

### Introduction

Timbers natural appeal, strength and environmental credentials continue to make it the ideal choice for decking in commercial, industrial and marine structures, including:

- boardwalks
- jetties
- pontoons
- marinas
- bridges
- foot bridges
- loading docks
- vehicle parking

### Scope

This data sheet provides details for the design, specification and construction of timber decks in fully exposed environments (including marine) in applications for light pedestrian traffic (2.7 kN or 4.5 kN point loads), heavy pedestrian traffic (9.0 kN point loads) and light vehicular traffic (13 kN point loads) with uniformly distributed loads of up to 5 kPa. Details for posts, other supporting/foundation structures and lateral stability etc. are not included and should be engineered for the specific site conditions.

### Species Selection

The traditional timber used in Australia for heavy decking is in-ground durability class 1 or 2 hardwood. The reasons for this are ready availability, natural durability and proven performance with minimum maintenance.

Preservative treated seasoned softwoods are now widely used in applications such as foot bridges, boardwalks, etc.

Table 1 provides guidance on readily available species suitable for heavy decking. It is recommended that for hardwood a range of acceptable species be specified for a project rather than a single species which will limit availability.

### Grades

Decking is available in both unseasoned and seasoned timber in a range of grades and sizes.

### Stress Grade

The general grade descriptions provided by the relevant Australian Standards (AS 2082 - Visually Stress-Graded Hardwood, AS 2858 - Softwood - Visually Stress-Graded For Structural Purposes) satisfy the structural requirements for bearers, joists and decking.

For greater serviceability, the following additional grade requirements should be specified for timber decking boards: - Open timber features such as knot holes, loose or unsound knots, gum pockets, loose gum veins, shakes and termite galleries should not be permitted on the upper face on the decking.

Square or near square sections can be more economical than rectangular sections of equivalent structural capacity because they can be cut from smaller logs containing sound boxed heart. Other advantages of square sections include longer length availability and greater lateral stability.

### Decking Board Sizes and Profiles

Table 2 provides general guidance on sizes and stress grades which are usually available, however, individual suppliers should be contacted to determine availability of different size, species, grade and quantities.

### Surface Texture

Experience has shown that timber with a sawn upper face provides greater long term weathering ability than a dressed surface. Decking therefore should be rough sawn all round or sized on two edges and one face (underside) only.

### Arrises and Corners

A 3 mm arris should be specified on the top corners. Some seasoned decking is available with rounded corners. Such treatment of arrises or corners will reduce the incidence of splintering and improve the performance of coatings.

**Table 1 Suitable Species**

Species	Post in Ground	Posts, Framing and Decking above Ground
PRESERVATIVE TREATED PINE (Carribean, Hoop, Radiata, Slash)	✓ H5 Treatment (H6 Treatment in seawater contact)	4H3 Treatment
CYPRESS	(See Note 1, 4)	(See Note 4)
BLACKBUTT	(See Note 1)	✓
GUM Forest Red	✓	✓
GUM Grey	✓	✓
GUM Spotted	(See Note 1)	✓
IRONBARK Red or Grey	✓	✓
MAHOGANY Red	(See Note 1)	✓
MAHOGANY White	✓	✓
MESSMATE Gympie	✓	✓
TALLOWOOD	✓	✓
TURPENTINE	✓	(See Note 6)

### NOTES:

1. These timbers are in-ground durability class 2 and may be used for in-ground applications only when they can be easily replaced if degrade occurs.
2. Hardwood decking boards containing sapwood must be preservative treated to H3 hazard level. (H5 if less than 400 mm from the ground)
3. Hardwood posts and framing containing more than 10% cross-section area of sapwood must be treated with preservative. (H5 level when in ground contact or less than 400 mm from the ground, H3 elsewhere). Small amounts of sapwood (less than 10% of cross section) may remain untreated provided they do not occur at joints or fixing points (not exceeding 50% of face or edge).
4. Cypress sapwood should be limited to 10% of the cross section (not exceeding 50% of face or edge) and should not occur at joints or fixing points.
5. Untreated softwood heartwood should be limited as for untreated hardwood sapwood (refer note 3).
6. Suitable only for posts and seasoned decking.

**Table 2 Decking Board Sizes and Stress Grades**

Timber	Finished or Sized	Stress Grades Dimensions
Hardwood - unseasoned	35/45 x 70 *, 35/45 x 90 * 35/45 x 120 *, 35/45 x 140 *	F14, F17, F22
Hardwood - seasoned	35/45 x 70 35/45 x 90 35/45 x 120, 35/45 x 140	F17, F27
Softwood - seasoned	35/45 x 70, 35/45 x 90 35/45 x 120, 35/45 x 140	F7, MGP 12
Cypress - unseasoned	35/45 x 70 * 35/45 x 90 * 35/45 x 120 *, 35/45 x 140 *	F5, F7

\* sized dimensions

## Moisture Content and Shrinkage

External decking timbers exposed to the weather will reach Equilibrium Moisture Content (EMC) with their surroundings after a period of 9-18 months, depending upon prevailing weather, size and type of timber used.

For coastal Australia, decks that are well ventilated should reach an EMC of approximately 16%. For decks close to and over water, EMC's will normally be a little higher (18-21%) and for dry inland areas considerably lower (10-12%).

Depending on location and species, the amount of shrinkage occurring in unseasoned timber will vary. Generally, about 6% shrinkage (6 mm per 100 mm) should be expected for unseasoned hardwood. An indication of shrinkage rates for individual species is given in Technical Data Sheet 16, Species Properties and Uses.

Allowance should therefore be made for shrinkage in unseasoned bearers, joists and decking, and for the gaps that will develop between the decking boards.

A minimum gap of 6 mm is recommended between decking boards to allow for good drainage and ventilation around boards.

Unseasoned decking boards should be laid tight together, with subsequent shrinkage creating the required gaps. As an example, if unseasoned spotted gum decking (45 x 120 mm) was butted together on installation, the final gap between the boards would be approximately 6% of 120 = 7-8 mm.

Seasoned decking should be installed with the required 6 mm minimum gap at the time of laying. Closing of these gaps may occur during prolonged wet periods. Larger gaps may be necessary for areas of higher EMC e.g. over water.

## Construction

### On-Site Storage

Timber delivered to site should be stored supported on level bearers not less than 150 mm clear of the ground. Timber should be left block stacked and banded until required. Both seasoned and unseasoned decking should be covered to protect it from the sun and rain.

### End-Plating and Sealing

To reduce end splitting in unseasoned timber, the end grain should be coated immediately after sawing with a suitable sealer such as Petroleum Jelly or Mobilcer-M Wax Emulsion. In addition, all unseasoned sections 300 x 75 mm or greater should be end-plated with a multi-toothed plate connector covering at least 50% of the exposed end section. Timber should be specified and supplied to site with the end-sealing and plating already in place.

### Fasteners

All fixings (nails, bolts, screws, plates, etc.) should be either stainless steel, monel metal, hot dipped galvanised or mechanically plated. Table 3 provides relevant fastener details for the fixing of the decks.

Where CCA, ACQ or copper azole treated timber has been used and continual moisture is present, hot dipped galvanised bolts etc., should be coated with a heavy bodied grease, bituminous epoxy paint or plastic sheath prior to installation.

**Table 3 Deck Fixing**

DECKING BOARD SIZE (mm x mm)	No.	Fixing Type	Minimum Deck Joist Width (mm)
35 x 70 35 x 90	1 2	100 x 3.75 Flat Head or Dome Head Nail * (Pre-drilling may be required)	50
35 x 70 35 x 90 35 x 120 35 x 140	1 2 2 2	75 mm x No.14 Type 17 Batten Screw	50
45 x 70 45 x 90 45 x 120	1 2 2	125 x 5.6 Dome Head Decking Spike (Pre-drilling Required)	75
45 x 70 45 x 90 45 x 120 45 x 140	1 2 2 2	90/100 mm x No.14 Type 17 Batten Screw	50

\* Ring shank if fixed to softwood joists.

## Pre-drilling

Bolt holes in unseasoned timber should be drilled to a size equal to the bolt diameter + 10%. Where multiple bolts or fasteners are used in unseasoned timber, allowance for shrinkage should be made to avoid shrinkage restraint and possible splitting.

Pre-drilling for screws or nails may be necessary to avoid splitting. Where pre-drilling for screws or nails is required, the pre-drilled hole should be approximately 80% of the shank diameter of the screw or nail.

The size of fastener required to fix the decking boards may dictate the minimum floor joist thickness. Table 6 provides guidance in this regard.

## Joint Detailing

The design of the joints is a key factor in ensuring the durability of the structure. When designing joints in timber decks, the following general guidelines should be considered:

- Keep the contact area between members to a minimum.
- Make all joints self draining.
- Where the contact area is excessive or durability in the joint may be a problem, use a preservative paste (e.g., Koppers CN Emulsion) or a bitumastic type sealer on the contact surfaces.
- Avoid bolt or nail configurations which are likely to cause splitting as the timber seasons.
- Seal all end-grain with a suitable sealer (e.g., Mobilcer-M Wax Emulsion).
- Ensure the joint receives as much natural ventilation as possible.

## Ventilation

The long term satisfactory performance of the decking and timber substructure can be markedly enhanced by ensuring adequate ventilation. Care should be taken to avoid dead air pockets. The wider the decking board spacing and the greater the ventilation, the longer the deck will last. As a minimum, a final decking board spacing of 6 mm is recommended.

## Finishing and Maintenance

### Finishing

For industrial and marine applications, the addition of coatings in addition to those used to protect end-grain joints, etc. is not usually necessary; however, the use of a suitable decking finish will improve long term performance. For LOSP treated timber, all members must be coated all-round with a paint or stain, and maintained as recommended in Timber Queensland Technical Data Sheet 22 - LOSP Treated Timber. For some commercial applications, the use of finishes may be appropriate to provide colour or alternatively, protection against staining during construction or where food and drinks are served.

A number of finishes which are easily maintained are available. An appropriate finish in most cases would be an oil based stain used in conjunction with a water repellent.

### Maintenance

Most heavy deck structures are generally designed to have minimal maintenance, however, the areas where maintenance may be required are as follows:

- Replacement of damaged decking boards.
- If a stain finish is used, refinishing will be needed at intervals dependent on exposure and traffic.
- The end sealants may leach out over time on exposed ends and further applications may be required.
- Loose boards may develop as a result of excessive vibration loading and these should be refixed.
- The re-punching of some nails or re-tightening of screws may be necessary after shrinkage.
- The tightening of bolts after shrinkage of larger members may also be necessary.

**Table 4 Allowable Decking Board Spans**

Point Loads	Size (mm x mm)	Allowable Decking Board Spans					
		F7	MGP12	F14	F17	F22	F27
Point Load 2.7 kN (Light Pedestrian Traffic)	35 x 70	580	700	700	740	760	800
	35 x 90	660	780	760	800	840	880
	35 x 120	720	860	840	880	920	960
	35 x 140	760	900	880	920	960	1020
	45 x 70	780	920	900	940	980	1040
	45 x 90	840	1000	980	1020	1080	1120
	45 x 120	940	1100	1080	1140	1180	1200
45 x 140	980	1160	1140	1200	1200	1200	
Point Load 4.5 kN (Light Pedestrian Traffic)	35 x 70	340	480	700	740	760	800
	35 x 90	420	600	760	800	840	880
	35 x 120	560	780	840	880	920	960
	35 x 140	640	900	880	920	960	1020
	45 x 70	580	800	900	940	980	1040
	45 x 90	700	980	980	1020	1080	1120
	45 x 120	920	1100	1080	1140	1180	1200
45 x 140	980	1160	1140	1200	1200	1200	
Point Load 9.0 kN (Heavy Pedestrian Traffic)	35 x 70	NS	NS	340	440	560	640
	35 x 90	NS	NS	420	520	680	700
	35 x 120	NS	380	560	700	740	780
	35 x 140	320	460	640	740	780	820
	45 x 70	NS	400	580	720	800	840
	45 x 90	340	500	700	820	860	900
	45 x 120	460	640	860	920	960	1000
45 x 140	540	740	920	960	1000	1060	
Point Load 13 kN (Light Vehicular Traffic)	35 x 70	NS	NS	NS	300	380	480
	35 x 90	NS	NS	NS	360	480	580
	35 x 120	NS	NS	380	480	620	680
	35 x 140	NS	320	440	560	680	720
	45 x 70	NS	NS	400	500	640	740
	45 x 90	NS	340	480	600	760	800
	45 x 120	320	440	640	800	840	880
45 x 140	360	520	740	840	880	940	

**NOTE TO TABLE 4:**

These sizes are also capable of carrying uniformly distributed loads of 5 kPa.

**Design**

AS/NZS 1170 (2002), Structural design actions, provides guidance on the loads required to be considered for most commercial and industrial applications.

**Decking Boards**

Table 4 gives the allowable spans for various grades and sizes of timber decking for a uniform distributed load up to 5 kPa and point live loads as indicated.

**Joists and Bearers**

Tables 5 and 6 provide joist sizes and Tables 7 and 8 provide bearer sizes.

**Table 5 Deck Joists - Seasoned Timber**

Joist Spacing	Size (mm x mm)	Maximum Joist Span (mm)															
		4.0 kPa Uniform Live Load / 4.5 kN Point Live Load						5.0 kPa Uniform Live Load / 13 kN Point Live Load									
		Single Span			Continuous Span			Single Span			Continuous Span						
		F7	MGP12	F17	F27	F7	MGP12	F17	F27	F7	MGP12	F17	F27	F7	MGP12	F17	F27
300	120 x 45	-	-	1000	2000	-	-	1400	2600	-	-	1000	2000	-	-	1400	2600
	140 x 45	-	-	1500	2700	-	1000	2100	3200	-	-	1500	2700	-	1000	2100	3200
	170 x 45	-	1100	2400	3400	-	1600	3400	3900	-	1100	2400	3400	-	1600	3400	3900
	190 x 45	-	1500	3200	3800	1200	2000	4000	4400	-	1500	3200	3800	1200	2000	4000	4400
	240 x 45	1600	2300	4400	4800	2200	3200	5000	5500	1600	2300	4400	4800	2200	3200	5000	5500
	290 x 45	2500	3200	5300	5800	3500	4500	6100	6600	2500	3200	5300	5800	3500	4500	6100	6600
450	120 x 45	-	-	-	1600	-	-	1200	2300	-	-	-	1600	-	-	1200	2300
	140 x 45	-	-	1300	2400	-	-	1700	3000	-	-	1300	2400	-	-	1700	3000
	170 x 45	-	1000	2000	3200	-	1300	2800	3700	-	1000	2000	3200	-	1300	2800	3700
	190 x 45	-	1300	2700	3600	1100	1700	3600	4100	-	1300	2700	3600	1100	1700	3600	4100
	240 x 45	1400	2000	4200	4600	1900	2700	4700	5200	1400	2000	4200	4600	1900	2700	4700	5200
	290 x 45	2200	2800	5000	5500	2900	3700	5700	6300	2200	2800	5000	5500	2900	3700	5700	6300
600	120 x 45	-	-	-	1400	-	-	1000	2000	-	-	-	1400	-	-	1000	2000
	140 x 45	-	-	1100	2100	-	-	1500	2900	-	-	1100	2100	-	-	1500	2900
	170 x 45	-	1000	1800	3100	-	1200	2400	3500	-	1000	1800	3100	-	1200	2400	3500
	190 x 45	-	1200	2300	3500	1000	1500	3200	3900	-	1200	2300	3500	1000	1500	3200	3900
	240 x 45	1300	1800	4000	4400	1700	2400	4500	5000	1300	1800	4000	4400	1700	2400	4500	5000
	290 x 45	2000	2500	4900	5300	2600	3300	5500	6000	2000	2500	4900	5300	2600	3300	5500	6000
750	120 x 45	-	-	-	1300	-	-	1000	1800	-	-	-	1300	-	-	1000	1800
	140 x 45	-	-	1100	1900	-	-	1400	2600	-	-	1100	1900	-	-	1400	2600
	170 x 45	-	1000	1700	3000	-	1200	2200	3400	-	1000	1700	3000	-	1200	2200	3400
	190 x 45	-	1200	2100	3400	1000	1500	2900	3800	-	1200	2100	3400	1000	1500	2900	3800
	240 x 45	1300	1800	3600	4300	1700	2300	4300	4900	1300	1800	3600	4300	1700	2300	4300	4900
	290 x 45	2000	2400	4700	5200	2400	3000	5200	5900	2000	2400	4700	5200	2400	3000	5200	5900
900	120 x 45	-	-	-	1300	-	-	1000	1700	-	-	-	1300	-	-	1000	1700
	140 x 45	-	-	1100	1800	-	-	1400	2400	-	-	1100	1800	-	-	1400	2400
	170 x 45	-	1000	1700	2800	-	1200	2100	3400	-	1000	1700	2800	-	1200	2100	3400
	190 x 45	-	1200	2100	3300	1000	1500	2700	3800	-	1200	2100	3300	1000	1500	2700	3800
	240 x 45	1300	1800	3400	4200	1700	2300	3900	4800	1300	1800	3400	4200	1700	2300	3900	4800
	290 x 45	2000	2400	4600	5100	2400	3000	4700	5800	2000	2400	4600	5100	2400	3000	4700	5800

**NOTES TO TABLE 5:**

1. Minimum end bearing length = 35 mm, Minimum internal bearing length = 70 mm.
2. Live load deflection limit = span/150 or 20 mm (This limit is considered appropriate where the maximum loads are only applied occasionally).
3. Maximum cantilever shall be not more than 25% of maximum allowable joist span and not more than 30% of actual span.
4. The availability of different grades, sizes and lengths may vary between individual suppliers. Availability should be checked prior to design/specification.
5. The maximum joist spans are based on a maximum decking mass of 40 kg/m<sup>2</sup>.





**Table 8 Deck Bearers - Seasoned Timber**

Floor Load Width	Size (mm x mm)	Bearer Span (mm) - 4.0 kPa Uniform Live Load / 4.5 kN Point Live Load								Bearer Span (mm) - 5.0 kPa Uniform Live Load / 13 kN Point Live Load							
		Single Span				Continuous Span				Single Span				Continuous Span			
		F7	MGP12	F17	F27	F7	MGP12	F17	F27	F7	MGP12	F17	F27	F7	MGP12	F17	F27
2400	2/170 x 35	1500	1900	2500	3000	1500	1900	2500	3100	1100	1600	2200	2800	1400	1700	2200	2800
	2/170 x 45	1800	2200	2800	3200	1800	2200	2800	3600	1400	1900	2500	3000	1600	1900	2500	3200
	2/190 x 35	1700	2100	2800	3300	1700	2100	2800	3500	1400	1900	2500	3100	1600	1900	2500	3200
	2/190 x 45	2000	2400	3100	3500	2000	2400	3100	4000	1800	2200	2800	3300	1800	2200	2800	3600
	2/240 x 35	2200	2600	3500	3900	2200	2600	3500	4400	2000	2300	3200	3700	2000	2300	3200	4000
	2/240 x 45	2500	2900	3900	4200	2500	2900	4000	4800	2300	2600	3600	3900	2300	2600	3600	4500
	2/290 x 35	2700	3000	4200	4500	2700	3000	4200	5200	2400	2700	3800	4300	2400	2700	3800	4800
	2/290 x 45	3000	3400	4500	4800	3000	3400	4800	5600	2700	3100	4200	4500	2700	3100	4300	5300
3600	2/170 x 35	1200	1500	2000	2500	1200	1500	2000	2500	1100	1400	1800	2300	1100	1400	1800	2100
	2/170 x 45	1400	1800	2300	2900	1400	1800	2300	2900	1300	1600	2100	2600	1300	1600	2100	2500
	2/190 x 35	1400	1700	2200	2900	1400	1700	2200	2700	1300	1500	2000	2600	1300	1500	2000	2300
	2/190 x 45	1600	1900	2600	3100	1600	1900	2600	3200	1400	1700	2300	2900	1400	1700	2300	2800
	2/240 x 35	1800	2100	2800	3500	1800	2100	2800	3400	1600	1900	2600	3300	1600	1900	2600	2900
	2/240 x 45	2000	2400	3200	3800	2000	2400	3200	4100	1800	2100	2900	3600	1800	2100	2900	3600
	2/290 x 35	2200	2400	3400	4100	2200	2400	3400	4100	2000	2200	3100	3800	2000	2200	3100	3500
	2/290 x 45	2500	2700	3900	4300	2500	2700	3900	4900	2200	2500	3500	4100	2200	2500	3500	4300
4800	2/170 x 35	1100	1300	1700	2200	1100	1300	1700	1900	1000	1200	1600	2000	1000	1200	1500	1700
	2/170 x 45	1200	1500	2000	2500	1200	1500	2000	2400	1100	1400	1800	2200	1100	1400	1800	2000
	2/190 x 35	1200	1500	1900	2500	1200	1500	1900	2200	1100	1300	1700	2200	1100	1300	1700	1900
	2/190 x 45	1400	1700	2200	2800	1400	1700	2200	2600	1200	1500	2000	2500	1200	1500	2000	2200
	2/240 x 35	1500	1800	2400	3100	1500	1800	2400	2700	1400	1600	2200	2800	1400	1600	2100	2300
	2/240 x 45	1700	2000	2800	3500	1700	2000	2800	3300	1600	1800	2500	3200	1600	1800	2500	2800
	2/290 x 35	1900	2100	3000	3800	1900	2100	3000	3300	1700	1900	2700	3400	1700	1900	2600	2800
	2/290 x 45	2100	2400	3400	4000	2100	2400	3400	4000	1900	2100	3000	3800	1900	2100	3000	3400
6000	2/170 x 35	-	1200	1500	1900	-	1200	1500	1600	-	1100	1400	1700	-	1100	1300	1400
	2/170 x 45	1100	1300	1700	2200	1100	1300	1700	2000	1000	1200	1600	2000	1000	1200	1500	1700
	2/190 x 35	1100	1300	1700	2200	1100	1300	1700	1800	1000	1200	1500	1900	1000	1200	1400	1600
	2/190 x 45	1200	1500	1900	2500	1200	1500	1900	2200	1100	1300	1800	2200	1100	1300	1700	1900
	2/240 x 35	1400	1600	2200	2800	1400	1600	2100	2300	1200	1400	2000	2400	1200	1400	1800	2000
	2/240 x 45	1500	1800	2500	3100	1500	1800	2500	2800	1400	1600	2200	2800	1400	1600	2200	2400
	2/290 x 35	1700	1800	2600	3400	1700	1800	2500	2700	1500	1700	2400	2900	1500	1700	2200	2400
	2/290 x 45	1900	2100	3000	3800	1900	2100	3000	3300	1700	1900	2700	3400	1700	1900	2600	2800

**NOTES TO TABLE 8:**

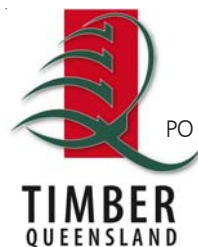
1. Minimum end bearing length = 100 mm, minimum internal bearing length = 150 mm.
2. Double bearers should be effectively fixed together at the third points within each span.  
Double bearers may be spaced using blocking pieces at the third points within each span.
3. Live load deflection limit = span/150 or 20 mm (This limit is considered appropriate where the maximum loads are only applied occasionally).
4. Maximum cantilever shall be not more than 25% of maximum allowable bearer span and not more than 30% of actual span.
5. The maximum bearer spans are based on a maximum decking mass of 40 kg/m<sup>2</sup>.
6. The availability of different grades, sizes and lengths may vary between individual suppliers. Availability should be checked prior to design specification.

**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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