TIMBER QUEENSLAND

TECHNICAL DATA SHEET

ISSUED BY TIMBER QUEENSLAND

OUTDOOR TIMBER PERFORMANCE

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RECOMMENDED PRACTICE // JUNE 2012

The satisfactory performance and life expectancy of timber used in outdoor applications is dependent upon a number of factors including:-

- **the type and level of hazard to which the timber is exposed**
- **the natural durability of the heartwood of the particular species**
- **the type and level of preservative treatment (if any)**
- **supplementary preservative maintenance (if any)**
- **protective coatings and their ongoing maintenance (protection from weathering)**
- **corrosive resistance of metal fasteners.**

The heartwood of many species has a high natural durability and preservative treatment to the required 'H' level will provide equivalent or greater durability to the sapwood.

Environmental hazards include weather exposure, termite and other insect attack and fungal attack. The type and degree of hazard varies markedly around Australia with severe conditions in the tropical north to less severe in the temperate south.

Correct timber and fastener selection, design, detailing, finishing and maintenance is necessary to maximise performance. Maintenance ensures that protection systems remain functional and the use of appropriate corrosion resistant fasteners is necessary to achieve equivalent life to that of the timber.

Additional information on specific applications and practices is provided in the following Timber Queensland technical data sheets.

- TDS 4 | Residential Timber Decks
- TDS 6 | Recommendations for the use of Treated Pine Outdoors
- TDS 7 | Timber Decks Commercial, Industrial and Marine
- TDS 8 | Timber Garden Walls
- TDS 13 | Timber Decks Close to the Ground
- TDS 16 | Species Properties and Uses
- TDS 19 | Pergolas and Carports
- TDS 23 | Timber Handrails and Balustrades
- Advisory Note | Recommendations for the use of H3 LOSP Treated Pine

NATURAL DURABILITY

The durability class, which indicates natural durability, relates to the resistance of the heartwood of the species to fungal and insect (including termite) attack. Natural durability classes, are assigned with respect to in-ground service in an adverse environment (i.e. high moisture content, warm temperatures and the presence of subterranean termites) or above ground, exposed to weather, well ventilated situations as appropriate. Evaluation of natural durability has been obtained from service records, field stake trials and laboratory studies. Table 1 gives guidance on expected service life. Table 4 provides a list of some common species and durability ratings.

PRESERVATIVE TREATMENT

To use sapwood in weather exposed situations, including ground contact, it is necessary to increase the durability of the sapwood by preservative treatment. It should be noted that when timber is treated, the treatment preservative will penetrate the sapwood but will not penetrate the heartwood to any significant extent. In any external weather exposed application it is therefore necessary to consider both the natural durability class (relating to the heartwood) of the species used and the level of preservative treatment (relating to the sapwood).

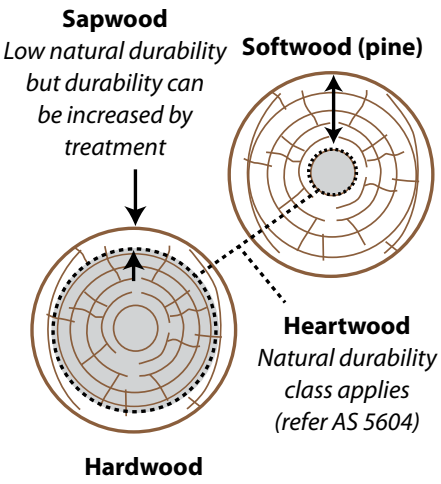
TABLE 1 - GUIDE TO SERVICE LIFE

Natural Durability Class	Heartwood Service Life (years) (For 'H' Class refer to Table 2)	
	H3 (Above Ground Exposed)	H5 (In-ground Contact)
Class 1 Highly Durable	>40	25+
Class 2 Durable	15-40	15-25
Class 3 Moderately Durable	7-15	5-15
Class 4 Non-durable	<7	< 5

*Note: 1. The service life given in the above table will be subject to **wide variation** depending upon climatic conditions, preservative treatment, finishing, maintenance and building practice. Life expectancy can be extended by application of supplementary preservatives.*

2. The untreated sapwood of all species should be considered as Class 4, non-durable.

Generally, hardwoods (broad leaf trees) have narrow sapwood bands but in softwoods (conifers) the sapwood band predominates and is usually very wide.



In-ground and Above Ground Durability Classes are quite distinct. Refer to AS 5604.

Australian Standards and referenced publications in the Building Code of Australia limit the amount of untreated heartwood that is permitted in preservative treated timber. Generally, for framing and sawn posts etc used in weather exposed situations, untreated heartwood should not exceed 20% of the cross section. For decking and similar board products, additional limits may apply. Treated timber is required to be branded with the hazard level ('H' class) to which it has been treated in accordance with AS1604.

ENVIRONMENTAL HAZARDS AND PRESERVATIVE TREATMENT

Hazard Classes are designated as H1 through to H6. H1 and H2 relate to timber protected from the weather and H6 relates to marine applications. **This data sheet does not cover applications in hazard classes H1, H2 or H6.**

Hazard Class H3 represents a service condition that is outside, above ground and exposed to the weather. Typical applications in this hazard class would include fence rails and palings, decking, deck framing, pergola beams and rafters, cladding and external balustrades. See Figure 1 and Table 2.

Satisfactory performance for this hazard class is obtained from Above Ground Durability Class 1 timbers where any sapwood present has been preservative treated to 'H3'. Similarly, Durability Class 4 softwoods (radiata, slash or hoop pine) will also perform well where the sapwood is treated to 'H3' and the untreated heartwood is limited and for LOSP treated timber, it is used in accordance with Advisory Note - Recommendations for the Use of H3 LOSP Treated Pine.

Hazard Classes H4 and H5 represent outside, in-ground applications subject to extreme wetting. Hazard Class H4 is appropriate for non-structural or other applications that are not critical or where a lesser service life would be acceptable. Typical applications in hazard class H4 include fence posts and landscaping. For structural or more critical applications such as piles, house poles, stumps and retaining walls etc Hazard Class H5 shall apply. Refer Table 2 and Figure 1.

To gain a satisfactory service life for these hazard classes, the heartwood of hardwood needs to be In-ground Durability Class 1 or 2 as required by Table 2 and the sapwood needs to be preservative treated to 'H4' or 'H5' as appropriate. Plantation softwoods are predominantly sapwood and with the sapwood treated to the appropriate level they will perform well in these service conditions provided any untreated heartwood is limited.

APPLICATION

Both the natural durability and level of preservative treatment are important to achieve satisfactory service life. It is therefore not advisable to use low natural durability hardwoods (Class 3 and 4) containing a predominance of heartwood in weather exposed situations where hazards are severe. Where hazards are less severe (drier/colder climates) they may provide satisfactory performance if appropriately detailed, finished and maintained.

Species of low above ground natural durability (Class 2, 3 & 4), containing high proportions of heartwood may, in some above ground weather exposed applications, have a reduced service life, even though the sapwood has been treated for an H3 hazard, and should therefore be limited to non-structural applications.

WEATHERING, FINISHES AND MAINTENANCE

Other than for aesthetic reasons, the main objective of applying and maintaining finishes (paints and stains) on timber used in external applications is to minimise the effects of weathering (exposure to sun and rain leads to wetting and drying and subsequent checking, splitting and distortion) and therefore to maximise the service life of the timber.

Application and maintenance of finishes should not be considered as a substitute for ensuring that the inherent durability (natural or by treatment) of the underlying timber is appropriate to the service life required for the applicable hazard level.

Finishes do not provide a complete moisture seal, but a suitable finish will reduce movement from moisture uptake and loss and will also reduce the effects of weathering.

From in-service performance data and recent research it has been found that low quality and or poorly maintained acrylic paints, applied to low durability timber, may actually speed up the onset and progress of decay by a factor of two. This is caused by the paint system permitting moisture entry and then trapping the moisture in the timber.

Conversely, a quality acrylic paint system applied to a highly durable timber such as a Class 1 or CCA, ACQ or Copper Azole treated pine, will extend the service life by delaying the effects of weathering and subsequent water entry. It has also been found from research that the application and regular maintenance of pigmented oil based stain finishes or water repellent preservatives on low durability timber will extend service life by inhibiting the onset of decay and weathering due to the water repellency and preservative nature of these products.

Dark coloured paints and stains should be avoided as they heat timber to elevated temperatures which cause greater loss of moisture and subsequent shrinkage and checking. Decay is also more active at higher temperatures.

End grain and surfaces within joints should be sealed with an oil based primer, stain or water repellent to maximise service life.

TABLE 2 - GUIDE TO HAZARD CLASS AND SUITABLE TIMBER

Service Condition	Hazard Level	Possible Hazards Encountered	Appropriate Applications	Requirements for Hardwoods and Softwoods
Outside above ground (exposed to the weather - see Figure 1)	H3	Moderate decay conditions (rot), borers and termites.	Fence palings and rails, cladding, decking, fascias, pergola rafters, beams and battens, handrails and balustrades, posts not in ground.	● Hardwoods of Above Ground Durability Class 1 or better with sapwood preservative treated to H3. (Small proportions of untreated sapwood may be permitted by some grading standards) ● Some Above Ground Durability Class 2 and 3 timbers are suitable in some locations for non-structural uses in these applications depending on climate, detailing and maintenance of the protective coating. ● Softwoods preservative treated to H3 or better with untreated heartwood limited.
In-ground	H4	Severe decay conditions, borers and termites.	Non critical applications such as fence posts, landscaping, garden walls and pergola posts.	● Hardwoods of In-ground Durability Class 2 or better with the sapwood limited or preservative treated to H4. ● Softwoods preservative treated to H4 or better with untreated heartwood limited.
In-ground contact or in fresh water	H5	Very severe decay conditions, borers and termites.	Critical applications such as house piles and posts, structural retaining walls, deck posts, poles, decking close to or on the ground and similar.	● Hardwoods of In-ground Durability Class 1 with the sapwood removed or preservative treated to H5. In-ground Class 2 rounds with a complete envelope of sapwood preservative treated to H5. ● Softwoods preservative treated to H5 or better with untreated heartwood limited.

Note 1. Irrespective of the hazard level or durability class, the sapwood of lyctus susceptible hardwoods should be preservative treated.
2. Table 4 outlines common species, their termite resistance, Durability Class and susceptibility to lyctus attack.

DETAILING

Good building design and construction detailing, which takes into consideration durability issues, can greatly increase the service life of a structure or building. Details that trap moisture and thereby allow water to soak into the timber should be avoided.

Overhangs or capping on end grain are physical systems that reduce levels of exposure. Adequate ventilation is also important as high humidities which can develop, may substantially increase the moisture content and therefore the hazard to which the timber is exposed.

The following are good design and detailing practices that will maximise service life:-

- Provide sloping cuts to the end grain of posts etc to permit rapid water run-off
- Incline the top surface of rectangular hand rails
- Leave a minimum 50 mm air gap to the bottom of posts on stirrups. Timber should be 75 mm clear of the ground for termite inspection in accordance with AS 3660.1.

CORROSION PROTECTION OF FASTENERS

Having ensured that the maximum service life will be achieved in the timber component, it is equally important to match this with nails, screws, bolts and other metal connectors of equivalent service life.

For most situations (up to and including close proximity to protected bays/mild marine) in exposed environments, hot dipped galvanised fasteners will afford the necessary protection from corrosion. The service life of hot dipped galvanised coatings will be proportional to their mass/area or thickness of galvanising and a minimum thickness of 42 microns is recommended for a service life of around 30 years.

For more extreme corrosive environments or where other conditions dictate such as in contact with moist CCA, ACQ or Copper Azole treated timber or in close proximity to swimming pools (within 450 mm of edge) guidance can be obtained from Table 3.

TABLE 3 - SELECTING CORROSIVE RESISTANT FASTENERS

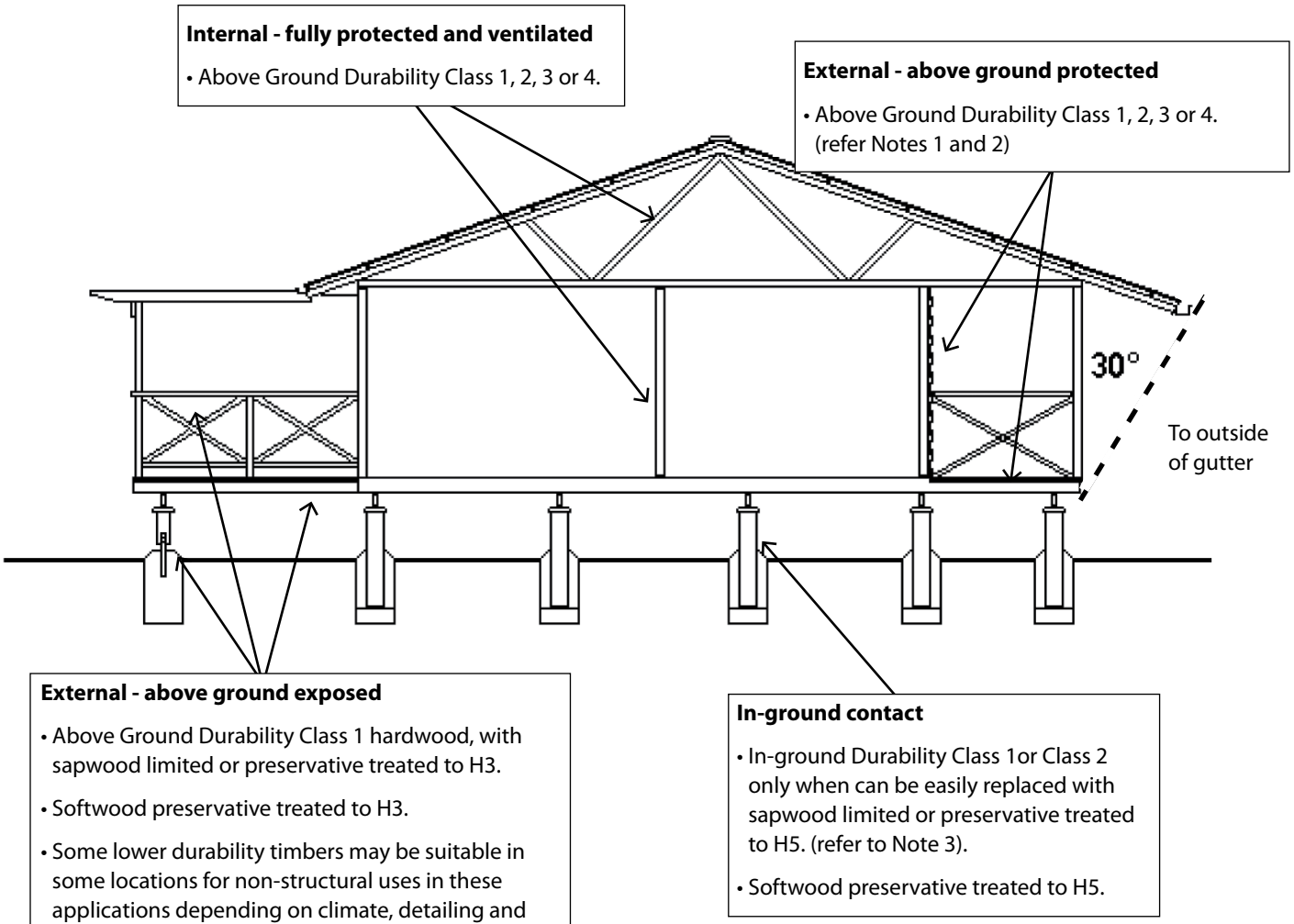
Application/Environment	Fastener Material	Remarks
Chemical, Industrial and Marine (surf beach or large bays)	Grade 316 stainless steel	Grade 304 stainless may require additional protective coatings such as epoxy paints.
Decking close to pools	Monel metal, silicon bronze and brass. Self drilling screws to be Class 4 finish.	Monel nails and screws available, usually used for boat building, are a good option for decking close to pools. Silica bronze nails are available and good for acidic species such as western red cedar.
Mild marine, industrial and other	Hot dipped galvanised or mechanically plated, minimum thickness 42 microns. Self drilling screws to be Class 3 finish.	Where hot dipped galvanised bolts etc are in contact with moist CCA, ACQ or Copper Azole treated timber, additional protection using plastic sheaths or bituminous or epoxy paints is required.

TABLE 4 - SPECIES DURABILITY RATINGS

	Common Species (Standard Trade Name)		Termite Resistance (Heartwood) (AS3660.1/AS5604)	Durability Class (AS 5604)		Sapwood Lyctus Susceptibility (AS 5604)
				Inground	Outside Above Ground	
Hardwoods	Ironbark, Grey		Resistant	1	1	Not Susceptible
	Blackbutt		Resistant	2	1	Not Susceptible
	Gum, Spotted		Resistant	2	1	Susceptible
	Gum, Forest Red		Resistant	1	1	Not Susceptible
	Stringybark, Yellow		Resistant	3	2	Not Susceptible
	Jarrah		Resistant	2	2	Susceptible
	Karri		Not Resistant	3	2	Not Susceptible
	Messmate	Note: Tasmanian Oak is a mix of these three species. Victorian Ash is a mix of Alpine and Mountain Ash.	Not Resistant	3	3	Susceptible
	Ash, Mountain		Not Resistant	4	3	Susceptible
	Ash Alpine		Not Resistant	4	3	Susceptible
	Kwila/Merbau		Resistant	3	2	Susceptible
	Meranti (mixed species)		Not Resistant	4	4	Susceptible
Softwoods	Cypress, White		Resistant	2	1	Not Susceptible
	Radiata Pine		Not Resistant	4	4	Not Susceptible
	Slash Pine		Resistant	4	4	Not Susceptible
	Hoop Pine		Not Resistant	4	4	Not Susceptible
	Cedar, Western Red		Resistant	3	2	Not Susceptible
	Douglas Fir (Oregon)		Not Resistant	4	4	Not Susceptible

Note: For a full list of species properties and uses, refer to Technical Data Sheet 16

Figure 1: Durability and Treatment Requirements for Housing



Note:

1. *External timbers are regarded as protected if they are covered by roof protection (or similar) at 30° to the vertical and they are well detailed and maintained (painted or stained and well ventilated).*
2. *Where framing is in extremely damp or unventilated locations, consideration should be given to using timber of higher durability similar to external above ground applications.*
3. *Hardwood poles for pole frame houses shall be In-ground Durability Class 1 only. Where the member is easily accessible and replaceable, In-ground Durability Class 2 treated hardwood rounds are acceptable. See Table 2.*
4. *Timber Queensland may be contacted for further information and/or assistance concerning the hazards, service life, species selection and appropriate detailing, preservative treatment, finishing and maintenance procedures.*
5. *Refer to AS5604 for In-ground and Above Ground Durability Classes.*

SAFE WORKING

Working with timber produces dust particles. Protection of the eyes, nose and mouth when sanding, sawing and planing is highly recommended. Refer to tool manufacturers for safe working recommendations for particular items of equipment.

DISPOSAL OF OFFCUTS AND WASTE

For any treated timber, do not burn offcuts or sawdust.

Preservative treated offcuts and sawdust should be disposed of by approved local authority methods.

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