

## Introduction

This data sheet provides guidance to designers, specifiers and builders on the specification of timber and timber based products, to ensure efficient use and long term performance. Information is given on timber properties and other issues that need to be considered, and how these should be described on documents.

## Timber Properties

Timber is an organic material with a wide variety of physical and mechanical properties. It is important that a timber species is selected which has the properties suitable for its intended use. The main characteristics that affect the choice are strength, appearance, durability, moisture content (shrinkage rates). Other properties such as density, hardness, smoke development indices etc. will also be important for certain applications. For a schedule of timber species, properties and uses refer to Technical Data Sheet 16 "Species Properties & Uses".

## Strength

Structural timber is graded into categories (stress grades) which can be used to determine member sizes. The stress grade will depend on the natural properties and characteristics of the species (e.g. density, knots, sloping grain).

Stress grades for hardwoods and some softwoods are designated by an 'F' number (F5, F14, F17, F27 etc.). Softwoods are also stress graded with an MGP number.

MGP10, MGP12 and MGP15 exceed the requirements of F5, F8 and F11 respectively, therefore these MGP grades may be substituted when projects are designed/specified using 'F' grade design tables. However, where MGP grades are specified 'F' graded timber must not be used without re-calculating sizes. 'F' grades can be allocated by visual grading, machine stress grading or proof grading. MGP grades can only be allocated by machine stress grading.

## Appearance

Timber comes in a variety of colours, textures and grains. Timber can also exhibit other natural characteristics such as knots, stains, splits, gum veins which would be undesirable for structural purposes (i.e. reduce the stress grade) but may be desirable aesthetically.

A higher stress grade does not automatically ensure a better appearance (could be higher strength timber species with more strength reducing characteristics). Where minimal characteristics are required in structural timber (exposed beams etc.) "appearance grade" should be specified in addition to stress grade requirements. This does not necessarily mean clear timber.

Milled products (flooring, panelling etc.) are manufactured in several grades. When these are to be covered (paint, carpets, etc.) standard grade would be appropriate. Where timber is exposed with a clear or stained finish (e.g. feature "polished" floors) 'select grade' should be specified if minimum natural characteristics are required, or 'natural feature grade' if such characteristics are desired.

## Durability

Durability of timber is the ability to perform its task for a required period of time. This means its performance when exposed to hazards such as decay (fungi) and insects (termites and borers). Timber species have different natural durability characteristics. Species are given a durability classification based upon their expected service life in ground or outside above ground and exposed to hazards.

Durability Class	Durability Rating	Expected Service Life (yrs)	
		In Ground	Outside above ground
1	High	25	> 40
2	Reasonably High	15-25	15 to 40
3	Moderate	5-15	7 to 15
4	Low	< 5	< 7

The durability classifications apply to the heartwood (truewood) of a species. The sapwood of all timber, irrespective of species, is not durable and can be regarded as durability Class 4.

The appropriate durability class must be specified for weather exposed situations (refer Table 1).

*There is a common misunderstanding that the higher the stress grade, the higher the durability. This is NOT the case. There is no direct relationship between stress grade and durability (e.g. certain low durability hardwoods such as Tasmanian Oak can have relatively high stress grades).*

## Preservative Treatment

The durability of sapwood of most species can be improved by impregnation with chemicals.

Only the sapwood of timber can be impregnated and therefore treatment will not change the natural durability of the truewood (heartwood) of a species.

Plantation softwoods have a very large band of sapwood and therefore preservative treatment can effectively increase the durability of the entire timber member (provided heartwood is limited).

The concentrations of preservative chemicals will vary depending upon the degree of exposure to hazards. The treatment level required (i.e. hazard level) should be specified (refer Table 1).

## Termites

Even though the BCA only requires termite protection of the structural elements, it is strongly recommended that WHOLE BUILDING PROTECTION is carried out using physical and/or chemical barriers.

If termite resistant materials are required, all durability Class 1 and some durability Class 2 timbers have a natural resistance to termites. Softwoods can be preservative treated to H2 (or better).

For more information on termite protection refer to Technical Data Sheet No.12 "Protecting Buildings from Subterranean Termites".

**Table 1 Timber Selection for Durability**

Application	Specific Service Conditions	Species Durability Class	Preservative Treatment (Hazard Level)	Comments
Framing, flooring, furniture, interior & joinery	Inside above ground - completely protected from the weather, well ventilated and protected from termites.	Class 1, 2, 3 or 4. (any Timber)	H1 (refer comments)	Timber Utilisation & Marketing Act (TUMA) requires lycid susceptible species containing sapwood to be treated.
Termite resistant framing	Inside above ground - completely or partially protected from weather.	All Class 1 or certain Class 2 hardwoods. (refer AS 3660.1)  Preservative treated softwoods.	H2	'Whole home protection' recommended.
Weatherboards, fascia, window joinery, exterior framing and decking.	Outside above ground subject to periodic moderate wetting and leaching.	Class 1 or Class 2 hardwoods.  Preservative treated softwoods.	H3	
Landscaping (non-structural)	Outside in ground contact or in fresh water - subject to extreme wetting and leaching.	Class 1. Class 2 timbers can be used where the members can be easily replaced.  Preservative treated softwoods.	H4	
Retaining walls, piling, house stumps, building poles.	Outside in ground contact or in fresh water - subject to extreme wetting and leaching.	Class 1. Class 2 timbers can be used where the members can be easily replaced or are protected from full weather exposure.  Preservative treated softwoods.	H5	Poles for pole frame construction should only be Class 1 hardwood or H5 treated softwood
Boat hulls, marine piles, jetty cross-bracing, landings	Marine water exposure - subject to extreme leaching in the marine environment.	Class 1. (also Spotted Gum if double treated)	H6	Extreme exposure should have double treatment. (CCA plus PEC)

**Weathering**

If timber is exposed to the weather for an extended period, the surface will discolour (i.e. fade to a silver grey), checks and cracks may form, and the surface becomes rough.

Varying degrees of protection from weathering may be provided by the application of coatings such as paints, water repellents, water repellent preservatives and pigmented penetrating stains. The main objective is to prevent or retard the uptake of moisture and the absorption of ultraviolet light. (refer Finishes)

Preservatives used to increase durability (protection from decay and/or insects) do not permanently prevent timber from weathering.

**Moisture Content/Shrinkage**

"Green" timber (when it is freshly sawn) has a very high moisture content. Timber will dry out until it reaches the "equilibrium moisture content" of the surrounding environment. The moisture content will then only change if there is a change in air humidity. As timber dries, it shrinks. It can also distort due to uneven shrinkage rates. When using unseasoned timber due allowance should be made for this movement.

Where there is a need to minimise any movement and distortion seasoned timber should be specified in accordance with the relevant Australian Standard. Seasoned means dried to a moisture content approximating the expected conditions of use. This figure is usually based upon an expected average indoor moisture content of 12% (range 10-15%) in coastal areas. External equilibrium moisture content is generally 3% higher than internal. In dry inland locations and in air-conditioned buildings, a lower moisture content should be specified. An average of 9% (range 7-12%) is recommended.

## Structural Timber

The following tables summarise the most common stress grades, readily available sizes and allowable tolerances.

### Seasoned Softwood

Softwood is generally supplied and used in a sized and seasoned form. It is also available preservative treated for termite resistance (H2) and for a range of external uses (H3 to H6).

#### Seasoned Softwood Sizes

mm	70	90	120	140	170	190	240
35	O	O	O	O	O	O	O
45	O	O	O	O	O	O	O
70	X	X	X	X	X	X	X
90	X	X	X	X	X	X	X

O - Commonly available sizes

X - 70 and 90 mm widths are generally made up by vertically nail laminating

Lengths: Up to 6 m in solid sections, (Increments of 0.3 m to 3.0m then 0.6m)

Longer lengths may be structurally joined with nailplates

Tolerances: +5, -0 mm (max 2 mm variation between members)

Stress Grades: Most common stress grades:

F5, F8, F11, MGP 10, MGP 12, MGP 15

### Hardwood

Structural hardwood is usually supplied as a mixture of species, although for specialty applications single species are available. Hardwood can be supplied and used rough sawn and unseasoned, or seasoned which increases in strength, stiffness and stability. Seasoned hardwood is usually sized.

#### Unseasoned Hardwood Sizes

mm	75	100	125	150	175	200	225	250	275	300
38	O	O	O	O	O	O	O	O	X	X
50	O	O	O	O	O	O	O	O	X	X
75	O	O	O	O	O	O	O	X	X	X
100	O	O	O	O	X	X	X	X	X	X

O - Commonly available sizes

X - Additional sizes, usually available on order only

Lengths: Up to 6 m readily available (Increments of 0.3 m)

6 to 6.9 m available on request

Tolerances: Sawn timber: +3, -3 mm.

Sized (max 2 mm variation between members)

Stress Grades: Most common stress grades: F14 and F17

#### Seasoned Hardwood Sizes

mm	70	90	120	140	170	190	240
35	O	O	O	O	O	O	O
45	O	O	O	O	O	O	O
70	X	X	X	X	X	X	X
90	X	X	X	X	X	X	X

O - Commonly available sizes

X - 70 and 90 mm widths are generally made up by vertically nail laminating.

Lengths: Up to 6 m in solid sections (Increments of 0.3 m)

Longer lengths may be structurally joined with nail plates.

Tolerances: +5, -0 mm (max 2 mm variation between members)

Stress Grades: Most common stress grades: F17 and F27

### Cypress

Cypress framing timber is usually supplied and used sawn and unseasoned. If required, it can also be supplied sized.

#### Cypress Sizes

mm	75	100	125	150	175	200	225	250
38	O	O	O	O	O	O	---	---
50	O	O	O	O	O	O	X	X
75	O	O	O	O	O	O	X	X
100		O	X	X	X	X	X	X

O - Commonly available sizes

X - Additional sizes, usually available on order only.

Lengths: Up to 6 m readily available, (Increments of 0.3 m)

Tolerances: Sawn sizes: +2, -4 mm

Sized: max 2 mm variation between members

Stress Grades: Most common stress grades: F4, F5 and F7

## Manufactured Products

Various timber based products are available where smaller timber members or veneers are glued or mechanically joined together to form structural members with increased strength and stability characteristics. These engineered products should only be used strictly in accordance with the manufacturer's specifications.

### Nailplate Joined Timber

Long length components are manufactured by butt-jointing shorter sections. Lengths up to 12.0 metres are possible. Larger section sizes are obtained by horizontally laminating.

Nailplate joined beams are fabricated using either seasoned hardwood or seasoned softwood and are generally not suitable for weather exposed situations.

### Prefabricated Trusses

Engineer designed timber trusses are usually factory fabricated, utilising nailplates to connect each member. Alternative connectors such as bolts and split rings are also available for special truss applications. Trusses are fabricated from cypress, hardwoods and softwoods.

### Glued Laminated Timber (Glulam)

Glued laminated components are fabricated by gluing together the faces of timber laminates.

Glued laminated components are fabricated with seasoned cypress, softwood and hardwood, and can be supplied with camber and manufactured to form arches etc.

### Plywood

There are four types of plywood to suit specific applications - Structural, Marine, Exterior and Interior. The variations are achieved with different adhesives, different stress grades and different species.

The most common plywood panel size is 2400 x 1200. Bracing ply is also manufactured in 2440 and 2740 lengths to suit standard 2400 and 2700 ceiling heights. Flooring ply is available in 2250 lengths to suit 450 joist spacings.

Detailed information on plywood can be obtained from the Plywood Association of Australasia, 3 Dunlop Street, Newstead 4006, Phone (07) 3854 1228 or from the plywood supplier.

### Laminated Veneer Lumber (LVL)

Laminated veneered products are manufactured from softwood veneers which are dried and glued together under heat and pressure.

Section sizes are re-sawn from 1200 mm wide production "slabs". Standard slab thicknesses are 36, 45 and 63 mm.

### Webbed Beams

Panel products such as plywood, LVL, particleboard, hardwood waferboard and oriented strand board (OSB) form the webs in built-up "I" beams and box beams.

### Milled Products

Seasoned timber is machined into a variety of profiles to suit various structural and non-structural applications.

For further information refer to manufacturers specifications or the following:-

- Timber Flooring - Technical Data Sheet 11
- Decking - Technical Data Sheet 4
- Cladding - Technical Data Sheets 3 and 5
- Panelling - Technical Data Sheet 1

**Table 2 Specification Checklist**

ITEM	CONSIDERATIONS/EXAMPLES
Application	Different applications require different specifications - external/internal - framing/joinery etc.
Products	Cladding, flooring, rafters, handrails etc. have different requirements.
Size	<ul style="list-style-type: none"> <li>•Width x thickness x length (if required)</li> <li>•Sawn or dressed sizes (use standard sizes where possible)</li> <li>•Tolerances (note that tolerances are permitted)</li> </ul>
Species	<ul style="list-style-type: none"> <li>•Species groups (hardwood, plantation softwood)</li> <li>•Specific specie where necessary (e.g. flooring, panelling etc.)</li> <li>•Source (Australian/imported/non-rainforest)</li> </ul>
Surface	Sawn, dressed, sized
Profile	<ul style="list-style-type: none"> <li>•Tongue &amp; grooved, end matched (flooring)</li> <li>•Pencil round, reeded finish (decking)</li> <li>•Weatherboard, shiplap (cladding)</li> </ul>
Moisture Content	<ul style="list-style-type: none"> <li>•Seasoned or Unseasoned</li> <li>•for special cases e.g. 7 - 12% (average 9%) for airconditioning</li> </ul>
Durability Class	1, 2, 3 or 4 inground or above ground exposed
Preservative Treatment	Specify hazard level required H3, H5 etc.
Structural (Stress) Grade	F5, F8, F14, MGP10, MGP12, MGP15 etc.
Appearance Grade	<p>Appearance Grade</p> <ul style="list-style-type: none"> <li>•Structural timber - "Appearance" to be specified in addition to the stress grade</li> <li>•For non-structural appearance products - the applicable grade as specified in AS2796</li> </ul>
Fixings	Material, number, size, spacing (consider durability appropriate for exposure)
Fabrication Detailing etc.	Special requirements
Finishing	Clear, stain, paint etc. (number of coats, priming etc.)

## Specification Guidelines

Specifications describe the quality, responsibilities and workmanship of a project. As a general rule quantity (sizes, spacings, etc.) is outlined on drawings. The size and complexity of the specification will generally relate to the size, cost and complexity of the project. Where a project has minimal timber content or is of a relatively small scale, the complete specifications for timber can be included on the drawings. These are generally a series of abbreviated words and numbers each of which describes a particular characteristic of the timber element, accompanied by an arrow which points to the relevant element within the structure.

Specifications on drawings could also use blocks of text including information such as:- a table of suitable species, schedule of timber sizes, fixings, finishing and maintenance.

Large projects require separate specifications which describe in detail the quality of materials and workmanship required. Formal specifications are produced in various formats. Irrespective of which format is adopted, the items listed in Table 2 should be considered and incorporated as appropriate.

Timber Queensland together with the other State Timber Advisory Services have produced a "Timber Specifications" datafile for the NAFI Timber Manuals. This datafile contains draft clauses in the NATSPEC format, which can be adapted for other specification systems.

## Finishes

Finishes to timber are used to increase its durability, reduce the weathering effects of sun and rain, and/or enhance its appearance. In all cases, the manufacturers' recommendations with respect to surface preparation, sealing, priming, number of coats etc., should be followed.

The reasons for internal finishes are primarily aesthetic, and therefore clear or stained products predominate. Gloss surfaces are recommended in kitchen, bathrooms and laundries to allow easier cleaning and reduce the likelihood of mould growth caused by the condensation of steam, fats and oils. Feature floors (and stairs) should be finished by a professional sanding and finishing contractor (refer Technical Data Sheet 11).

Opaque pale colour external finishes, when properly applied and maintained, provide the best protection against weathering. Paints provide a film which is substantially impervious to water and gives maximum protection against the sun's UV. Pigmented stains are available which provide reasonably high moisture and UV protection and do not hide the timber's natural characteristics.

## 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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