preservatives (without water repellent components) are also available. Copper naphthenate is the preservative most commonly available for do-it-yourselfers; this preservative has largely replaced the now restricted penta solutions for brush or dip applications. Copper-8-quinolinolate is a very safe oil-borne wood preservative, but is only available in some parts of the country.

Proper Moisture Content

The second important consideration in using wood outdoors is applying the material at the correct moisture content level. Lumber and other wood products should always be dry;

for most parts of the country, the moisture content of wood used outdoors should be between 12 and 15 percent moisture content. However, most construction lumber is only dried to 19 percent moisture content; this lumber is likely to exhibit shrinkage after installation. In addition, dry lumber may be resoaked with rain or snow during storage at lumber yards bringing the moisture content to unacceptably high levels. Whenever possible, only lumber dried to the appropriate level should be used for outdoor applications; using green lumber should be avoided. Lumber delivered to construction sites that is very wet and heavy should be properly stacked and allowed to air-dry for a period of time before installing. Stack the lumber in an open shed or garage, and provide for air flow between the different layers by using uniform spacers between the boards. Several weeks may be needed to season the wood.

Fasteners

Mechanical fasteners used to assemble lumber in outdoor structures or assemblies should always be corrosion-resistant. Galvanized, aluminum, stainless steel, or other corrosion-resistant nails, screws, lag bolts, or bolts are appropriate choices for assembling wood components exposed to the weather. To achieve maximum durability when using CCA-treated lumber, use fasteners manufactured from special stainless steel (type 304 or 316), silicon bronze, or copper; in less demanding exposures, where the wood is not subjected to frequent water soaking, high-quality, hot-dipped galvanized fasteners may perform adequately.

If wood adhesives are applied to supplement mechanical fasteners, only exterior formulations are recommended. For completely waterproof gluelines that can be cured without using elevated temperatures, only resorcinol resin glues are appropriate for wood; however, these glues must be applied to dry wood. Several different types of exterior

elastomeric adhesives are commonly used in construction today. These adhesives have good exposure durability, are very tolerant of moisture and temperature variations, and develop a somewhat flexible glue line which is less likely to rupture as the moisture content of the lumber changes. Several other moisture-resistant wood adhesives are available for interior uses; however, these are not appropriate for outdoor applications where periodic water soaking is likely to occur.

Finishing

Almost without exception, exterior wood should be protected with a suitable finish. Wood exposed to the weather is subject to deterioration caused by the combined effect of water and sunlight. Wood can be allowed to weather naturally, but undesirable changes will occur on the surface. Checks, splits, and surface roughness will develop, and the color will eventually change to some shade of gray. The most rigorous exposures for wood are horizontal applications which are subject to full sunlight and precipitation; for example, achieving a long finish life on exposed decks presents a major challenge.

Two broad classes of finishes can be used on exterior wood: *penetrating* or *film-forming*. Penetrating finishes include water-repellents or water-repellent preservatives and semi-transparent, oil base stains. Solid exterior stains and paints are the two most common types of film forming finishes; both oil-base and latex-type stains and paints are available for wood.

In many outdoor applications, the more natural, somewhat transparent appearance of penetrating finishes is often preferred. In horizontal exposures where the surface is subject to foot traffic and resulting wear, the penetrating finishes are also the best choice. Many manufacturers of semi-transparent stains recommend applying two coats initially with

the second applied before the first coat is completely dry. A third coat may be required in two to five years.

Where a uniform appearance and maximum protection from weathering is desired, a three-coat paint system is strongly preferred. One highly recommended system is an oil-base primer plus two topcoats of acrylic latex paint. A pretreatment with a paintable water-repellent will add to the durability of the finish and increase the service life. Recently improved latex primers are available and can be used instead of the oil-base formulation. Quality oil-base topcoats can also be substituted for acrylic latex, and are still preferred by some people. The quality of exterior paint is fairly closely correlated with price; one good rule is to never buy anything but the top of the line from a reputable manufacturer. Finishes should be applied to dry surfaces when the temperature is above 50 and below 90 degrees F; elapsed time between successive coats should not be longer than two weeks. The finish should be applied to exterior wood as soon as the surface is dry; extended weathering before staining or painting is not recommended. In general, brushing is preferred over any other application method; direct physical contact with the wood appears to be quite important in promoting longer finish life.

Summary

Care in selection, assembling, and finishing is critical, if outdoor wood is to perform satisfactorily. Select naturally durable or pressure-treated wood, and make sure that it is at the appropriate moisture content. Use corrosion-resistant fastenings and appropriate exterior wood adhesives. Apply recommended high quality exterior finishes or surface treatments to protect wood against weathering.