TechLine

Forest Products Laboratory

Relative Durability of Untreated Wood in Above-Ground Applications

Wood that is exposed in non-soil-contact applications, such as fencing components and window frames, experiences a lower risk of decay than does similar material in contact with the soil. This document summarizes some information on the rate of decay in wood that is not in direct contact with the soil.

Approach

Test units of softwood and hardwood species were exposed on test fences in Gulfport, Mississippi, and Madison, Wisconsin. The test units were constructed of 3/4-in.-thick by 3-in.-wide by 6-in.-long boards, nailed together in a cross formation.

The intersection of the boards provided water catchments similar to joints where wood decay often originates in wood structures. Millwork and vertical fence components may fit into this category. Sapwood was included for all species and heartwood for some. Ten replicates were tested for each tree species. When both heartwood and sapwood specimens were included, 10 replicates of each type were tested. Each summer the units were examined for decay and fungal fruiting bodies. This information was used to establish relative decay resistance and to estimate service life.

Results

Classification of relative decay resistance is shown in Table 1. Average estimated life is the time for more than half the test units of a given species to fail. To be assigned to the most resistant class, the average estimated life had to be $\geq$20 years; resistant species had an estimated life of 14–19 years; moderately resistant, 8–13 years; and nonresistant, $\leq$7 years. (Estimated life is for comparative purposes. Service life of larger structure members could be shorter.)

Climate can affect estimated service life. Wisconsin has a moderate decay hazard climate, and Mississippi has a severe climate, with high levels of rainfall and warm and humid weather. Thus, test units in Mississippi usually had a shorter estimated life than did those in Wisconsin, which is reflected in the assigned durability class.

The estimated life of a species is also affected by board size and type of joint. For example, in southern Mississippi, untreated 4-in.-thick Douglas-fir heartwood was estimated to have a life of 12 years, compared with more than 20 years for ¾-in.-thick boards. The thicker lumber may experience longer periods of moisture retention, which would increase the time that invading fungi can grow and deteriorate the wood.

L-joints provided greater end-grain absorption than did the cross-bracing characterized in Table 1, and thus remained wet longer. Oak L-joint units had an average life of 6 years, compared with more than 20 years for cross-bracing units (Table 2). A flatwise-oriented joint, such as in decking, might also be less durable because of the opportunity for water to puddle around the joint.

Heartwood is generally more durable than sapwood because heartwood can contain extractives that are toxic to decay organisms. However, some species, such as basswood, have no extractives and are exceptions.

Figure 1.Climate-index of above-ground decay potential (Scheffer 1971).

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Table 1. Relative above ground decay resistance of ¾- by 3- by 6-inch cross-braced joints

Most Resistant	Resistant	Moderately Resistant	Nonresistant
Gulfport, Mississippi (Severe decay hazard, Scheffer Climate Index >65)			
Douglas-fir, heart	Douglas-fir, sap	Eucalyptus, sap	Alder, red, sap
Oak, red, heart	Eucalyptus, heart	Hemlock, western, sap	Basswood, heart
Oak, red, sap	Pine, lodgepole, heart	Pine, ponderosa, sap	Basswood, sap
Oak, white, heart	Pine, ponderosa, heart	Pine, red, sap	Birch, yellow, int.[a]
Redwood, heart	Spruce, Engelmann, heart	Pine, southern, sap	Maple, sugar, int.[a]
Pine, western white, heart	Spruce, Engelmann, sap	Pine, western white, sap	Pine, lodgepole sap
	Redwood, sap	Redcedar, western, sap	Poplar, balsam, sap
		Spruce, Sitka, sap	Sweetgum, sap
		Spruce, western white, sap	
Madison, Wisconsin (Moderate decay hazard, Scheffer Climate Index 35–65)			
Douglas-fir, heart	Douglas-fir, sap	Alder, red, sap	None tested
Eucalyptus, heart	Birch, yellow, int.[a]	Basswood, heart	
Oak, red, heart	Eucalyptus, sap	Basswood, sap	
Oak, red, sap	Maple, sugar, int.[a]	Hemlock, western, sap	
Oak, white, heart	Poplar, balsam, sap	Pine, lodgepole sap	
Oak, white, sap	Spruce, Engelmann, heart	Pine, red, sap	
Pine, lodgepole, heart	Spruce, Engelmann, sap	Pine, southern, sap	
Pine, ponderosa, heart		Redcedar, western, sap	
Pine, western white, heart		Sweetgum, sap	
Redcedar, western, heart			
Redwood, heart			
Redwood, sap			

[a]Int. is interior wood, a term used for species that do not have true heartwood

Table 2. Effect of joint type and board size on average estimated life (years) of woods exposed above ground in southern Mississippi[a]

Type of Unit	Pine	Douglas-fir	Red Oak	Maple
Cross-brace (3/4 by 3 by 6 in.)	10	>20	>20	6
L-Joint (1.5 by 1.5 by 8 in.)	6	9	6	5
Plank (4 by 10 in.)	5	12	—	—
Post-rail (1.5 by 3.5 by 12 in.)	7	20	—	—

[a]Estimated life is for comparative purposes. Service life of larger structure members could be shorter.

Learn More About It

Eslyn, W.E.; T.L. Highley; F.F. Lombard. 1985. Longevity of untreated wood in use above ground. Forest Products Journal 35(5): 28–35.

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