

Natural Durability of Timber by classes

Some species of trees are more effective at resisting biological hazards such as fungi and termites than other species. This natural resistance or durability is a function of the type of extractives the tree stores in its heartwood. Durability is not determined by the density or 'hardness' of the species. Designers can match the natural durability of a particular species with the hazard classification to specify an appropriate species for a specific application.

Sapwood

Sapwood of most species has little durability because there are no extractives contained in the wood, and it is laden with starches (normally intended for the growth of the tree, but also essential for the growth of fungi).

[Link to details on sapwood](#)

Heartwood

The resistance of a particular species to attack from fungi and termites is determined by the type of extractives stored in the heartwood.

[Link to details on heartwood](#)

Durability Classes

Species are rated according to their ability to resist attack from biological hazards – Class 1 for highly durable species to Class 4 for non-durable species. The durability class only relates to the heartwood of the species (not the sapwood).

Natural durability refers to the durability of the heartwood of timber species with respect primarily to resistance to decay and termite attack in an in-ground situation. Natural durability ratings or classes are assigned with respect to in-ground service in an adverse environment, ie. High moisture content, high temperatures and presence of subterranean termites.

Natural durability is measured by examining the progressive decay of small wooden stakes buried in the ground at a number of locations around Australia, "graveyard tests". The range of test sites has been selected to cover different climates and different soils around the nation. The stakes are periodically sampled to see how much degradation has taken place over time. The data on durability are continually being updated, and the table in the Australian Standard is modified as evidence of performance in tests or of performance of timber in buildings is made available. The table is continually updated as new data from tests becomes available. It can take decades to fully assess a species for its natural durability.

Natural durability cannot be measured in one country and used in another. Australia has different environmental conditions that can accelerate fungal and termite degradation when compared with North America or Northern Europe. Also our range of fungal and insect species is different to other parts of the world and may give greater or lower deterioration rates (even on the same species) compared with the species mix in North America, Europe or Asia.

Durability classes are appropriate for heartwood only. All untreated sapwood is considered non-durable. Core wood (wood from the very centre of the tree) generally also has marginally lower natural durability than the rest of the heartwood as it was laid down when the tree was immature and production of the full range of extractives was not fully developed.

The durability classes are:

Class 1 – highly durable

Class 2 – durable

Class 3 – moderately durable

Class 4 – non-durable

AS1702.2 *Properties of Timber* includes a table of some commonly used species and their durability class.

The following is an excerpt from the table. The table shows some species rated according to their resistance to biological hazard. Notice that while some of the Class 1 species such as ironbark are very hard, it is not hardness or density that causes the resistance. Cypress has a much lower density than ironbark, but has comparable durability. Note also that the ratings do not take into account natural variation within a species, preservative treatment, variations in design or maintenance schedules.

Durability Class	Species
1 Highly durable	Grey Ironbark Tallowwood Cypress Turpentine Forest red gum Grey gum
2 Durable	Spotted gum Blackbutt Western red cedar River red gum Jarrah Sydney blue gum Stringy bark (yellow and white)
3 Moderately durable	Brush box Rose/flooded gum Keruing Messmate Karri Silver topped stringy bark
4 Non- durable	Douglas fir Hoop pine Slash pine Radiata pine Mountain ash / Tasmanian oak Meranti Unidentified timbers Sapwood of any species

The durability class can be matched to the hazard level to estimate the long-term performance of untreated timber heartwood. However, the life expectancy for any structural material is difficult to predict, and this is particularly so for timber. The life of the material in service is affected by the microclimate (especially by presence of moisture – in the air or direct water contact), and also by the quality and regularity of maintenance. Maintenance includes termite inspections and remedial measure, checking and replacement of surface protection (including paints), and checking for corrosion of connections.

The following table is a simplistic presentation of the expectation of lifetime performance of timber, given an environment in which wise detailing has been used, and regular termite inspection and maintenance schedules are used.

Natural durability class	Heartwood service life (years)		
	H1 fully protected	H3 above ground exposed	H5 in-ground exposed
1	50+	50+	25+

2	50+	30	15 – 25
3	50+	15	8 – 15
4	50+	5 – 8	<5

Some general principles:

- Class 3 and 4 timbers should not be used for structural members in H3 environments unless stringent detailing and workmanship, treatment or sealing has been specified.
- H6 environments require the use of Class 1 timbers.

Note that where maintenance is neglected, it is possible for even a Class 1 timber to degrade in service within 25 years if it is intermittently in contact with water. Absolute life expectancy is almost impossible to determine. None the less, the relative durability of species and treatments will assist in selecting between available materials to satisfy durability expectations. Probabilistic approaches are being developed and will be incorporated in future reliability-based design procedures for the durability of timber.