

# ROADS AND MARITIME SERVICES (RMS)

## QC SPECIFICATION 2380

### TIMBER FOR BRIDGES

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**RMS QC SPECIFICATION 2380****TIMBER FOR BRIDGES****REVISION REGISTER**

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Issue 6		Amendments by BT Section	M, BS&R	2.5.05
Issue 7		Amendments by BT Section for 2007-08 timber order, as agreed at Tumut workshop on 5 Sep 2006.	M, BS&R	26.9.06

<b>GUIDE NOTES</b>
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**Using RMS 2380**

RMS 2380 is a RMS QC Bridgeworks Specification.

**Issue 7**

Comments and suggestions on Issue 7 should be forwarded to the Senior Bridge Engineer (Policy, Specifications & Durability), RMS Bridge & Structural Engineering Branch, tel. 02 8837 0241 or fax. 02 8837 0054.

**Scope**

This specification is intended for use with the supply of newly milled and treated timber which is otherwise unmodified and has not yet been used in bridgeworks, nor recycled from other projects.

A separate but related specification will be developed for supply of recycled bridge timber.

Two different specifications are used for supply of timber laminates for stress-laminated timber decks:

- (a) RMS 2382 for hardwood laminates (to be used unless otherwise specified);
- (b) RMS 2383 for softwood laminates (not normally used).

**Reference Documents**

A new Australian Standard, AS 3818.7 *Timber—Heavy structural products—Visually graded – Large cross-section sawn hardwood engineering timbers*, was issued during 2006. This provides more lenient requirements for heart and other different requirements compared to AS 2082. At this stage, RMS 2380 will maintain AS 2082 rather than AS 3818.7 as the reference for the grading of sawn timber, pending further review of the new Standard.

**Approval to alternative species**

The list of hardwood species in Table 2380/3 is considered to comprise all known acceptable species. Any proposal to supply an alternative species must be carefully reviewed. Only Australian-grown timber is acceptable.

The RMS Superintendent must obtain the prior approval of both the Principal Bridge & Structures Engineer, RMS Bridge & Structural Engineering Branch and the Chief Timber Inspector, Forests NSW prior to approving use of an alternative species.

Brushbox shall not be approved for use as bridge timber under any circumstances.

**Ordering of timber**

Where possible, timber should be ordered a minimum of 12 months, and preferably at least 18 months, in advance of the works.

The person responsible for specifying the timber order should be an experienced bridge works supervisor or bridge engineer.

The timber order should specify:

- (a) the bridge name(s);
- (b) the bridge element according to Table 2380/1;

- (c) the required length (rounded to nearest 100 mm). The length ordered shall be at least 200 mm longer than the design length shown on the drawings (to allow for cutting ends to size and removal of end seals and end damage).
- (d) for sawn timber, the required cross sectional dimensions of each piece (rounded up to nearest 5 mm, based on the original design cross section plus shrinkage allowance). For truss components, the shrinkage allowance shall be 5% (i.e. 1 mm per 20 mm) greater than the design thickness and width. For non-truss components, no shrinkage allowance shall be provided.
- (e) for round girders and corbels, the required cross sectional diameter at the small end (rounded up to the nearest 5 mm, based on the original design cross section at mid-length and allowing for the taper requirements in Clause 5.2).
- (f) for round piles (refer Clause 5.3), the required minimum cross sectional diameter, both at the small end (300 mm unless otherwise specified) and at 500 mm from the butt end (450 mm unless otherwise specified). Each dimension and its location must be specified on the timber order.
- (g) the number of pieces in each size
- (h) the delivery site (which should be a depot with a suitable timber storage shed)
- (i) any additional requirements to this specification.

Regions should specify the required dimensions:

- (a) based on the design dimensions (e.g. as shown in the Materials List from RMS M756)
- (b) adding any additional allowances for cross sectional shrinkage and length.
- (c) The dimensions resulting from (a) and (b) are then rounded to the nearest metric dimension, as indicated above.

Upon placement of the timber order, provide a copy of the order and the closing date of tender to the Chief Timber Inspector, Forests NSW, P.O. Box 100, Beecroft NSW 2119 [fax no. 02 9872 9093], to assist coordination of timber inspection services for the timber to be supplied under the order.

For timber truss components, the Construction Drawings and Materials List prepared under RMS M756 provide the proposed quantities and design measurements from which the required sizes and lengths of components in the timber order can be determined. To facilitate timber procurement, the preconstruction activities under RMS M756 should be carried out at least 2 years in advance of the proposed timber truss repairs.

The following new requirements, consistent with RMS M757, apply for timber truss components:

- The supplied cross sectional dimensions must allow for 5% shrinkage.
- The supplied lengths must be at least 200 mm longer than design lengths, to allow for cutting off split or damaged ends and to provide true ends.
- Nominated delivery site should be a timber storage shed rather than bridge site.

### **Truss bottom chord timber**

Durability Class 2 timber is not acceptable for timber truss bottom chords, except as follows:

- (a) for a bottom chord strengthening using steel plates where the load is transmitted from the diagonals and principals directly into the steel plates and the bottom chord timber is non-load bearing, i.e. the bottom chord shoes engage directly with the steel plates.
- (b) for strictly short term repairs (i.e. where the entire bottom chord, or the bridge itself, will be replaced within 5 years, based on an identifiable project with funding in the forward RNIM bridge programme). In this case, the bottom chord must be monitored for early deterioration.

In either case, an exemption must be obtained from the Manager Bridge Maintenance and Rehabilitation Methods for the use of Durability Class 2 timber on the specific project, but only the Durability Class 2 species specified in Table 2380/1 Note (b) will be acceptable.

### **Boxed heart**

Components should not be upsized to circumvent the restrictions on use of boxed heart.

Coastal Blackbutt is not permitted for use with boxed heart for any bridge application (refer Table 2380/3).

Sound boxed heart is only permitted in whole section truss span components where the smaller dimension exceeds 200 mm (based on the design cross section of the flitch shown in the original drawings). Examples include:

- (a) the top chords and principals of old PWD and McDonald trusses, provided the timber meets natural in-ground durability class 1;
- (b) truss span cross girders and sway cross girders;
- (c) stringers on Allan, Dare and De Burgh truss spans.

### **Longitudinal sheeting and decking**

Proposals to supply longitudinal sheeting and decking in more than one species should be provided with the quotation and, where possible, should include a schedule detailing the amounts of each species to be supplied and the source mills for the timber of each species.

Where longitudinal sheeting and decking is supplied in more than one species, the timber should be placed in the works so that the timber of the same species is kept together to the maximum extent feasible, to ensure consistent effects of shrinkage and performance.

### **Preservative treatment**

It has proven very difficult to source untreated large section timber and even smaller sections such as decking timber. This has had a major impact on timber bridge projects, causing unacceptable delays.

Edition 7 has been designed to reduce the volume of sawn treated timber used in timber bridges using a selective treatment strategy. This requires treatment of sapwood where the sapwood limits of Clause 6.2 are exceeded, but excludes treatment where the limits are not exceeded.

As a general policy, the use of alternative preservatives and end sealants that offer lower toxicity and are less harmful to human and environmental health, while still providing adequate protection to the timber, is encouraged.

Where a Hazard Class 5 (H5) preservative treatment is required under the specification, the use of alternative preservatives to CCA is encouraged, provided that it can be demonstrated that the alternative preservative will offer near-equivalent efficacy to CCA for that component.

Unless otherwise specified, treated piles for use in tidal waters should be treated to AS 1604.1 Hazard Class 6 (H6).

In accordance with AS 1604.1 Table H6.2, a double treatment (with both CCA and creosote) is recommended for tidal waters north of Bateman's Bay. However, in some of these areas, a single treatment (with either CCA or creosote) may be sufficient, depending upon the marine borer threat (refer to recommendations of AS 1604.1). For tidal waters south of Bateman's Bay, a single treatment (with either CCA or creosote) is recommended.

For each type of component supplied under a single order, the treatment should be consistent.

### **Management of New Truss Timber**

Truss timber is scarce and expensive. Therefore, consistent with RMS M757, new truss timber needs to be managed as critical, “high value” materials in accordance with the Australian Hardwood Drying Best Practice Manual (refer Clause 1.5).

Truss timber should be carefully managed at all stages of production, handling and storage in order to minimise deterioration, damage and wastage. The Supplier should use production methods that minimise the degree of degradation due to air drying and other damage to the truss timber prior to delivery. This extends from the initial identification of a tree in the forest as suitable for truss timber, through harvest, transport of sawlogs to the sawmill, milling, preservative treatment, transport of milled timber and up to final delivery to RMS.

The quality risks are greater where the timber making up the order is accumulated by the Supplier over a long period of time, or by consolidating timber from different sources or sawmills.

### **RMS Timber Supply Strategy**

The requirements of RMS 2380 (for supply) and RMS M757 (for ordering, use and storage of truss timber after delivery) are consistent with the RMS Bridge Timber Supply Strategy. This Strategy has been developed to support the long term supply of timber for the RMS’s heritage timber truss bridges.

The supply of Australian grown hardwood timber truss components is now critical compared to the situation that applied at the time of the original construction of timber truss bridges.

RMS M757 assumes that RMS will stockpile the critical large section components suitable for the main truss elements in accordance with the RMS Bridge Timber Supply Strategy. This would allow the Contractor to build up adequate stock of 12 months air-dried timber in regional storage sheds, in the sizes and lengths appropriate to typical timber truss repairs, even if no immediate works are planned.

The RMS Bridge Timber Supply Strategy provides for erection of regional truss timber storage sheds at strategic locations around the State to provide the necessary air-drying conditions for shelter, ventilation and security. These sheds should be used for all long term storage of truss timber and should be nominated as the delivery site for new truss timber components, rather than the bridge site. Truss timber should not be stockpiled on site until just before it is needed.

In the absence of suitable stock, lead times for procurement of truss timber will need to allow for the scarcity of supply and also provide for 12 months air drying of the truss components after delivery.

### **Protection of timber after delivery**

In accordance with RMS M757, all truss timber and all other sawn timber components intended to be painted in the works should be primer painted on all exposed surfaces within 1 week of delivery to the site or as soon as the timber surfaces have dried, whichever is the later.

Prior to the primer painting, the corners of truss components should be arrised. The end seals (containing identification marks) are not to be primer painted.

**Identification marks**

Identification marks on end seals should not be removed or defaced until a timber component is about to be cut for fabrication.

During truss fabrication, the identification details should be transferred to permanent identification marks on the side of the component, after finishing of the component. The permanent identification mark should also include date of supply and the date of installation (month/year). Permanent identification marks are only required for large cross section timber (i.e. truss components, stringers, girders, headstocks, piles) and not for small section components such as decking and railing components.

Identification marks for preservative treatment shall meet AS 1604.1 and other legislative requirements and any additional requirements of the RMS Draft Treated Timber Policy.





# TIMBER FOR BRIDGES

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## RMS QC SPECIFICATION 2380

### TIMBER FOR BRIDGES

## 1 GENERAL

### 1.1 SCOPE

This Specification sets out details and requirements for the supply and delivery of timber for bridges, other than for stress-laminated timber decks.

### 1.2 REFERENCE DOCUMENTS

Unless otherwise specified the applicable issue of a reference document shall be the issue current at the date one week before the closing date of tenders.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given below:

#### **Australian Standards**

AS/NZS 1148	Timber – Nomenclature – Australian, New Zealand and imported species
AS 1604.1	Specification for preservative treatment - Sawn and round timber
AS 2082	Timber - Hardwood - Visually stress-graded for structural purposes
AS 2209	Timber - Poles for overhead lines
AS/NZS 2878	Timber - Classification into strength groups
AS 3818.1	Timber - Heavy structural products - Visually graded – General requirements
AS 3818.3	Timber - Heavy structural products - Visually graded – Piles
AS/NZS 4491	Timber - Glossary of terms in timber related Standards
AS 5604	Timber – Natural durability ratings

#### **RMS Specifications**

RMS M756	Timber Truss Repairs–Measure, Inspect & Draw
RMS M757	Timber Truss Repairs–Construction

#### **Other Documents**

NSW Timber Marketing Act  
Australian Hardwood Drying Best Practice Manual

### 1.3 NOMENCLATURE

For the purpose of this Specification, the standard trade names of the timbers shall be used, and their equivalent botanical and standard trade reference numbers shall be those listed in AS/NZS 1148.

If not otherwise specified in Standards, timber nomenclature, definitions and other timber terminology shall be in accordance with AS/NZS 4491.

## 1.4 PRINCIPAL'S APPROVAL

Where the Principal's approval is required, and/or where submission of documents is specified in this Specification, the following shall apply:

- (a) The Supplier shall give not less than 5 working days notice to the Principal and/or submit the necessary documentation as per the General Conditions of Contract.
- (b) The Supplier shall obtain written approval or concurrence of the Principal prior to carrying out further work.

Unless otherwise specified, all tests shall be carried out by a laboratory with an appropriate NATA registration, at the Supplier's cost.

Where the Supplier maintains a quality management system, quality assurance requirements shall be agreed and approved by the Principal as detailed in Appendix A of AS 3818.1.

## 1.5 TRUSS TIMBER PRODUCTION METHODS AS FOR "HIGH VALUE" MATERIALS

Truss span superstructure components (refer Group A of Table 2380/1) shall be managed as critical, "high value" materials in accordance with the Australian Hardwood Drying Best Practice Manual at all stages of production, handling and storage (including harvest, transport of sawlogs to sawmill, milling, preservative treatment, transport of milled timber and delivery to the Principal).

NOTE: The Supplier should use production methods that minimise deterioration, damage, wastage, the degree of degradation due to air drying or other damage to the timber. Methods include use of temporary end seals and end split restraints on sawlogs, and appropriate stacking and storage of timber at sawmills, both in log and cut form.

# 2 SELECTION OF TIMBER

## 2.1 GENERAL

For each of the bridge elements listed in Table 2380/1, the timber shall be a hardwood which meets the requirements of Table 2380/1 for minimum structural grade, minimum stress grade, and minimum natural in-ground durability class.

In this specification, "natural durability class" always means the natural in-ground durability class.

Timber shall be selected from the species listed in Table 2380/3, subject to the selection requirements of Clause 2.2. All timber shall be sourced from Australian forests.

The structural grade, stress grade and natural in-ground durability class in Tables 2380/1 to 2380/3 are in accordance with AS 2082 (sawn timber), AS 3818.3 (round timber) and AS 5604.

However, for the purpose of structural grading of treated sawn timber in this specification (refer Clause 6), the AS 2082 permissible characteristic (n) "want, wane and Lyctid-susceptible sapwood" shall be replaced by "want, wane and untreated sapwood". In this case, prior to treatment, the timber shall meet Structural Grade No.3 or better. The structural grading of the timber after treatment shall be used in Tables 2380/1 to 2380/3.

## 2.2 SELECTION

The permissible species for supply of timber shall be in accordance with Table 2380/3, based on the following selection procedure.

The permissible strength groups shall be selected from Table 2380/2, according to the minimum stress grade and minimum structural grade specified for the bridge element in Table 2380/1.

Timber species shall then be selected using Table 2380/3 to suit:

- (a) the permissible strength groups determined from Table 2380/2;
- (b) the minimum natural in-ground durability class specified in Table 2380/1.

Timber of the appropriate species shall be visually graded to ensure it meets the minimum structural grade specified in Table 2380/1.

Australian hardwood species other than those listed in Table 2380/3 may be approved by the Principal for use as bridge timbers, upon the advice of the Chief Timber Inspector, Forests NSW. Species submitted for approval shall have an unseasoned strength group of S3 or better and a natural in-ground durability class of 2 or better.

Where a species not listed in Table 2380/3 is approved for use, the strength group shall be in accordance with AS/NZS 2878. The natural in-ground durability class shall be determined in accordance with AS 5604.

Timber for built-up bolted laminated components shall be free of heart but shall otherwise meet the same requirements as for the equivalent whole component being replaced.

Associated timber components (e.g. spacer blocks) shall be of the same natural in-ground durability class as the main components to which they will be attached in the works.

## 3 INSPECTION

The Supplier shall arrange for all timber to be inspected by a nominated representative of the Principal at the Supplier's mill before dispatch and as soon as practicable after milling. The nominated representative for inspection shall be an authorised Forests NSW timber inspector.

Each piece of timber shall be inspected within 1 month of its milling. The date of inspection for each piece and the RMS purchase order number shall be recorded on the inspection certificate.

Identification marks shall be placed on the timbers so passed.

The passing of such timbers shall not relieve the Supplier of its responsibility for delivering the timber as specified at the point of delivery mentioned in the Schedule.

However, in the case of cross sectional dimensions of sawn timber, the required dimensions mentioned in Clause 4.1 shall apply at the date of the timber inspection only (the date of inspection for each piece must be recorded).

A notice of not less than five (5) working days, shall be given by the Supplier to the nominated representative to enable inspections to be carried out.

The costs of all inspection services relating to the order shall be borne by the Supplier and shall be included in the quotation.

All sawn and round section timber shall be stamped with the species identification brand, the stress grade (sawn timber only) and the preservative treatment brand (where applicable) on the ends of the timber.

Timber selected for supply of one bridge element and stamped as acceptable under one order shall not be acceptable for use:

- (a) for a different bridge element; or
- (b) for the same bridge element under a different order;

unless the Supplier can demonstrate that it meets all the requirements of the different bridge element and/or the different order and the original identification marks are present.

## **4 SAWN TIMBER**

### **4.1 GENERAL**

The cross sectional dimensions of sawn timber shall be specified on the timber order.

Shrinkage is allowed for in the specified dimensions. The Supplier shall make no additional allowance for shrinkage.

The quality and dimensional tolerances of sawn timber shall comply with Section 2 of AS 2082 for the grade of timber specified in Tables 2380/1 and 2380/2, except that:

- (a) The cutting tolerance on thickness and width shall be  $-0 / +6$  mm; and
- (b) Heart and heart shakes shall not be permitted where the smaller dimension of the piece of timber is less than 175 mm. Where the smaller dimension of the piece is more than 175 mm (or 200 mm in the case of truss timbers - as specified in Clause 4.2), heart and heart shakes are permissible provided that they occur in the central one third of the cross-section of the piece as shown in Figure C3 of AS 2082 (i.e. “boxed heart”); and
- (c) The additional requirements of Clauses 4.2 and 4.3 shall apply for the relevant bridge components.

Heart and heart shakes shall not be permitted in Coastal Blackbutt under any circumstances (refer Table 2380/3).

Timber shall not be kiln-dried.

### **4.2 TRUSS SPAN SUPERSTRUCTURE COMPONENTS**

All truss timbers shall be free of heart, except that sound boxed heart is permitted in whole section components other than Coastal Blackbutt where the smaller dimension exceeds 200 mm (based on

the design cross section of the flitch shown in the original drawings), in which case the provisions of Clause 4.1 (b) shall apply for extent of heart.

### **4.3 DECK AND RAILING COMPONENTS**

Longitudinal sheeting shall have no wane, want or sapwood.

## **5 ROUND TIMBER**

### **5.1 GENERAL**

Piles, girders and corbels shall be natural rounds only, except that the following sawn components are acceptable on heritage bridges:

- (a) piles in truss span cluster piers;
- (b) girders and corbels of edge girders.

Sawn piles, girders and corbels shall conform to Clause 4.

### **5.2 GIRDERS AND CORBELS**

The diameter of round girders and corbels at the small end shall be specified on the timber order.

Round girders and corbels shall taper naturally and uniformly at not more than 8 mm of diameter per metre of length. The quality and dimensional tolerance of round girders and corbels shall comply with AS 2209. Round girders and corbels shall also meet the following requirements:

- (a) Unsound knots are not permitted;
- (b) Sound knots, clustered, are not permitted;
- (c) For sound knots, unclustered, the diameter of an individual knot shall not exceed 70 mm and not more than two knots shall be permitted in any 2000 mm of length.

Round girders and corbels shall not be trimmed, shaped or desapped.

### **5.3 PILES**

Round piles shall have a minimum diameter of 450 mm at a distance of 500 mm from the butt, and a minimum diameter of 300 mm at the toe, unless otherwise specified. Both dimensions (and their locations) shall be specified on the timber order.

Pile quality and dimensional tolerances shall comply with AS 3818.3 except that Clause 1.7.4 shall be varied such that piles must conform to the ovality requirement from the toe to within 500 mm of the butt.

No bark shall be removed from turpentine piles which are being supplied for use in tidal waters and every care shall be taken to protect the bark of those turpentine piles from damage. Turpentine piles which are to be used in situations of non-tidal waters or ground contact shall have their bark removed.

Piles, other than turpentine piles which are being supplied for use in tidal waters, shall be debarked and shall have the sapwood treated in accordance with Section 6 of this Specification.

Piles shall not be trimmed, shaped or desapped.

## **6 PRESERVATIVE TREATMENT**

### **6.1 GENERAL**

Preservative treatment shall be in accordance with the NSW Timber Marketing Act and shall comply with AS 1604.1 except where otherwise specified in this Clause.

### **6.2 SAPWOOD ON SAWN TIMBER**

No preservative treatment shall be permitted to longitudinal sheeting.

All other sapwood shall be treated to Hazard Class 5 (H5) where:

- (i) Sapwood exceeds one third of the width of the edge on which it occurs; or
- (ii) Sapwood exceeds one half of the width of the face on which it occurs; or
- (iii) Sapwood exceeds one tenth of the cross sectional area.

Sapwood on sawn components shall not be treated if none of the sapwood limits of Items (i) to (iii) above are exceeded.

### **6.3 SAPWOOD ON ROUND GIRDERS AND CORBELS**

All sapwood shall be treated to Hazard Class 5 (H5).

A certificate of treatment shall be supplied for each round girder and corbel piece that has been treated.

### **6.4 SAPWOOD ON ROUND PILES**

All sapwood on debarked piles shall be treated as follows and a certificate of treatment shall be supplied for each pile piece that has been treated:

- (i) Piles in contact with ground or non-tidal waters shall be treated to Hazard Class 5 (H5).
- (ii) Piles in tidal waters subject to prolonged immersion shall be treated to Hazard Class 6 (H6).

Turpentine piles for use in tidal waters, with bark intact, do not require preservative treatment of sapwood.

### **6.5 MARKING TREATED TIMBER**

All individual pieces of treated timber shall be clearly marked with essential information, including treatment plant number, preservative code number and hazard class number as specified in AS 1604.1.

## 6.6 CERTIFICATE OF TREATMENT

A certificate of treatment shall be provided and shall include at least the following information in accordance with AS 1604.1:

- (i) Description of timber and species;
- (ii) Hazard class number;
- (iii) Preservative/s used;
- (iv) Penetration requirement and whether achieved;
- (v) Retention requirement and whether achieved (with actual test value);
- (vi) Name and identification number of the treating organisation.
- (vii) RMS purchase order number

## 7 END SEAL

Immediately following the inspection of timbers, the ends of all timbers (sawn, round and piles) shall be coated with a bituminous or wax emulsion or other approved end seal treatment that will effectively minimise rapid drying through the open end grains.

Bituminous end seals shall be a high build. bitumen paint.

Wax emulsion end seals shall be either a paraffin wax emulsion, with a minimum solids content of 50 percent, or a paraffin-polymer wax emulsion, with a minimum solids content of 40 percent.

The Principal's approval shall be obtained to the proposed end seal treatment.

## 8 DELIVERY AND STACKING

Unless otherwise specified in the timber order, the delivery, unloading and stacking of timber shall be the Supplier's responsibility.

Sawn timber shall be tied in bundles for stacking, handling and while in transit, to restrain against bowing. Each bundle shall contain pieces of uniform length and cross sectional dimensions.

Where two pieces of truss timber are cut from opposite sides of the same log, the pieces shall be bundled together and suitably marked to identify their common origin.

Each bundle shall be marked on the side of each bundle (i.e. on visible timber surfaces), using indelible white ink, with the following information:

- (i) RMS purchase order number
- (ii) Forests NSW inspection certificate number
- (iii) Bridge name(s)
- (iv) Length and cross sectional dimensions of pieces within bundle
- (v) The number of pieces within bundle.

All timber delivered to site shall be stacked at least 150 mm clear of the ground and supported on sound packers at intervals sufficiently close to prevent excessive bending or permanent set of the timber pieces.

Round timber shall be stacked so that each piece is separated from adjacent pieces by at least 75 mm.

Sawn timber shall be stacked so that each piece is separated from adjacent pieces by at least 25 mm horizontally, and if in more than one layer, the pieces in each alternate layer shall be spaced at intervals sufficiently close to prevent excessive bending or permanent set of the timber pieces in the layer above.

All sawn timber shall be stacked with the faces oriented to minimise exposure-related deterioration and loss of shape due to warping and shrinkage. Large section sawn timber shall be stacked with the larger cross-sectional dimension vertical. Sawn timber shall be stacked with cross-sectional orientation heart side downwards or inwards (i.e. away from the weather).

**TABLES****TABLE 2380/1 - STRENGTH AND DURABILITY REQUIREMENTS**

Bridge Element	Minimum Structural Grade	Minimum Stress Grade	Minimum Natural In-ground Durability Class
<b>A. Truss Span Superstructure Components</b>			
1 Top Chords	No 1	F22	1 or 2 Note (b)
2 Principals	No 1	F22	1 or 2 Note (b)
3 Bottom Chords	No 1	F22	1 Note (c)
4 Vertical Struts	No 1	F22	1
5 Diagonal Struts	No 1	F22	1
6 Cross Girders and Sway Cross Girders	No 2	F22	1
7 Butting Blocks	No 1	F22	1
8 Jacking Blocks	No 1	F22	1
9 Truss Span Stringers	No 1	F22	2
<b>B. Beam Span Superstructure Components</b>			
1 Round Girders	Note (a)	F27	2
2 Round Corbels	Note (a)	F27	2
3 Sawn Girders	No 1	F22	2
4 Sawn Corbels	No 1	F22	2
5 Cross Beams	No 2	F22	2
<b>C. Substructure Components</b>			
1 Round Piles (tidal waters)	Note (a)	F22	1
2 Round Fender Piles (tidal waters)	Note (a)	F17	1
3 Round Piles (ground contact or non tidal waters)	Note (a)	F22	2
4 Sawn Piles (driven)	No 2	F22	1
5 Sawn Columns	No 2	F22	2
6 Capwales	No 2	F22	2
7 Bracing	No 3	F17	2
8 Headstocks	No 2	F22	2
9 Wales	No 2	F22	2
10 Gravel boards	No 3	F17	2
11 Abutment Sheeting	No 3	F17	1
12 Sills	No 2	F22	1
<b>D. Deck and Railing Components</b>			
1 Decking	No 2	F17	2
2 Kerbs	No 3	F17	2
3 Longitudinal Sheeting	No 2	F17	2
4 Handrails	No 2	F17	2
5 Handrail Posts	No 2	F17	2
6 End Posts	No 2	F17	2

- NOTES:
- (a) Round timber grading applies.
  - (b) For top chords and principals only, the following Durability Class 2 species are acceptable:
    - Coastal Blackbutt (free of heart) ~ *Eucalyptus pilularis*
    - Spotted Gum (free of heart) ~ *Corymbia maculata*, *Corymbia citriodora*, *Corymbia henryi*
  - (c) For bottom chords in certain special cases, the Principal may issue a specific exemption allowing use of the Durability Class 2 species specified in Note (b).

**TABLE 2380/2 – RELATIONSHIP BETWEEN STRENGTH GROUPS, STRUCTURAL GRADES AND STRESS GRADES FOR UNSEASONED TIMBER**

Strength Group	Stress Grade			
	Structural Grade No. 1 *	Structural Grade No. 2 *	Structural Grade No. 3 *	Round Timber (Piles, Girders & Corbels)
S1	F27	F22	F17	F34
S2	F22	F17	F14	F27
S3	F17	F14	F11	F22

NOTE: \* Sawn timber visually graded to AS 2082.

**TABLE 2380/3 - STRENGTH GROUP AND DURABILITY CLASS FOR VARIOUS SPECIES**

<b>Common Name</b>	<b>Botanical Names</b>	<b>Strength Group (unseasoned)</b>	<b>Natural In-ground Durability Class</b>
Brown Bloodwood	<i>Corymbia trachyphloia</i>	S3	1
Coast Grey Box or Bosisto's Box	<i>Eucalyptus bosistoana</i>	S1	1
Coastal Blackbutt (free of heart)	<i>Eucalyptus pilularis</i>	S2	2
Forest Red Gum	<i>Eucalyptus tereticornis</i>	S3	1
Grey Box or Gum-Topped Box	<i>Eucalyptus microcarpa</i> <i>Eucalyptus hemiphloia</i> <i>Eucalyptus woosiana</i> <i>Eucalyptus moluccana</i>	S2	1
Grey Gum	<i>Eucalyptus propinqua</i> <i>Eucalyptus punctata</i>	S1	1
Grey Ironbark	<i>Eucalyptus paniculata</i> <i>Eucalyptus siderophloia</i>	S1	1
Gympie Messmate	<i>Eucalyptus cloeziana</i>	S2	1
Red Bloodwood	<i>Corymbia gummifera</i>	S3	1
Red Ironbark (Broad-Leaved)	<i>Eucalyptus fibrosa</i>	S1	1
Red Ironbark (Narrow-Leaved)	<i>Eucalyptus crebra</i>	S2	1
Red Ironbark	<i>Eucalyptus sideroxylon</i>	S2	1
Red Mahogany	<i>Eucalyptus resinifera</i>	S2	2
Spotted Gum	<i>Corymbia maculata</i> <i>Corymbia citriodora</i> <i>Corymbia henryi</i>	S2	2
Steel Box	<i>Eucalyptus rummeryi</i>	S2	1
Tallowwood	<i>Eucalyptus microcorys</i>	S2	1
Turpentine	<i>Syncarpia glomulifera</i>	S3	1
White Mahogany	<i>Eucalyptus acmenoides</i>	S2	1
White Stringybark	<i>Eucalyptus eugenioides</i>	S3	3
White Stringybark	<i>Eucalyptus globoidea</i>	S3	2
White Topped Box	<i>Eucalyptus quadrangulata</i>	S2	2
Woollybutt	<i>Eucalyptus longifolia</i>	S2	1
Yellow Box	<i>Eucalyptus melliodora</i>	S3	1
Yellow Stringybark	<i>Eucalyptus muellerana</i>	S3	3

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