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TIMBER FOR EXTERNAL USES

INTRODUCTION

The failure of timber to perform to user expectations when used externally in situations such as decking, pergolas and landscaping is probably the greatest cause for complaint by users and owners alike. Generally though, the fault rarely lies with the timber itself. Rather, the cause is more often the result of a lack of understanding of the material and its inappropriate use by specifiers and users.

Wood is a naturally occurring material and its conversion to timber adds little to its properties. Seasoning and preservative treatment are considered to be further processing and not part of the basic conversion process of wood to timber.

UNDERSTANDING THE MATERIAL

It is critical when using any material in situations where inadequate performance could result in physical or economic loss or damage that specifiers and users have at least some understanding of its properties and characteristics. This is particularly so when using timber which, while being conveniently available and relatively easy to use, can vary greatly in performance depending on the chosen species and its ultimate use.

SOFTWOOD AND HARDWOOD

It is important to understand that the terms hardwood and softwood bear no relationship to the physical hardness or softness of the wood itself. For example Balsa, one of the softest, lightest timbers available is botanically a hardwood and would obviously be unsuitable for use in a structural application. Therefore, when specifying or ordering timber for external use it would be unwise to simply request hardwood. Conversely, a softwood would not automatically be light and easy to work. The primary difference between the two groups is in the structure of the wood, with hardwood having vessels, or pores, whereas softwoods have none.

WOOD STRUCTURE

While an intimate knowledge of wood structure is not necessary to successfully design and build externally with timber, two facts will have a bearing on long-term performance.

Because of its starch and sugar content, non preservative treated sapwood must be considered to be completely non durable and its presence in sawn or milled timbers should be minimised. In New South Wales the presence of sapwood in various types of timber, e.g. sawn, dressed, etc. is limited by the provisions of the Timber Marketing Act (1977). The sapwood is the part of the wood that transmits and stores the nutrients essential for the growth of the tree. These nutrients are stored in the sapwood as sugars and starches which makes it attractive to various fungi and insect pests. The sapwood occurs immediately below the bark and is generally visible as a lighter coloured band encircling the heartwood. It varies in width from approximately 10 mm to as much as the entire diameter of the tree in some instances.

The heartwood (or true wood) is the part of the tree that gives the timber its strength. It occurs immediately below the layer of sapwood and is usually more distinctive in colour. Because of the nature of its formation it is usually difficult to adequately impregnate with preservatives but it does have a higher natural durability than sapwood.
DURABILITY

Forease of expression most timber species are categorised into one of four natural durability classes. These classes relate to the in-ground contact performance of the heartwood only and timbers used out of ground contact and properly maintained would be expected to far exceed the service life indicated in the following table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Service Life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Highly durable</td>
</tr>
<tr>
<td>Class 2</td>
<td>Durable</td>
</tr>
<tr>
<td>Class 3</td>
<td>Moderately durable</td>
</tr>
<tr>
<td>Class 4</td>
<td>Non durable</td>
</tr>
</tbody>
</table>

These classifications represent an assessment of the combined risk of decay and termites and do not take into account any of the special properties of some species which may be particularly resistant to one hazard while being susceptible to another. An example of this is brush box which, while being classified only as moderately durable (Class 3) because of its lack of resistance to decay, is very resistant to termites.

As noted earlier, sapwood is considered to be non-durable in all species. The difference in durability between heartwood and sapwood is due mainly to the presence of naturally occurring toxic phenolic compounds in the heartwood.

When determining the durability classification of timber required for external use, it should be appreciated that the above table must not be considered an absolute indication of service life. With the wide range of climates and soil types found throughout Australia, the degree of hazard may vary enormously depending on area. Where the placement of timber in direct ground contact is unavoidable or desirable, its performance may be enhanced by taking measures to ensure that the surrounding soil is drained as effectively as possible (Figure 1).

Precautions that may be taken include the placement of free draining rubble at the bottom of holes, backfilling with coarse gravel or rubble and ensuring that concrete occurring around posts is crowned rather than creating water traps.

Ideally, rather than embedding timber posts in the ground they should be supported on one or another of the proprietary galvanised metal post supports widely available from most suppliers.

PRESERVATIVE TREATMENT

The preservative treatment of timber requires the impregnation of its cell structure with chemicals formulated to protect the wood from infestation by fungi and insects.

Generally, it is accepted that only the sapwood will be effectively treated because of the resins and other extractives contained within the cells of the heartwood. In major softwood species such as radiata pine, the wide sapwood band makes it particularly suitable for preservative treatment.

METHODS OF TREATMENT

There are number of methods available, ranging from brush application to dip diffusion and pressure impregnation. Of these, the most common commercial method is pressure impregnation where the timber is placed in a large pressure vessel, a vacuum drawn and the vessel or cylinder flooded with the chosen preservative under pressure. Subsequently excess preservative is drawn to remove any excess chemicals from the timber.

TYPES OF PRESERVATIVES

With constant research, the range of chemical preservatives available may be expected to change constantly in both formulation and application, however, the four major preservatives currently in use are:

- Boron salts
- Copper chrome arsenic salts (CCA)
- Creosote, and
- Light organic solvent preservatives (LOSP)

Boron salts

Boron is considered to be an effective formulation for the protection of timber against insect attack but because it is unable to be 'fixed' in the timber it will leach out if exposed to the weather. It is however, relatively
inexpensive to apply and being colourless may be an attractive option provided it is adequately shielded from the elements.

Copper chrome arsenic (CCA)
This is currently the most widely used preservative treatment in Australia and can usually be visually identified by its distinctive green colouring. Introduced to the timber by the vacuum pressure method, its elements of copper and arsenic are to protect the wood from fungal attack while the arsenic also deters insects. The chromium chemically fixes the other elements into the wood. Because of its resistance to leaching, CCA treated timber may be safely utilised for all manner of uses, particularly where it will be exposed to the weather. Therefore, where long-term appearance is important, CCA treated timber should be maintained as should any other timber, i.e. with supplemental coatings of paints or stains.

There are several derivatives of CCA offered under various trade names, some include water repellents and other features that are beyond the basic formulation. All these formulations, while having their own particular benefits, offer the same basic protection. Under certain circumstances, a white powdery substance will sometimes appear on the surface of CCA treated timbers, particularly in the first few months after treatment and usually when the timber was not re-dried following treatment. This substance is harmless and presents no hazard to humans or animals.

Creosote
The use of commercially creosote treated timber is normally restricted to heavy engineering applications but occasionally such material is available for light commercial and domestic situations. While creosote has proven an excellent preservative, particularly when pressure impregnated employing the boultonising method of boiling under vacuum, the handling of creosote treated timber does however, present certain problems. In recent years a preservative known as Pigment Emulsified Creosote (PEC) has been developed which is considered a far cleaner alternative because the bleeding and smell typically associated with creosote has been minimised.

Light organic solvent preservatives (LOSP)
Regarded principally as a fungicide, insecticides such as synthetic pyrethroids can be introduced into LOSP when necessary. LOSPs, because they are spirit-borne, are particularly useful where it is not desirable to re-wet already dried timber. Because of their spirit base they are unlikely to raise the grain of the timber as do water-borne preservatives.

DRYING
Of the broad range of preservatives discussed, CCA, under its various trade names, is the most readily available preservative. It is a water-borne preservative. To successfully treat timber with preservatives it must first be at least partially dried. Following treatment, if the timber is not correctly re-dried, distortion such as twisting, warping and shrinkage will be likely to occur. Therefore, where both appearance and performance are required, particularly in the case of softwoods, it would be wise to specify that treated timber be seasoned following treatment.

HAZARD LEVELS
Australian Standard - AS 1604 defines hazard levels for timber under various circumstances. Preservative treated timber is chemically treated to meet each of these hazard levels by the retention of certain quantities of chemical in a given volume of timber. This is usually expressed as kg per m$^3$. However, the required levels of preservative may vary with the chemical used, species and natural durability class.

None of this need be of undue concern to users as all preservative treated timber sold in New South Wales, with the exception of:

- Fence palings, battens and droppers,
- Timber less than 1500 sq.mm in cross-section area (except light decking),
- Timber less than 15 mm in thickness (except light decking),
- Timber less than 500 mm in length,

must be branded with an approved brand issued by the State Forests of New South Wales under the provisions of the Timber Marketing Act 1977 Part 4 and the regulations pertaining to the Act. This brand identifies, in part, the preservation plant, chemical used and hazard level to which the timber has been treated.

The following chart is intended only as an indication of the in-service hazards that may be encountered and the chemical levels that should be specified for preservative treated timbers in such situations.
## A Guide to Hazard Levels

<table>
<thead>
<tr>
<th>Exposure</th>
<th>In Service Conditions</th>
<th>Insect or Fungal Hazard</th>
<th>Possible Uses</th>
<th>Defined Hazard Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior - not in ground contact</td>
<td>Dry, well ventilated, no termite hazard</td>
<td>Lyctid (only affects hardwood sapwood) or anobium borer (only affects softwood sapwood)</td>
<td>Wall, floor and roof framing, interior joinery</td>
<td>1</td>
</tr>
<tr>
<td>Interior - not in ground contact</td>
<td>Not completely protected from dampness or other hazard</td>
<td>Termites, borers or moderate decay</td>
<td>Roof, wall and floor framing and decorative timbers, particularly adjoining wet areas</td>
<td>2</td>
</tr>
<tr>
<td>Exterior - above ground</td>
<td>Occasionally exposed to moderate wetting</td>
<td>Moderate decay, termites and borers</td>
<td>Cladding, decking and sub-frames, joinery (including windows), outdoor furniture, pergolas</td>
<td>3</td>
</tr>
<tr>
<td>Exterior - in ground contact</td>
<td>Regular and excessive wetting and leeching</td>
<td>Severe decay, termites or borers</td>
<td>Fencing, landscaping timbers, pergola posts etc.</td>
<td>4</td>
</tr>
<tr>
<td>Exterior - in ground contact or in fresh water</td>
<td>Exposed to severe and regular to constant wetting or where the cost of failure indicates a requirement for a high level of protection</td>
<td>Severe decay, termites or borers</td>
<td>Building poles, piles, retaining walls, transmission poles, house stumps and sole plates</td>
<td>5</td>
</tr>
<tr>
<td>Marine - salt and fresh water exposure</td>
<td>Extreme exposure in a marine environment</td>
<td>Marine borers and decay</td>
<td>Wharf piles, and ancillary timbers subject to tidal inundation, boat hulls etc.</td>
<td>6</td>
</tr>
</tbody>
</table>

## DESIGN

Timber is a versatile material able to be used in a wide variety of situations and applications. It provides a higher strength to weight ratio than any of the alternatives and, coupled with its natural resistance and forgiving nature when exposed to hostile environments, is unmatched by other products.

Notwithstanding these attributes however, a number of factors should be considered when planning to use timber externally, among them:

- Desired effective design life
- Performance
- Material and installation costs (versus ongoing maintenance, replace etc.)

### EFFECTIVE DESIGN LIFE

Generally it would be considered an unrealistic expectation for an unprotected timber member to provide the same effective service life as one fully protected from the ravages of the weather, soil and insects. However, with careful species selection, planning and detailing it...
is possible to greatly enhance the effective design life of timber in external situations. Obviously timber used in temporary applications such as formwork or bracing will not require the same degree of planning as perhaps a retaining wall, pergola posts or the sub-frame of a timber deck.

**PERFORMANCE**

The level of performance expected of structures or components will usually relate to the cost of failure, whether that may only be in materials or, more importantly, in terms of the risk of injury or worse to humans. The cost of failure in a fence is unlikely to be considered as high as say a cantilevered balcony falling off a house or a pergola collapsing. Therefore, factors of performance must be a major consideration during the planning process.

**MATERIALS AND INSTALLATION COSTS**

When determining durability and performance, they should be carefully weighed against the initial cost of materials and the level of cost for ongoing maintenance. For instance, it would be false economy to use a non-durable (Class 4) hardwood or softwood for the sub-frame of an exposed sun deck instead of a well detailed naturally durable species or a preservative treated (H3 or better) softwood. Obviously, any initial saving on materials in such a case would soon be outweighed by the expense of new materials and labour to replace a degraded sub-frame, decking and any other superstructure subsequently attached to the deck.

Where long term performance will be an issue, careful consideration must be given to:

- **Species** (natural durability or an appropriate level of preservative treatment provided to low or non-durable species)
- **Detailing** (eliminate soil contact, interfaces where moisture could be trapped and ensure good water run-off)
- **Correct fastenings** (hot dipped galvanised or other coatings where appropriate)
- **Protective finishes** (paints, stains or other brush on preservatives)

**SPECIES**

There are a wide range of species available and suitable for use in exposed positions although, as a rule, no timber with a natural durability of less than Class 2, or its preservative treated equivalent, would be recommended unless detailing was such that it was totally protected from any hazards. A number of these species are detailed in the table below.

**SPECIES AVAILABILITY**

With the exception of certain hardwood species such as tallowwood and blackbutt, it is unlikely many retail timber suppliers will offer more than a limited range of naturally durable species for sale, other than treated radiata pine or perhaps the highly durable white cypress pine. In the case of preservative treated timber, care should be taken to ensure that any such material is

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Highly durable</th>
<th>Class 2</th>
<th>Durable</th>
<th>Class 3</th>
<th>Moderately durable</th>
<th>Class 4</th>
<th>Non-durable</th>
</tr>
</thead>
<tbody>
<tr>
<td>box, grey coast</td>
<td>blackbutt</td>
<td>ash, silvertop</td>
<td>ash, alpine (tas oak)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cedar, western red</td>
<td>gum, river red</td>
<td>box, brush</td>
<td>brownbarrel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ironbark, grey</td>
<td>gum, spotted</td>
<td>gum, mountain grey</td>
<td>pine, hoop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ironbark, broad leafed red</td>
<td>mahogany, red</td>
<td>gum, rose (flooded)</td>
<td>pine, radiata</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ironbark, narrow leafed red</td>
<td>pine, black cypress</td>
<td>gum, Sydney blue</td>
<td>fir, Douglas- (oregon)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mahogany, white</td>
<td>stringybark, white</td>
<td>messmate</td>
<td>hemlock (western)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pine, white cypress</td>
<td>stringybark, yellow</td>
<td>stringybark, brown</td>
<td>meranti (pacific maple)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tallowwood</td>
<td></td>
<td>stringybark, silvertop (class 2-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>turpentine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Note:** In the case of the Class 4 softwoods, hoop pine and radiata pine in particular accept preservative treatment readily. Douglas-fir (or oregon) on the other hand does not. The only apparently successful method of treating Douglas-fir is by incising it prior to treatment, a process not widely available in this country.
correctly branded with the required hazard rating and other information. There will of course be exceptions to this supply conundrum, particularly in country areas where local sawmills may also sell timber in retail quantities and will be able to cut available species to order. It should be appreciated by buyers however, that it is not sufficient to simply specify to the supplier that you require hardwood or treated pine. In doubt provide the supplier with a written order setting out your requirements and stating the intended use of the material. This will, at the least, lessen the opportunity for any misunderstanding between buyer and seller and assist in ensuring the timber supplied is 'fit for purpose'.

DETAILED

Except under the harshest conditions timber, with careful design, workmanship and maintenance, is a permanent structural material. Protected from the weather, moisture and insects, timber will perform satisfactorily indefinitely. However, when used in external applications the realities of:

- Fire
- Fungal attack
- Insect attack and
- Weathering

must all be taken into account.

FIRE

Larger section timbers typical of those used externally, with the possible exception of some of the highly resinous pines, do not ignite readily requiring sustained temperatures within the wood of approximately 250° to 300° C to sustain ignition. In larger section members the layer of char formed on the surface of the timber will act as an insulator and inhibit burning to approximately 0.6 mm per minute.

FUNGAL ATTACK

Decay caused by fungal attack requires a favourable environment.

- Unprotected nutrients such as minerals and carbohydrates typical of those normally present in sapwood must be available.
- Oxygen must be present. Timber more than 600 mm below ground level and completely submerged material is rarely attacked.
- Temperature must be within a range of 5° to 40°C. Above or below these temperatures fungal attack is retarded. Temperatures of 25° to 40°C are considered to provide ideal conditions.
- Moisture must be present in the wood and must exceed 20% for attack to occur. Attack will be limited within a range of 20 to 25% MC while above 25% is considered to provide an ideal environment.

INSECT ATTACK

The best way to protect timber from insect attack is by careful design and good workmanship. This, coupled with correct identification of likely hazards and selection of appropriate species or preservative treatment, will help ensure a satisfactory result. The two insects presenting the greatest hazard to timber are termites and lyctids.

Termite

These may be divided into two main types, drywood and subterranean. Generally, New South Wales is considered a low (H1) risk area for drywood termites. However, where timber is exposed to the weather or to ground contact a higher hazard level should be assumed. As drywood termites do not require contact with the ground there is usually little evidence of their presence. However, this pest is usually considered more of a danger in the coastal areas of south-east Queensland and beyond. The best protection available is to use a naturally termite resistant species or preservative treated timber.

New South Wales is considered a medium risk (H2) area for subterranean termites. However, where timber is exposed to the weather or is in ground contact a higher risk must be assumed.

Of all the insect pests, subterranean termites are by far the greatest danger to timber. In order to survive, they require moisture and access to their nest which is usually in the soil or in a warm damp location. The best protection against infestation by these pests is site preparation and detailing to ensure they do not have direct access between their nests and a food source by providing a physical or chemical barrier.

Lycids (Powder Post Beetles)

While a major destroyer of timber, the lyctid should not be of undue concern to users for the following reasons.

- Softwoods are naturally immune from attack.
- Only the sapwood of certain hardwoods is susceptible.
- Various Australian Standards limit the percentage of susceptible sapwood able to be included in any individual piece.
In New South Wales the Timber Marketing Act (1977) identifies various classes of timber and timber products and limits the inclusion and sale of lyctid susceptible sapwood. The Act provides for penalties for those found to be in breach of the Act at all levels of the distribution chain.

WEATHERING

If timber is protected from the weather, either by well maintained paints, stains or other physical means such as verandas eaves, protective capping or shielding etc., degrade due to weathering will be minimised.

Where no physical barrier exists, weathering, which should not be confused with decay, will occur. This degrade due to weathering will occur slowly (between 6 to 13 mm per 100 years). However, resultant lifting of the grain and the formation of cracks and checks may provide secondary conditions conducive to decay.

While some timbers and preservative treatments provide long-term performance in ground contact it is advisable, wherever possible, to avoid such situations where the cost of replacement may be high. For example, timber building poles and posts or stairs are best isolated by means of hot dipped galvanised supports or similar. Similarly, where posts or other timber members must abut a structure, some means of clearance should be provided if there is any possibility of moisture ingress which, if undetected, could promote decay.

Weathering can be inhibited by the application of surface finishes i.e. paints and stains or by landscaping and good design. Detailing against weathering, therefore, is important. Some of the key elements to consider are:

- Physical protection
- Clearances
- Adequate ventilation
- Detailing of joints
- Elimination of moisture

PHYSICAL PROTECTION

The use of paints and stains has already been noted. Any timber product will only perform within the limits of its natural properties but its behaviour may be enhanced by providing additional protection to the material (Figures 2 and 3). This could be as simple as positioning trees and shrubs to minimise the effects of sun and rain, to providing other means of shielding such as roofs over pergolas and decks or the placement of sacrificial capping on the tops of fences, screens and exposed sub-structures.

VENTILATION

The minimum amount of ventilation required in the sub-floor areas of buildings is detailed in the Building Code of Australia and any subsequent variation to those requirements may be in breach of relevant regulations. Lack of ventilation in most cases will inevitably result in the formation of condensation. This may be under sheet roofing, glass or cladding but wherever that build up occurs it will ultimately produce the same result as constant wetting. Care must be taken to ensure any external additions, be they decks, pergolas or simple landscaping, do not interfere with the under floor ventilation of any adjacent structures.
DETAILING OF JOINTS

The success of any project will ultimately depend upon attention to detail wherever the timber has to be joined, whether to adjoining timber members or to other materials.

Some additional thought and care in this area will, in the long run, pay dividends. Some points worth considering are:

- Making allowance for shrinkage
- Choice of fasteners
- Minimisation of moisture traps
- Workmanship.

SHRINKAGE

Unseasoned timber will shrink until its moisture content reaches a balance with the surrounding atmosphere. It will not shrink appreciatively in length but over a period of time a reduction in both width and thickness must be expected. This shrinkage may be minimised by the application of protective coatings. Shrinkage will invariably be proportionally greater in the wider section, e.g. in a 150 x 38 mm board the amount of shrinkage will be greater across the 150 mm plane than in the 38 mm plane. Moisture will be lost at a higher rate through the end grain than from the faces of the piece, resulting in faster dimensional changes at either end of a board than toward the centre. It would be wise, therefore, to seal the ends of the timber with a non permeable sealing compound as quickly as possible. Shrinkage in timber will always take the path of least resistance (i.e. towards the fixing points) (Figure 4). Therefore, try wherever possible to position fastenings toward the dimensionally critical edge of the member.

When using unseasoned timber bolts holes should be drilled approximately 10% oversize to allow for shrinkage.

NAILS

Nails are without doubt the most commonly used fixing system in domestic construction offering advantages of:

- Low unit cost
- Ease and speed of installation
- Ready availability
- Wide range of types, finishes and sizes.

While there is a wide range of head shapes available for specialised uses there is also a range of different shanks and point types available for all manner of specialised purposes. These usually have advantages of increased withdrawal resistance and, in the case of specially pointed types such as shear or chisel points, they are less likely to split sheet products and hardwoods.

Because of the wide range of nails available and the variety of possible applications, it is recommended specific advice be sought from nail manufacturers or their agents.

In general, plain shank nails will provide less holding power than annular ring or spiral shank nails. There is a tendency to use ring shank nails in softwood and screw shank nails in hardwood. It should be noted however, that because of the keying effect of the deformed shanks of these nails their withdrawal resistance drops sharply following initial slip due to the displacement and tearing of the wood fibres. Additionally, it is recommended that only hot dipped galvanised nails be used in most external domestic construction situations.

Bolts, coach screws and other proprietary fasteners all have greater capacities than nails. They are, therefore, better applied in situations where there are large loads and greater forces to be contained and where space and access may be limited.

There are two types of bolts commonly available and used in domestic construction:

- Cuphead bolts - where a relatively flush surface is desired, and
- Hexagon head bolts - for general construction.

Additionally, coach screws which are simply large screws with hexagon heads are used where it may be impracticable to thread a nut to one side of a member or where aesthetics are a consideration. These fasteners are also available in a wide range of finishes, lengths and diameters.
Bolts are usually referred to by their overall diameter e.g. an M10 bolt refers to a 10 mm overall diameter. The only additional information (other than surface coating) required is the length which is measured from the underside of the head to the tip. Again, while cadmium, chrome and electro plated zinc bolts are readily available, these coatings do more to improve appearance than to provide long-term corrosion resistance. Hot dipped galvanising is a far more effective proposition.

**MOISTURE TRAPS**

The inclusion of any joints or interfaces that have the potential to receive and hold moisture should be avoided. Where it is impracticable to avoid such situations, joints should be designed to be free draining. Where possible, drainage holes should be included and all interfaces liberally coated with a proprietary preservative compound.

The flush seating of timber in proprietary metal support sockets or shoes should be avoided. The timber should have several millimetres of clearance at the base and be supported by bolts of appropriate load bearing capacity (Figure 5).

**WORKMANSHIP**

The importance of accurate cutting and fitting of joints cannot be over emphasised. Rough loose fitting joints and out of square ends not only look poor, they are unlikely to do the job expected of them and provide potential moisture traps. All joints and inaccessible interfaces should be liberally coated with a finish of some kind. Ideally with a proprietary preservative compound.

**TIMBER GRADES**

Standards Australia publish a wide range of timber standards that provide a working guide to the selection and use of appropriate timbers.

For stress graded structural timbers, AS 2082 provides the necessary rules for hardwood while AS 2858 applies to softwood.

In the case of milled products AS1782-1787 and AS 1492-1498 provide the information required for clear, select, standard and utility grades.

As noted earlier, sapwood is not durable and should, unless preservative treated, be limited in most situations. The inclusion of small percentages of sapwood is allowed in some sawn structural timbers and these limits are noted in the Australian Standards referred to previously. The Timber Marketing Act (1977) also controls the inclusion of (lyctid) susceptible sapwood in various types of timber products and in New South Wales supersedes any other standards or requirements.

[Diagram of approximation 25 mm gap in timber]