# DURABILITY

## - Making it Happen -

Colin MacKenzie
Timber Queensland

Wood Solutions
design and build
www.woodsolutions.com.au
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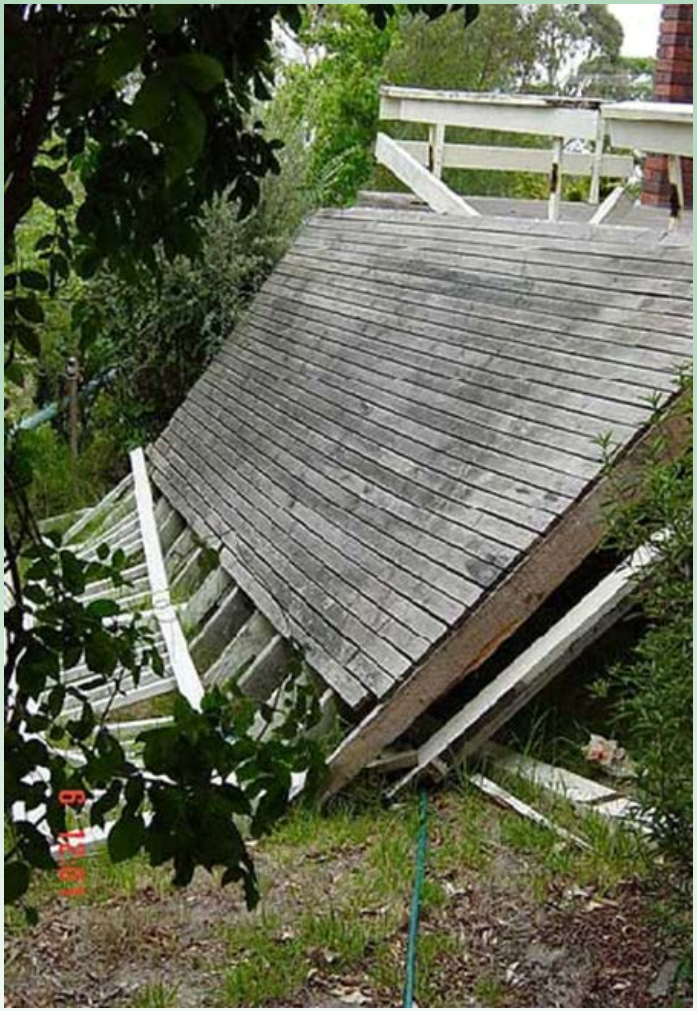
## Get it right

## Get it wrong



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# No Excuses!


Durability in Buildings
Guid ocument
2003
ABCB
NASH
National Timber Development Council
FOREST & WOOD PRODUCTS
CSIRO
Construction
Book
05
Wood Solutions
design and build
Timber service life design
Design guide for durability
Technical Design Guide issued by
Forest and Wood Products Australia

# Content

- Regulations and Standards
- Design Process
- Some Basics
- Treatment Levels
- H2 vs H2F vs H3
- Specifications
- Where to next

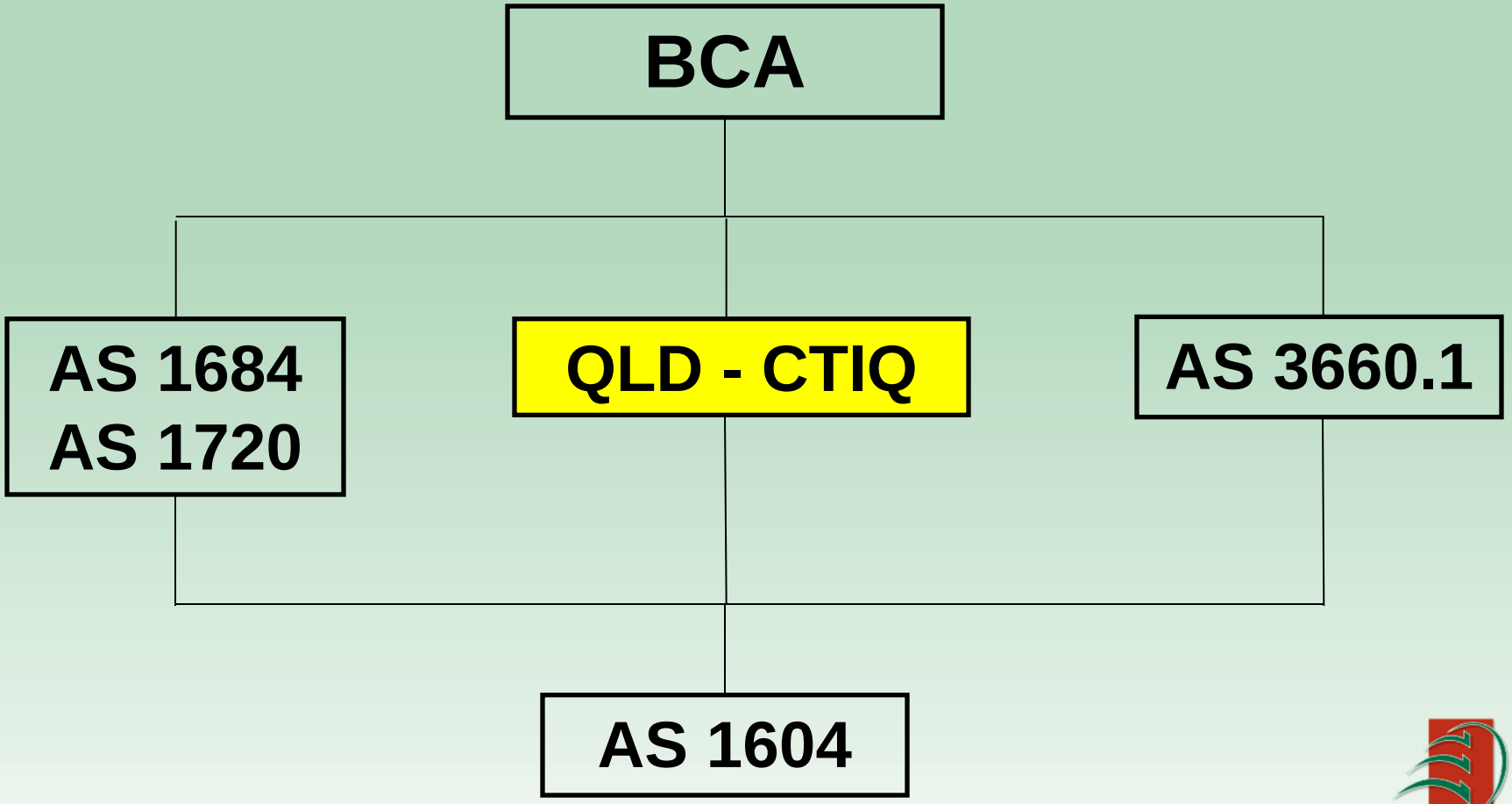
# Regulations & Standards

**APVMA**

**Review and approve pesticides (preservatives) in accordance with registration label**

**AS 1604 etc**

# Regulations & Standards



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# Design Process

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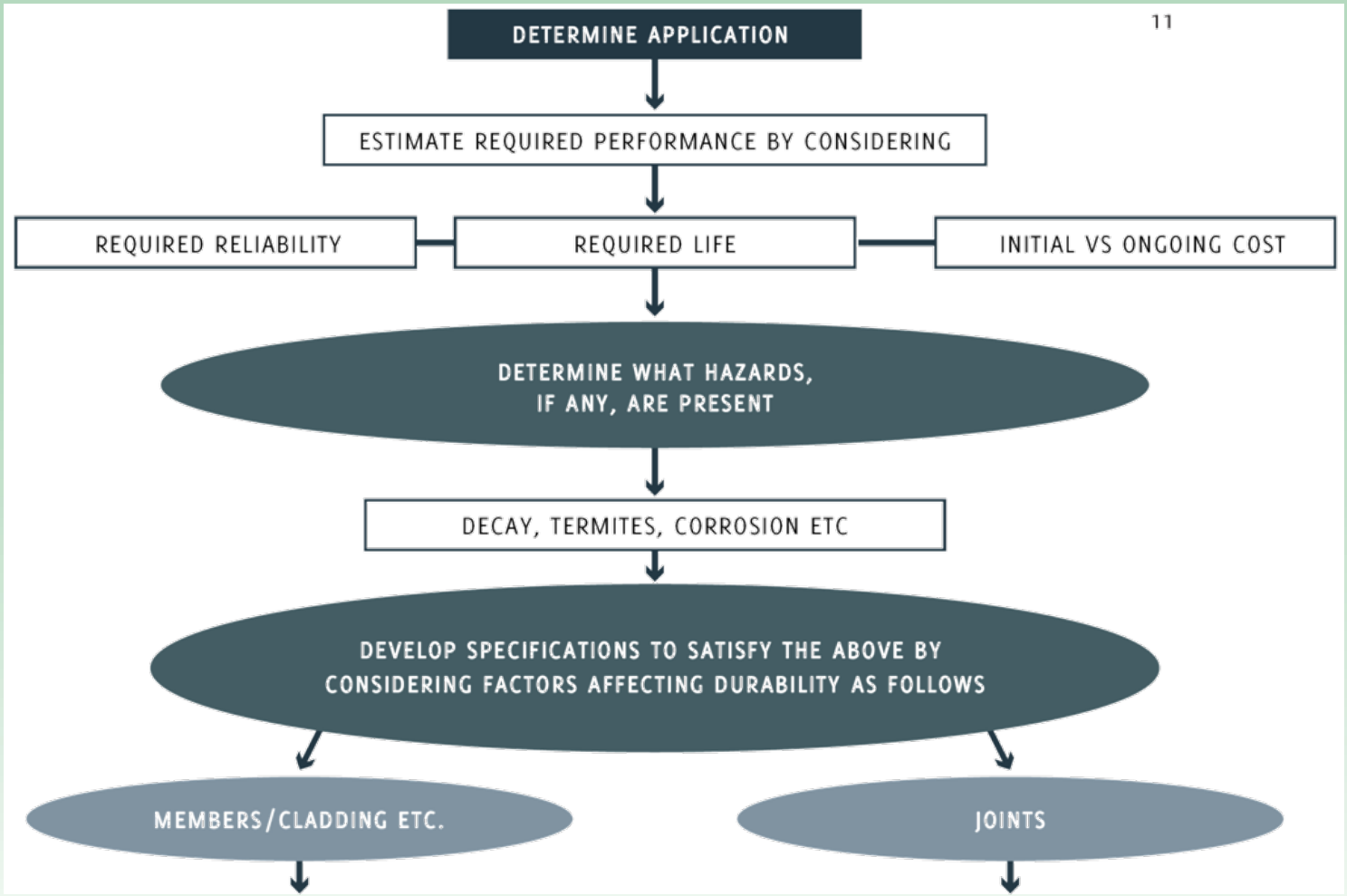
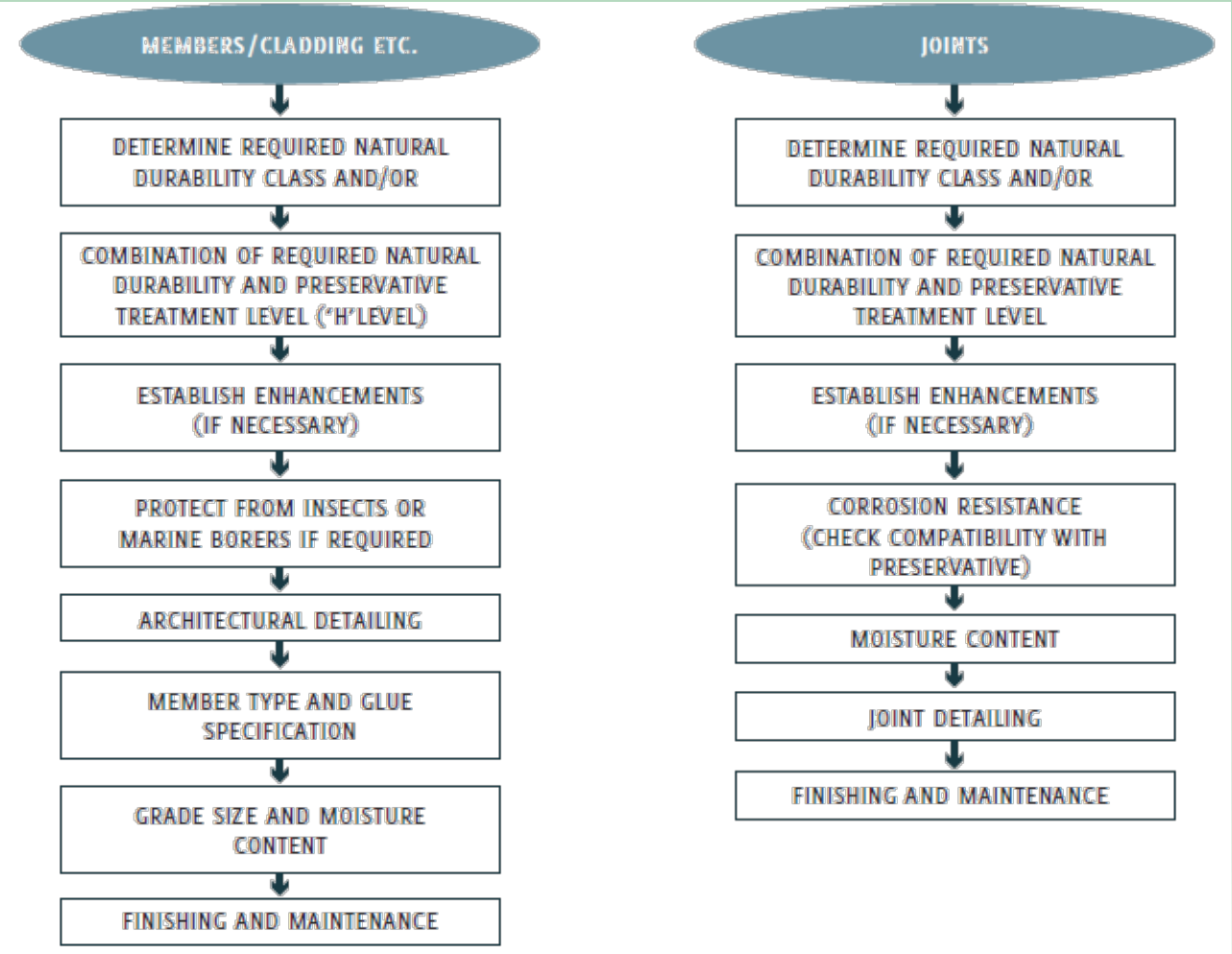
# Design Process: 1



# Design Process: 2



# Design Process: Discussion

- To determine performance requirements you may need to consider:
  - **Target life expectancy** (minimum regulatory, standards or contractual requirements)
  - **Level of reliability** (life safety, cost or consequence of failure)
  - **Costs** (initial vs ongoing maintenance, repair or replacement)
- In the context of building regulations, the Building Code of Australia (BCA) has implicit durability performance expectations:
  - see *Durability in Buildings – Guideline Document* at www.abcb.gov.au

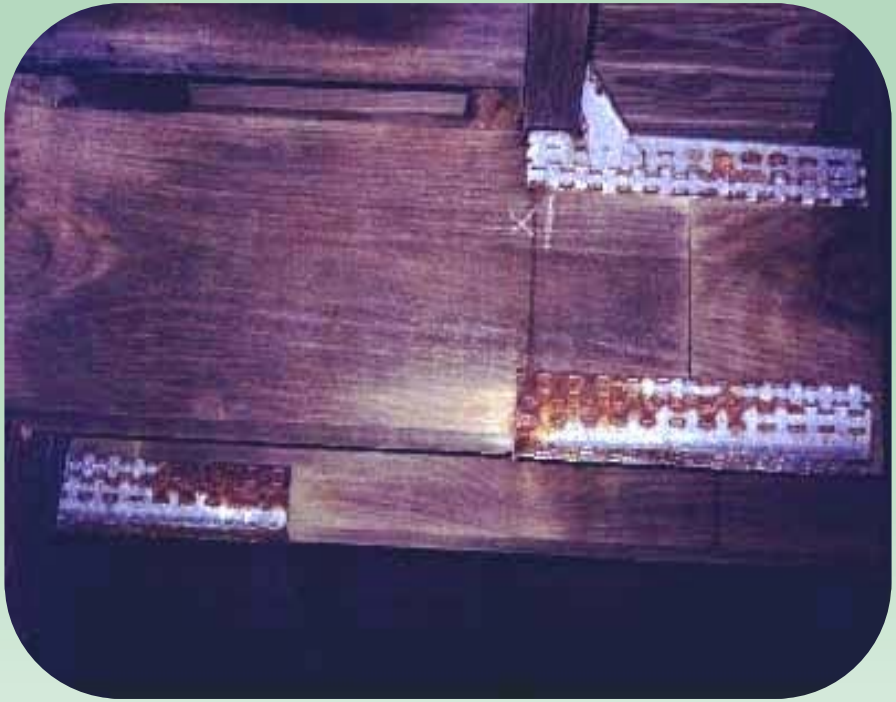
# BCA Design Life Guideline

*Table 2.1: BCA Durability Design Life Guideline.*

| Design life of building (*dl*) (years) | | Design life of components or sub-systems (years) | | |
|---|---|---|---|---|
| | | Category | | |
| Category | No. of years | Readily accessible and economical to replace/ repair | Moderate ease of access but difficult or costly to replace or repair | Not accessible or not economical to replace or repair |
| Short | $1 < dl < 15$ | 5 or *dl* (if $dl < 5$) | *dl* | *dl* |
| Normal | 50 | 5 | 15 | 50 |
| Long | 100 or more | 10 | 25 | 100 |

*Note: Houses are considered normal, with respective design life requirements of 5, 15 and 50 years.*

# Timber Hazards



# Timber Hazards

From a durability perspective, the main hazards that need to be considered are:-

- In-ground and above ground decay (including hazard or ‘H’ levels etc)
- Insects (inc. termites)
- Corrosion (of fasteners)
- Weathering
- Marine borers
- Chemical degradation (not usually an issue), and
- Fire *(subject of other resources)*

Hazard Classes (‘H’) apply to these 3 agents

*Above ground durability trials, Beerburrum QLD*

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# Decay

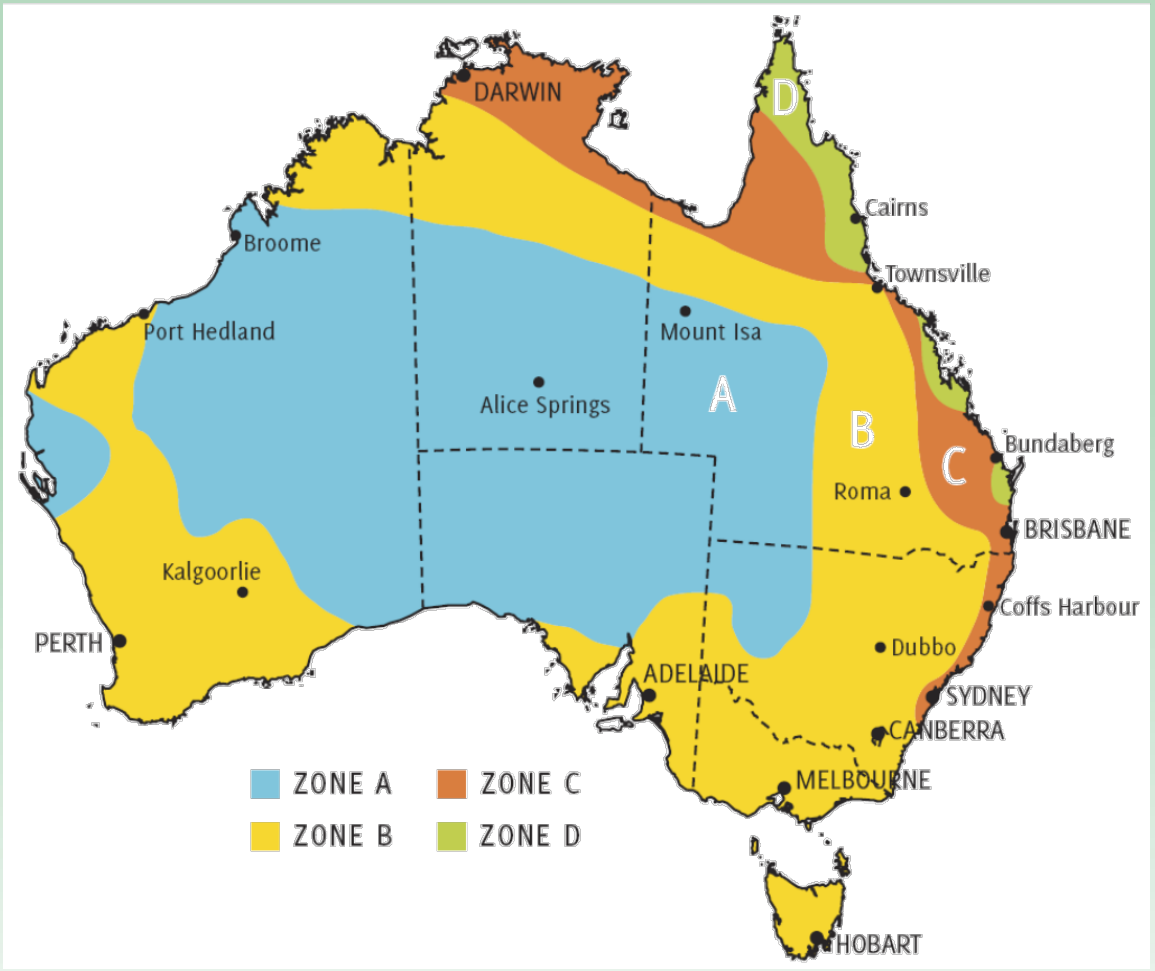
The performance of timber with respect to decay is:

- Highly related to the presence of free moisture in the wood above 20% moisture content (MC)
- Different with respect to decay when in-ground vs above ground (different timber durability ratings apply in each case)

Macro climatic decay hazard maps have been developed to address these fundamental differences

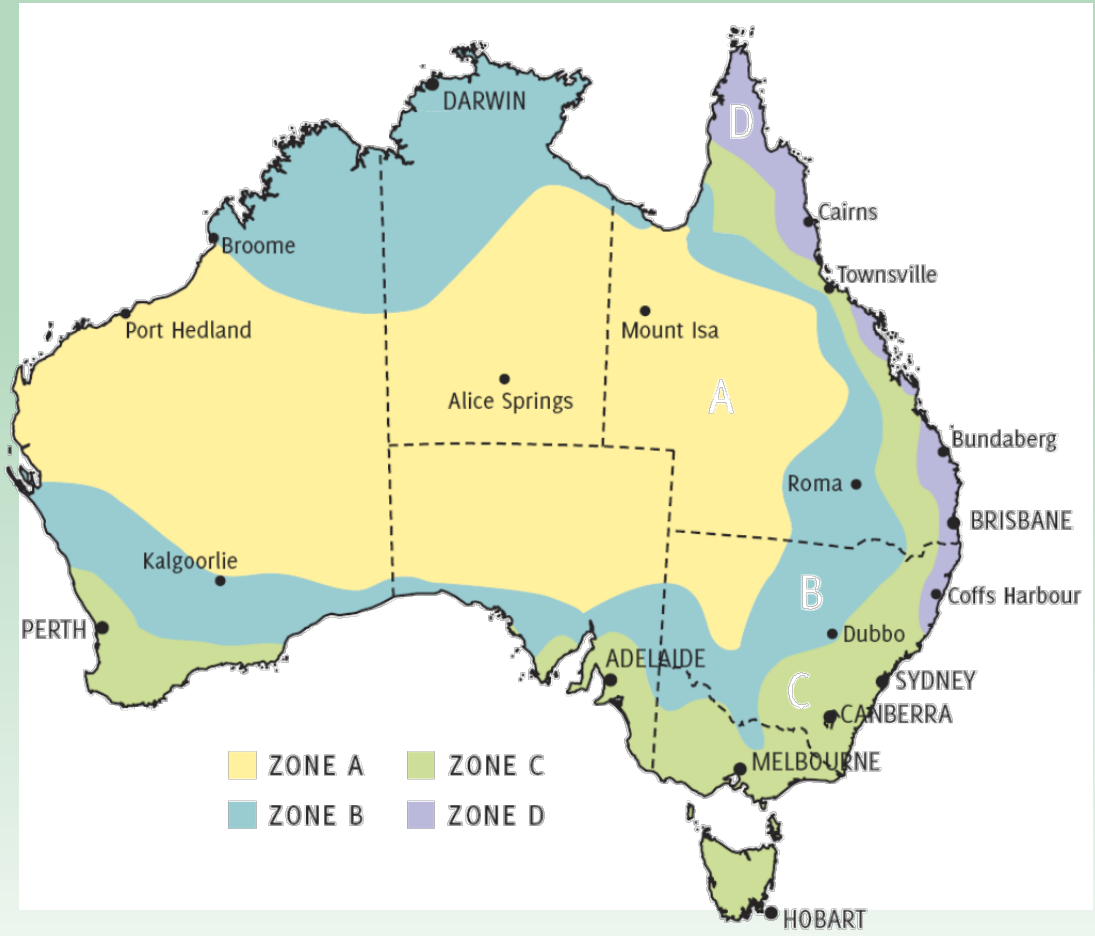
*In-ground durability trials*
*'Wedding Bells', Nth NSW*

# Decay: In-Ground Decay Hazard Zones




**In-ground decay hazard zones for Australia**
(Zone D has the greatest in-ground decay potential)

# Decay: Above Ground Decay Hazard Zones




**Above ground decay hazard zones for Australia**
(Zone D has the greatest decay hazard potential)

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# CTIQ

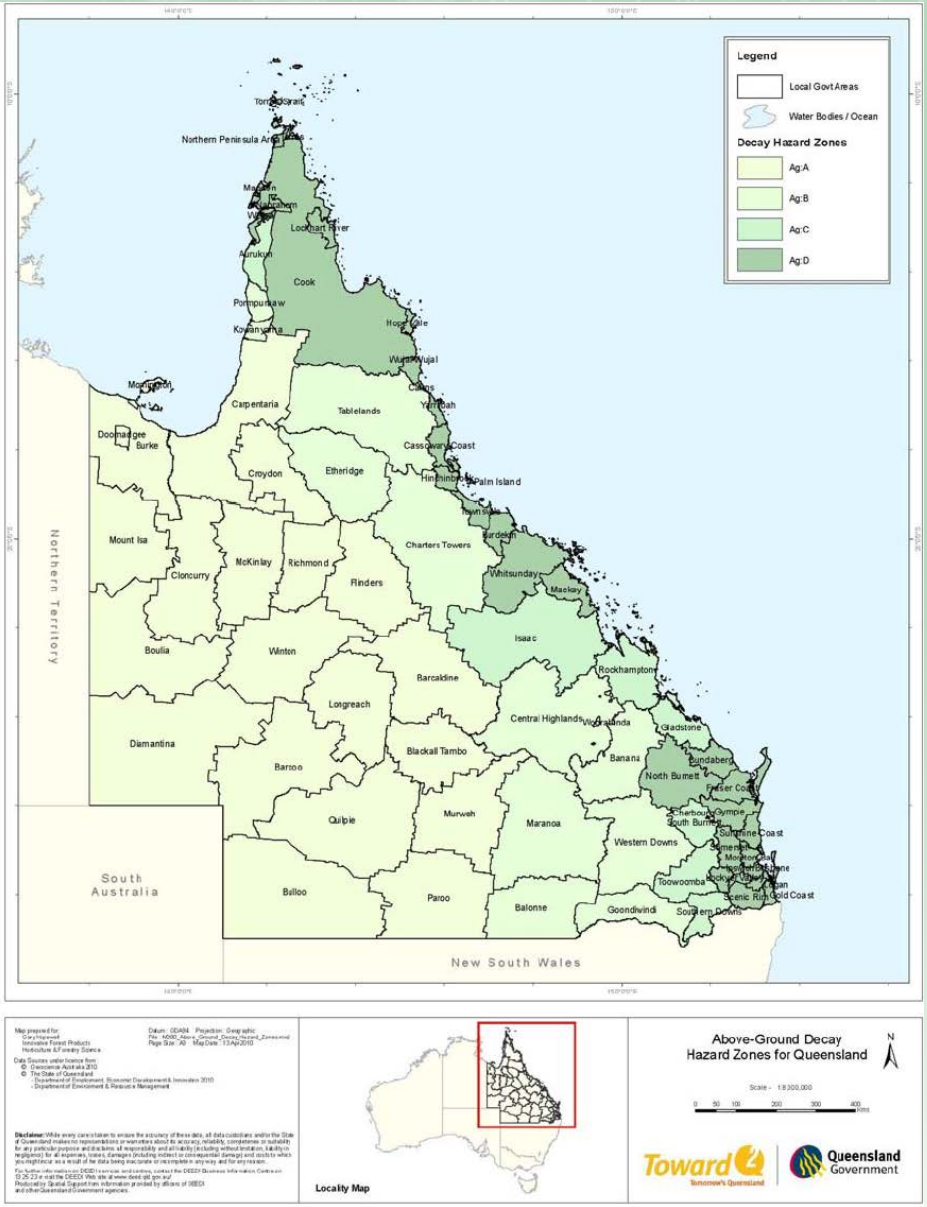


**Figure 1 Above-ground decay hazard zones for Queensland**
Map compiled by Spatial Support, Information & Technology Services, DEEDI (after MacKenzie et al. 2005)

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# Decay: Causes

To thrive fungi need:

- Moisture > 20% MC in wood
- Oxygen
- Temperature >25$^{o}$ to <40$^{o}$ (ideal)
- Food

Remove any of these four key elements and fungal growth is either stopped or retarded

e.g. preservative treatment renders the ‘food’ (wood) immune



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# Decay: Absence of Causes Example

Wood in an anaerobic condition (i.e. without access to oxygen) lasts indefinitely

e. g. Kauri dug out from the ground after 10,000 to 50,000 years

# Hazard Classes (H1 – H6 AS 1604)

**H1** - fully protected indoors, borers only

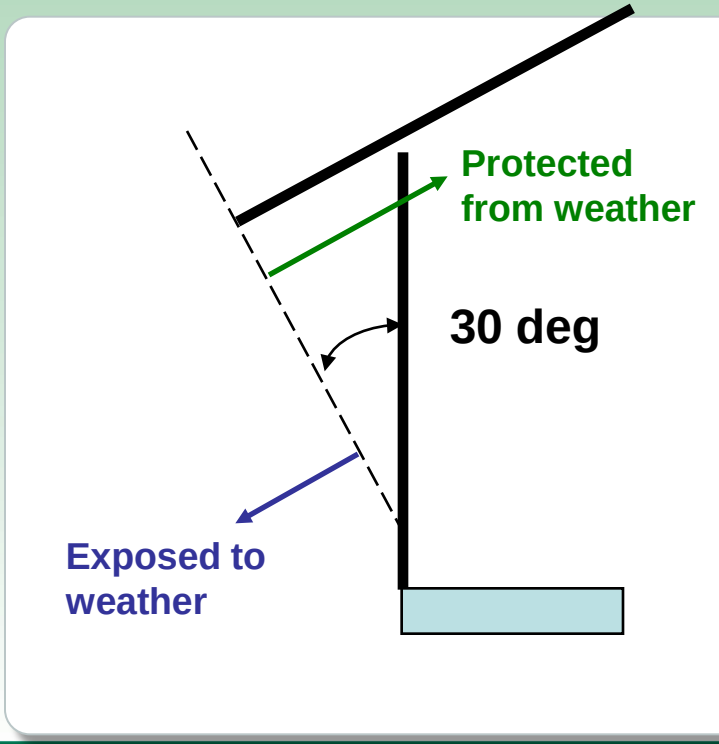
**H2** – fully protected indoors, borers and termites

**H3** - ***exposed*** *to weather, above ground, well ventilated*

**H4** - in ground (landscaping)

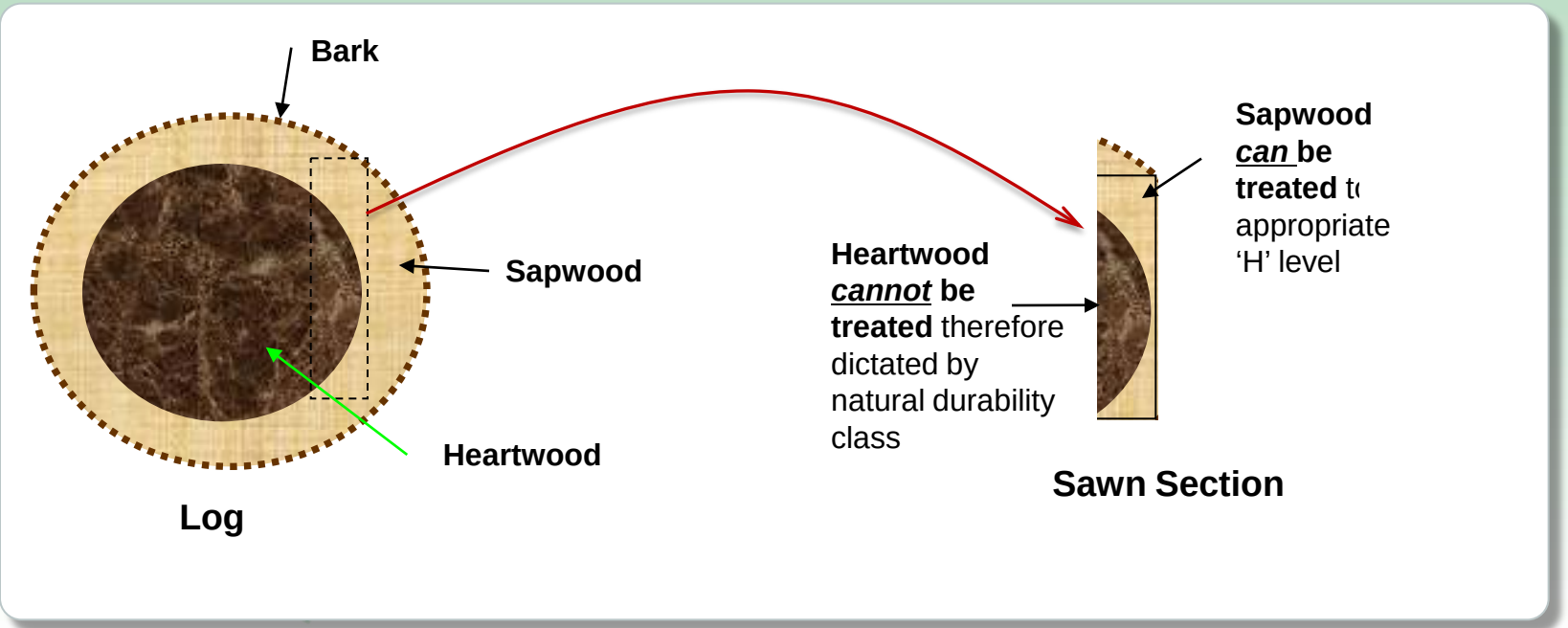
**H5** - in ground (more critical)

**H6** - marine piles



# Decay: Resistance to Decay

- Natural Durability Ratings apply to heartwood (or true wood) only – not sapwood
- Only sapwood can be effectively treated
- Limit non-durable timber to 20% cross-section (max)

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# Examples of In-ground Durability

## Class 1 (highly durable)

- ironbark, tallowwood, Gympie messmate

## Class 2 (durable)

- spotted gum, blackbutt

## Class 3 (moderately durable)

- brush box, rose gum

## Class 4 (non durable)

- all sapwood for all species, Victorian ash, Tasmania oak, Oregon, radiata pine, slash pine, hoop pine

# Examples of Above Ground Durability

## Class 1 (highly durable)

- ironbark, tallowwood, river red gum, spotted gum, blackbutt, cypress

## Class 2 (durable)

- rose gum, jarrah, yellow stringybark, Sydney blue gum , brush box

## Class 3 (moderately durable)

- Victorian ash, Tasmanian oak, huon pine

## Class 4 (non durable)

- all sapwood for all species, Oregon, radiata pine, slash pine, hoop pine

For an extensive list of natural durability ratings refer to AS 5604 Timber – Natural durability ratings or the Timber Service Life Design Guide, at www.woodsolutions.com.au

# Service Life of Heartwood

| Natural Durability Class | Heartwood Service Life (years) (1) (2) | | |
|---|---|---|---|
| | H1 Fully Protected | H3 Above Ground exposed | H5 In- Ground |
| Class 1 | $50^{+}$ | >40 | $25^{+}$ |
| Class 2 | $50^{+}$ | 15 – 40 | 15 - 25 |
| Class 3 | $50^{+}$ | 7 – 15 | 5 - 15 |
| Class 4 | $50^{+}$ | 0 - 7 | < 5 |

(1) Based on in-ground graveyard stake trials and above ground 'L' joint trials

(2) Greater service life can be achieved with larger sections, relevant maintenance and/or preservative treatment

# Suitable Preservatives

| TYPE | | HAZARD LEVEL | | | | | |
|---|---|---|---|---|---|---|---|
| | | H1 | H2 | H3 | H4 | H5 | H6 |
| Water | Boron | ■ | ■ | | | | |
| | CCA | ■ | ■ | ■ | ■ | ■ | ■ (1) |
| | Copper Azole | ■ | ■ | ■ | ■ | ■ | |
| | ACQ | ■ | ■ | ■ | ■ | ■ | |
| Solvent | LOSP | ■ | ■ | ■ | | | |
| Double | CCA + Creosote | | | | | | ■ |

(1) Southern waters only

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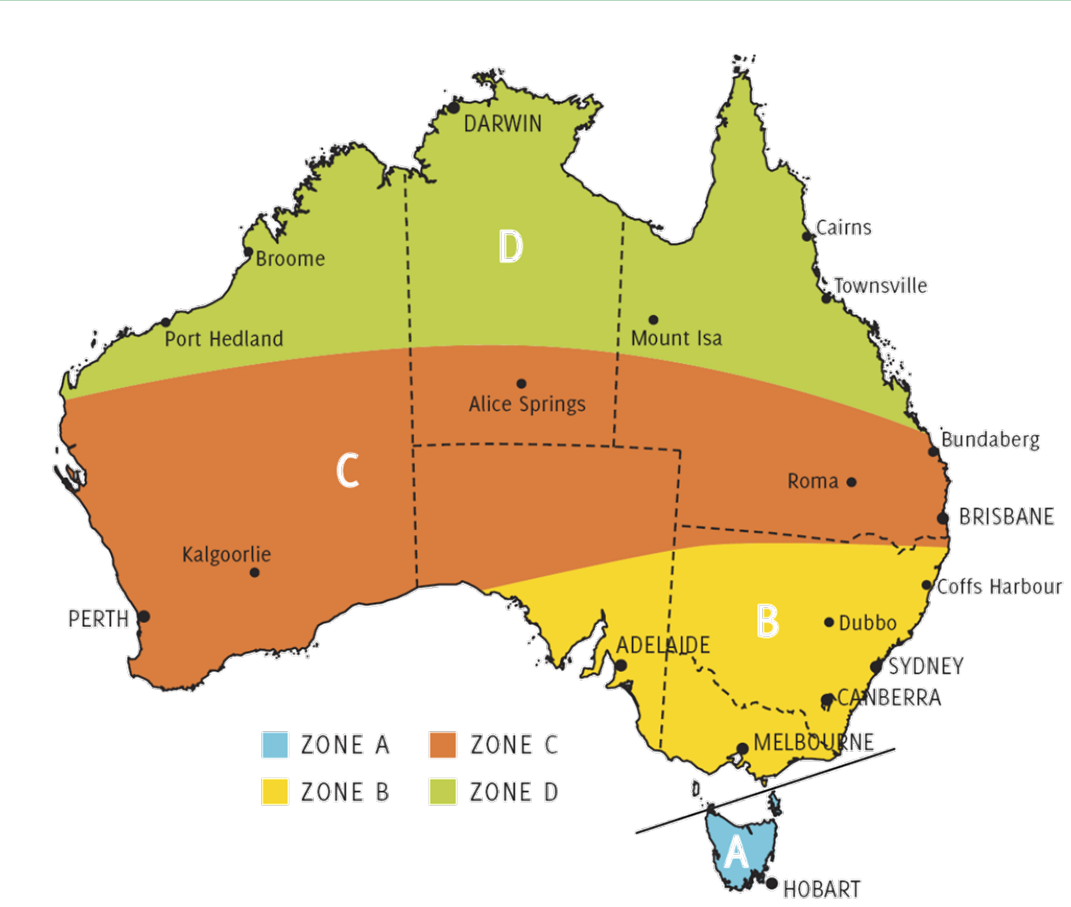
# Insects: Termite Hazard Zones




**Termite hazard zones for Australia**
(Zone D has the greatest termite hazard)



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# Termite Protection

- The Building Code (BCA) requires termite protection for buildings in designated termite prone areas
- In termite prone areas, the BCA provides two options:
  - Either all ‘primary structural elements’ (specific QLD variation requirements) are to be termite resistant (for timber refer to AS 3660.1), OR
  - Termite protection shall be provided in accordance with AS 3660.1 which provides options and combinations including isolation, termite shields, physical and chemical soil barriers, termite resistant materials etc.

# Whole of House

- Chemical and or Physical Barriers to isolate wood & ‘cellulose’ from termites
- Regular Inspection
- AS 3660.1 – Protection of New Buildings from Subterranean Termites
- TQ Tech Data Sheet 12

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# Technical Data Sheet

# Protecting Buildings from Subterranean Termites 12

Recommended Practice / March 2006

Issued by: Timber Queensland Limited

## Introduction

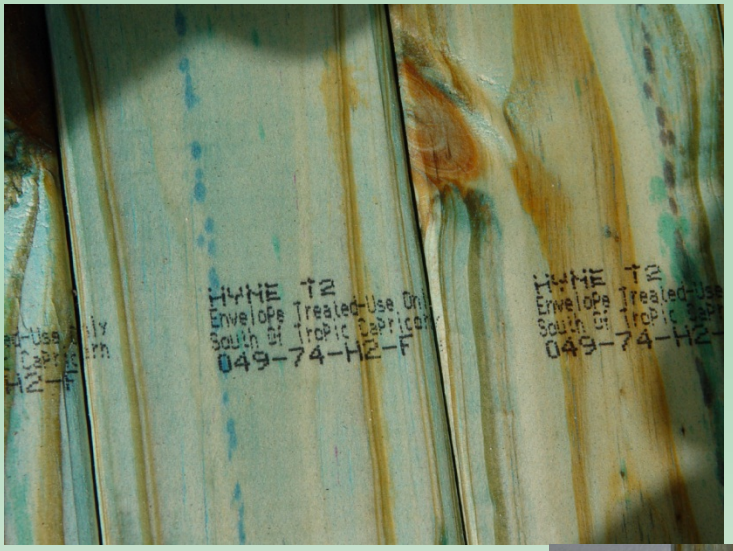
All buildings, building materials and building contents are subjected to a number of hazards throughout their useful life. These include

physical barriers into the design, coupled with regular inspection of these barriers. Queensland's rich heritage of timber buildings is testimony to the effectiveness of these measures.

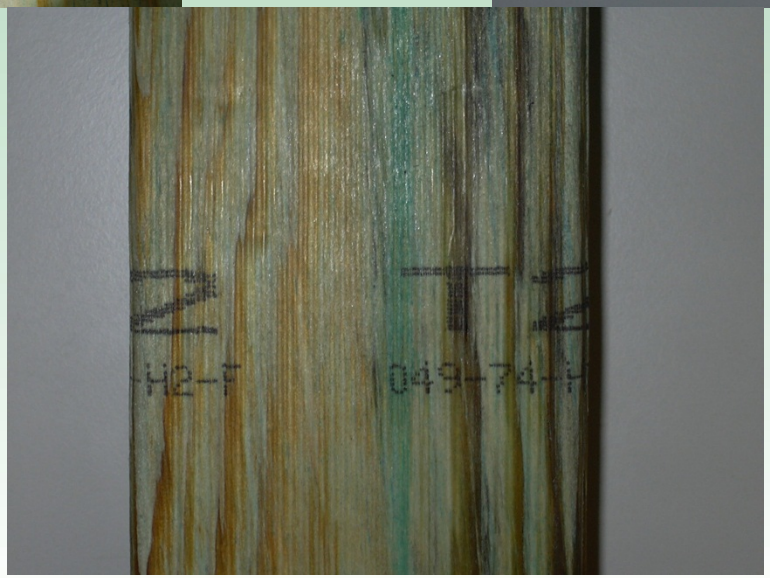
# Termite Treated Timber

- Commercial/trade names
- ‘T2 Blue’, ‘T2 Red’, ‘Red Alert’, ‘H2 Termigaurd’, ‘True Blue T2’, Terminator, etc
- AS 1604.1 specifies regulatory brands
- H2 = termites and borers all Qld – not decay
- H2 ‘F’= termites and borers Sth of TC
- ‘H3’ = termites, borers & decay
- ‘H4’ = in-ground landscaping – not structural
- ‘H5’ = structural in-ground – poles, retaining walls

# Brands





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# Brands

| 1234 75 H2 |
|---|

‘F’ ‘Not to be used North of tropic of Capricorn’

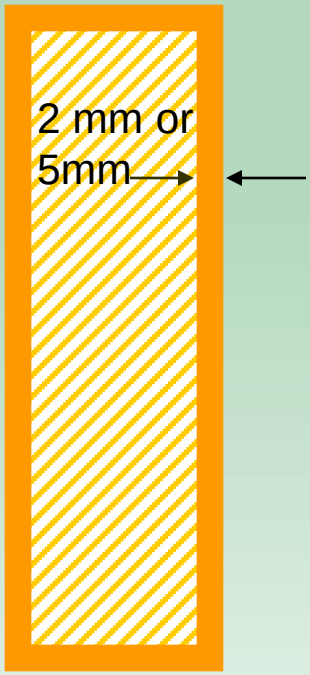
( 2 or 5 mm envelope, 45 mm max thick.)

| 1234 73 H2 |
|---|

( all sapwood plus 5 or 8 mm envelope

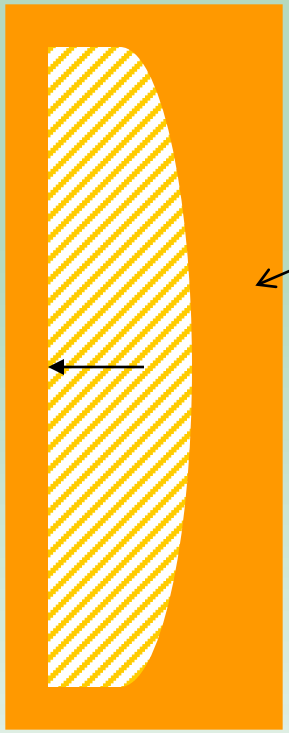
No size limit )

# Envelope H2 ‘F’




Max thickness
45 mm

## H2



All sapwood treated + limitations on untreated heartwood in some cases

5mm, or 8mm for >35mm thick or; termite resistant heartwood

**Heartwood of local slash and Carribean pines are termite resistant AS 5604/AS 3660**



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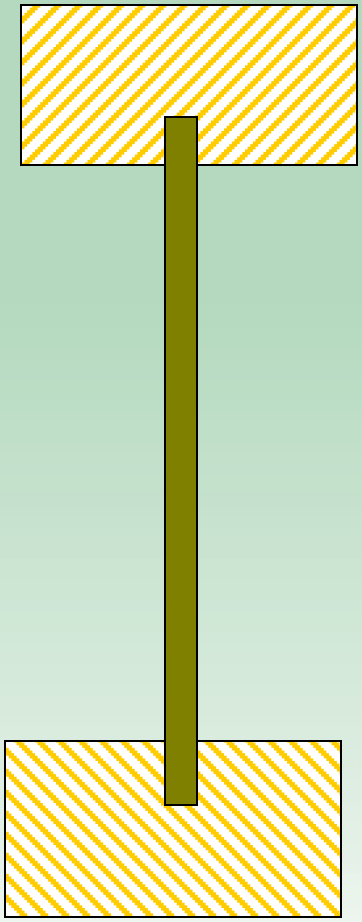
# ETP's





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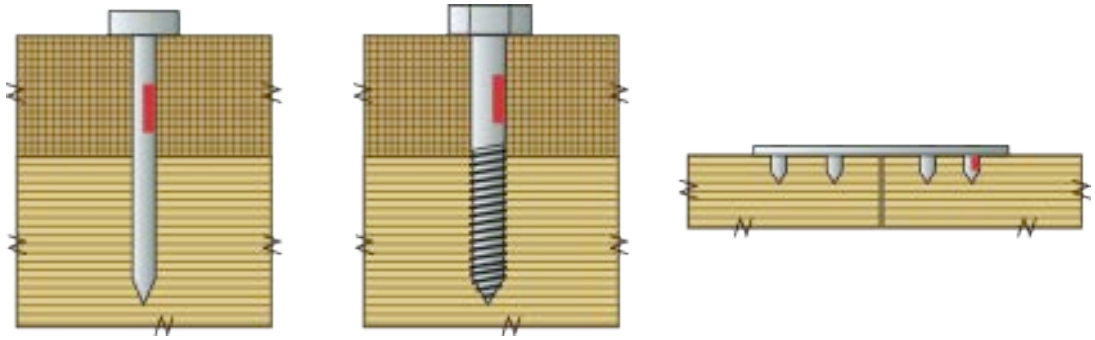
# Corrosion: Fasteners

There are two types of corrosion:

**Embedded**

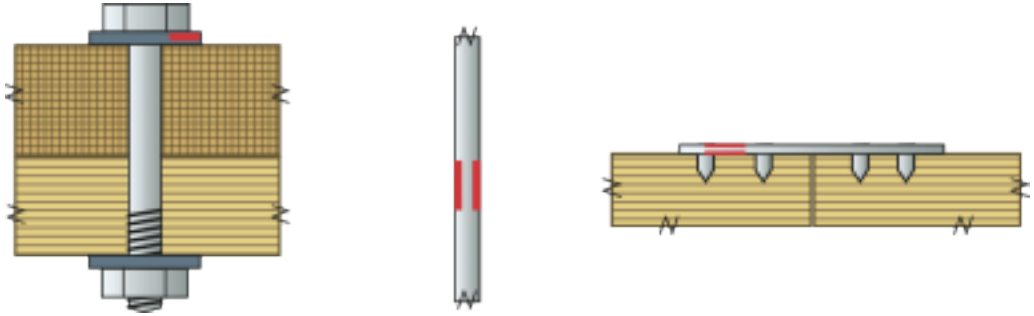
Typical installation of fasteners embedded in wood subjected to corrosion



**Note: red marks denote where corrosion is possible**

**Atmospheric**

Typical fastener installation subjected to atmospheric corrosion



# Corrosion: Fasteners

Most metal fasteners for timber have a part that is in the timber and a part exposed to the atmosphere

**Embedded portion**

Corrosion of the embedded part will be dictated by:

- the moisture content of the timber
- the natural pH of the timber
- electrolytic action that may occur due to the presence of preservatives such as copper in CCA or ACQ treated timber

*The sapwood in this pole has been treated with CCA and is causing accelerated corrosion of the galvanized plate*

# Corrosion: Fasteners

**Exposed portion**

Corrosion of the exposed portion of the fasteners will be influenced by:

- all of the embedded factors
- air-borne contaminants such as salt or other chemicals

Macro climatic hazard influences on corrosion need to differentiate between embedded and atmospheric corrosion, and apply separate hazard maps

# Hazard Zones – Embedded Corrosion


**Hazard zones for embedded corrosion**
(Zone C is the most hazardous)



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# Hazard Zones – Exposed Corrosion


**Hazard zones for exposed corrosion**
(Zone E is the most hazardous)

# Resistance

Resistance to corrosion is best provided by selecting and using material with the required resistance to corrosion, appropriate to the intended life of the structure


Cross-arm King bolt (hot dipped galvanized) after 35 years exposure in power pole.

# Weathering

Unprotected timber exposed to moisture and sunlight will undergo physical and chemical changes known as weathering

Weathering is the result of:

- surface erosion (this is slow – 6 mm to 13 mm per century)
- wetting/drying (causing swelling and shrinking)
- chemical change (caused by sunlight and oxygen)
- freezing and thawing in alpine areas

*20 year old deck and retaining wall*

# Weathering

Although hazard maps for weathering have not yet been developed, it is generally accepted that the effects of weathering are more severe and accelerated in harsher climates with greater extremes in temperature and rainfall

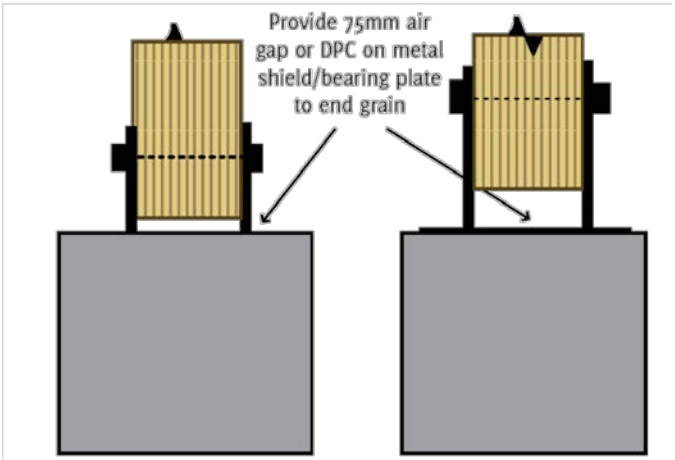
*Note the delineation in degree of weathering owing to shelter provided provided by the roof.*

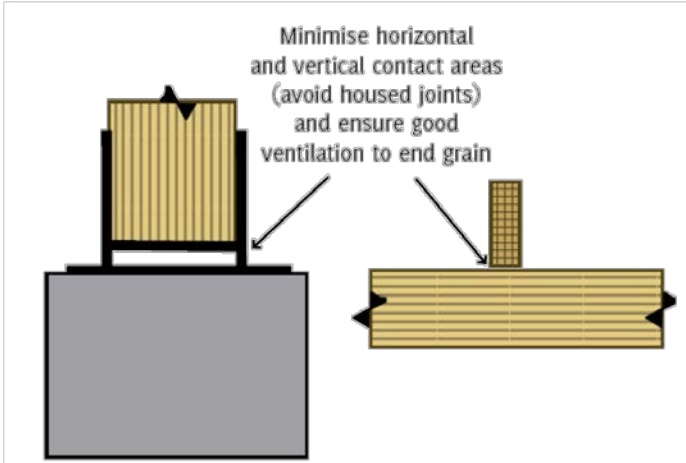
# Weathering: Resistance

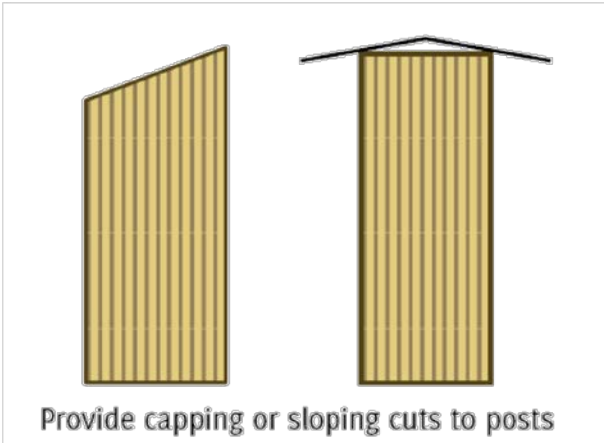
Protection from weathering can be maximised by:

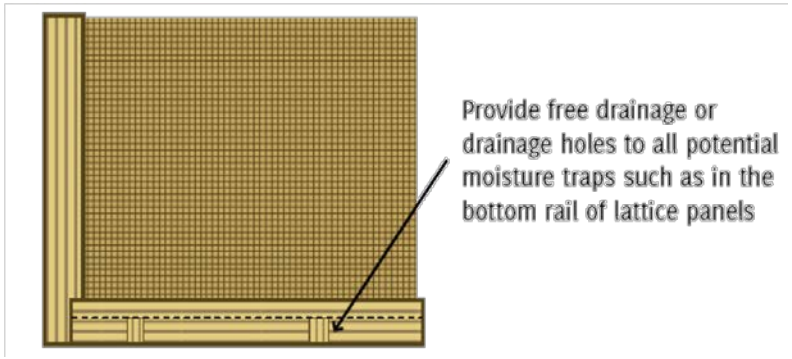
- Applying appropriate finishes, including paints, stains and water repellants
- Regular maintenance with appropriate finishes
- Architectural and design detailing that specifies overhangs, capping, verandahs and shading
- Considering ventilation, water shedding and drainage during design and construction

# Good Detailing



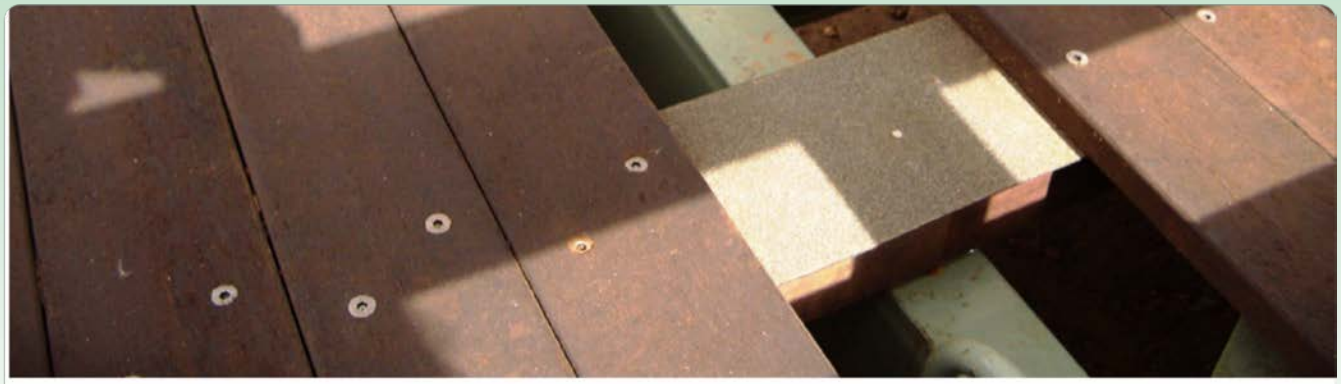



# Good Detailing

A well-ventilated, free-draining post support.

Capping protects top and end grain of projected beam.



Good detailing (staggered screws and DPC over joists) used for this prefabricated bridge.

# Marine Borers

Where timber (piles, braces etc.) is in contact with marine waters (ocean, bay and tidal), specific hazards such as marine borers and organisms need to be considered.

Factors that affect the level of marine borer hazard include:

- Macro-climatic hazard zone (warmer waters, higher hazard)
- Water salinity
- Sheltering effects
- Construction details

*Aquaculture is a valuable wood use.*

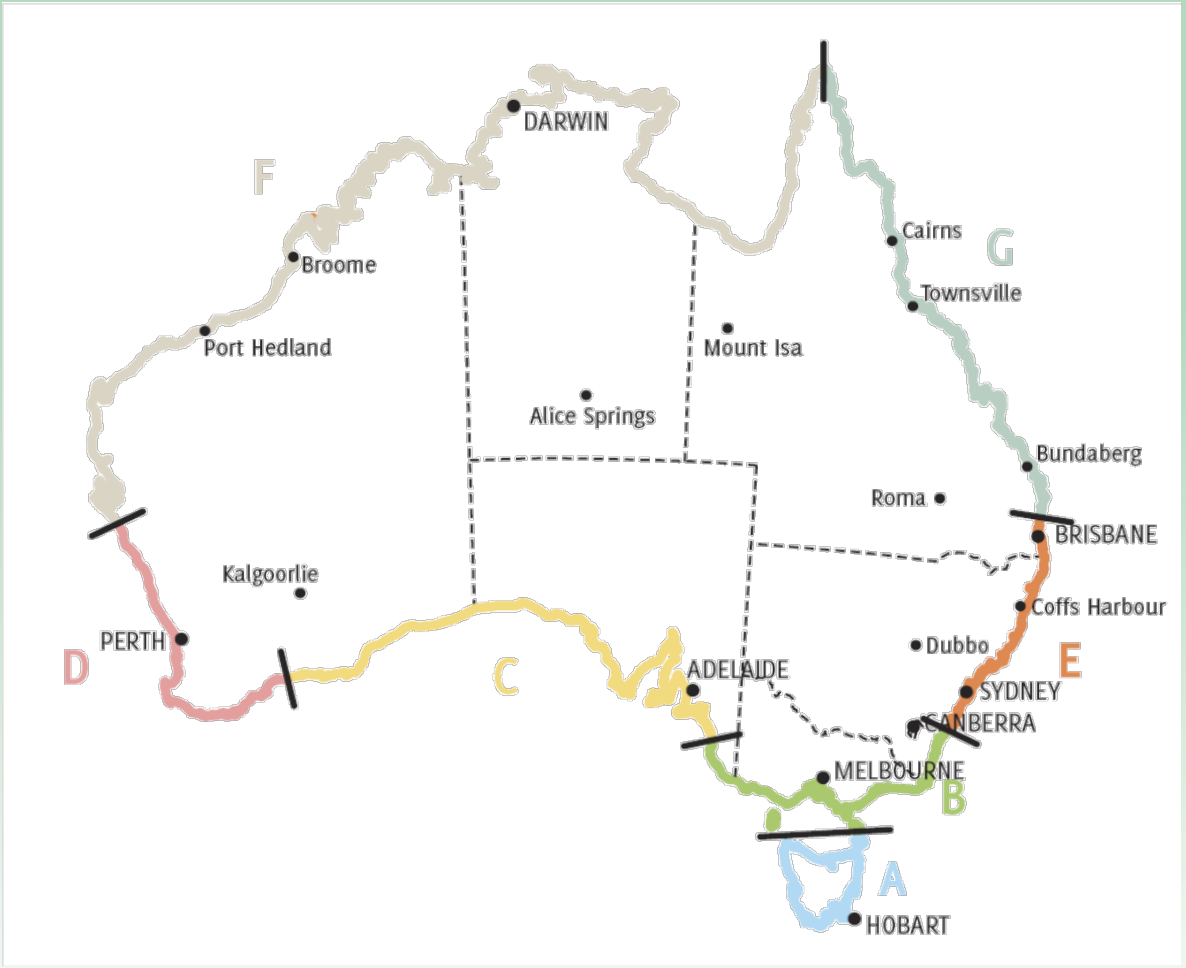
# Marine Borers

Marine piles and timber in marine contact are best protected by:

- Using species with high natural resistance such as turpentine or in cooler southern waters, swamp box, river red gum or white mahogany
- Using preservative treated timbers (‘H6’) with wide sapwood bands such as spotted gum and plantation softwoods
- Using mechanical barriers and floating collars

*Piles encased in sand filled concrete pipe*

# Marine Borers: Hazard Zones




**Marine borer hazard zones (**Zone G is the most hazardous)

*Timber recycles carbon*

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# Marine Borers: Resistance

AS 5604 provides an extensive list of species with their marine borer resistances where known – as seen in the extract below.

**NATURAL DURABILITY RATINGS OF TIMBER SPECIES**

| 1 | 2 | 3 | 4 | | 5 |
|---|---|---|---|---|---|
| Standard common name and scientific/botanical name | Lyctid susceptibility of sapwood | Termite resistance of heartwood (inside above ground—applicable to H2 in AS 1604 series) | Natural durability class of heartwood | | Marine-borer resistance of heartwood |
| | | | In-ground contact, $D_{ig}$ | Outside above ground, $D_{ag}$ | |
| gum, blue, southern<br>*Eucalyptus globulus* | S | NR | 3 | 2 | 4 |
| gum, blue, Sydney<br>*Eucalyptus saligna* | S | NR | 3 | 2 | 3 |
| gum, grey<br>*Eucalyptus canaliculata*<br>*Eucalyptus major*<br>*Eucalyptus propinqua*<br>*Eucalyptus punctata* | NS | R | 1 | 1 | 2 |
| gum, grey, mountain<br>*Eucalyptus cypellocarpa* | S | NR | 3 | 2 | 4 |

# Fire

- Fire is covered by additional TQ/WS resources:
  - Using Wood in Bushfire-prone Areas
  - Fire Safety and Performance of Wood in Multi-Residential and Commercial Buildings

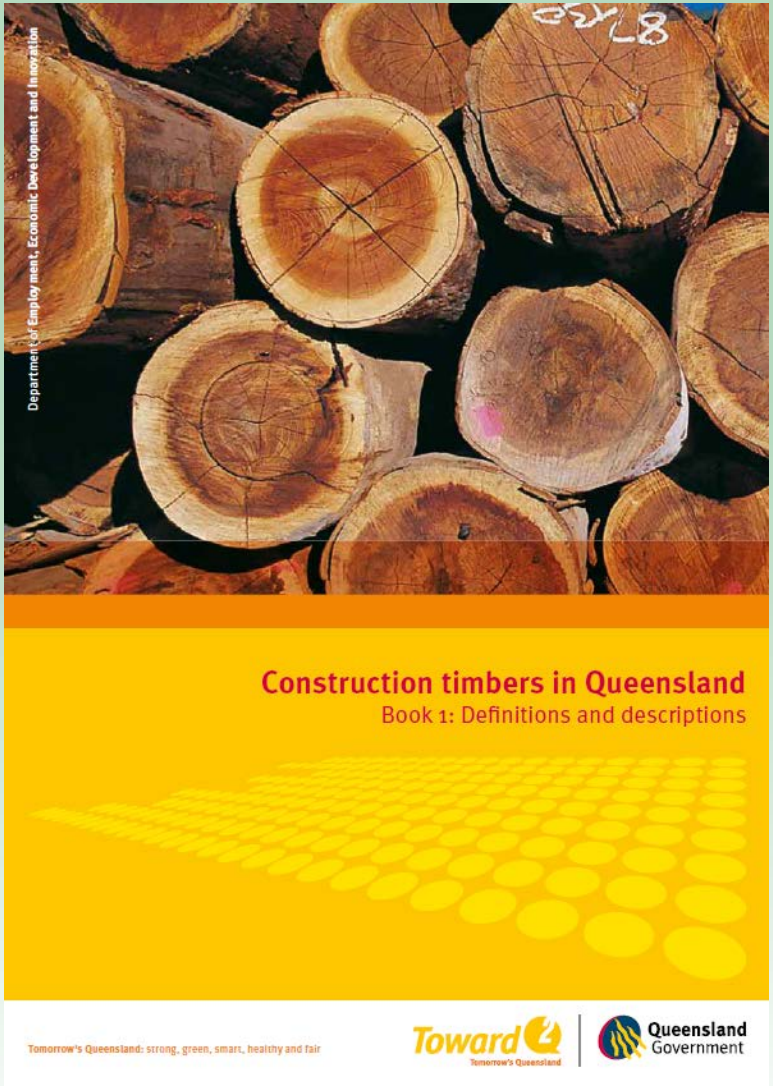
# Maintenance

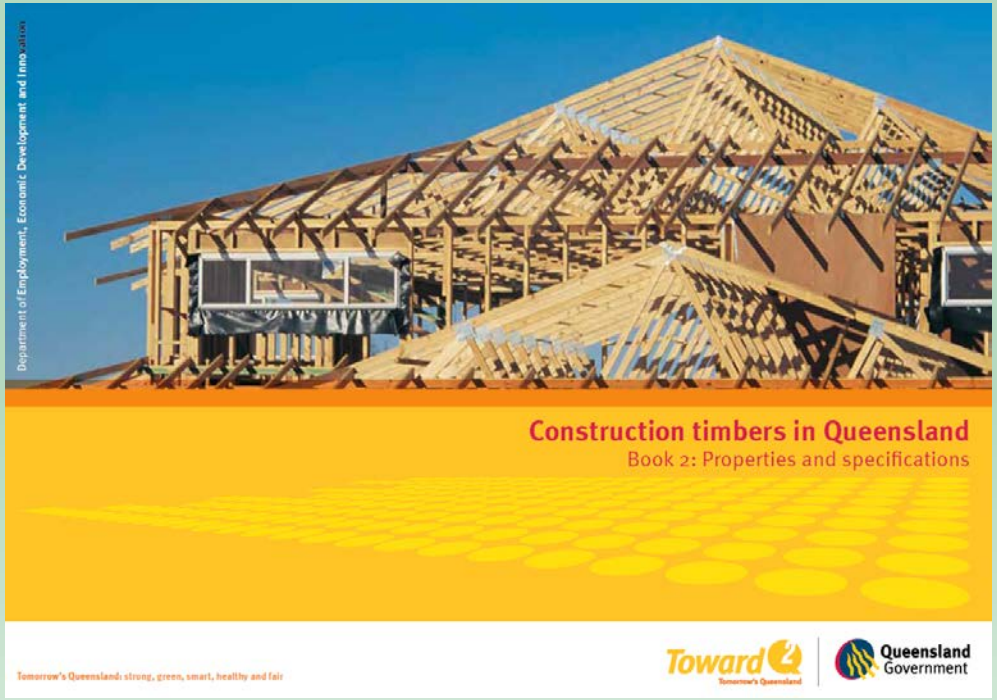
The satisfactory performance of timber structures will often depend on adequate maintenance programs.

Maintenance issues to consider are:

- Finishes
- Termite barriers, inspection and replenishment of treatments
- Maintaining sub-floor ventilation
- Tightening bolts and fasteners
- Re-applying supplementary preservatives and sealants
- Cleaning - sweep or blow, don’t hose away (moisture issues)

# CTIQ - 2 Books

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# **CTIQ – Book 1** - Contents

**Information relating to applications, target design life and decay hazard zones contained in Book 2**

Target design life

Applications

Above-ground decay hazard zones

In-ground decay hazard zones

Conditional use codes in Schedules A, B and C

Advisory codes used in Part 2 of Schedules

Seasoning and timber moisture content

Building members, target design life and applications

5 target design life applications

15 year target design life applications

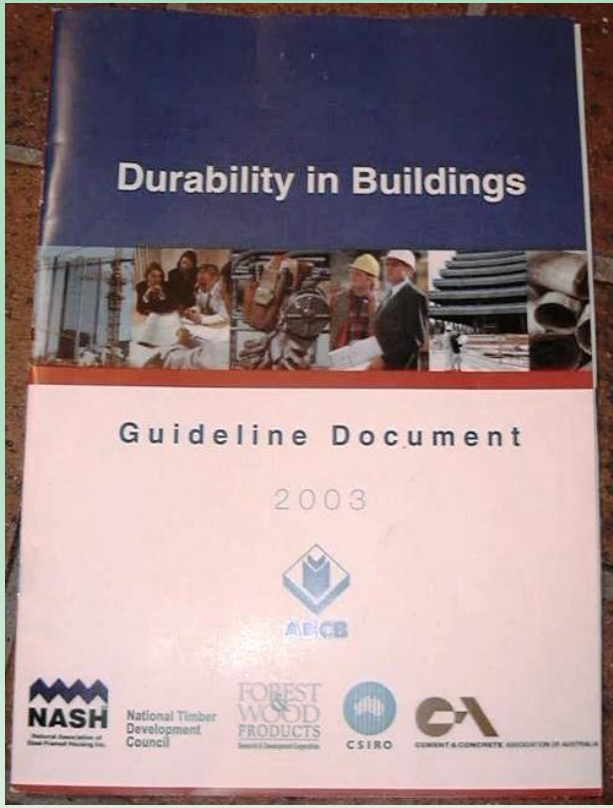
50 target design life applications

*Schedules A, B and C*

# **Book 1** – Durability Performance

***Note 9: Regulatory durability***

***performance requirements***




***The ABCB has published a guideline "Durability in Buildings". It explains the implicit requirements of the BCA that should be followed by manufacturers and specifiers wishing to satisfy the BCA's requirements.***

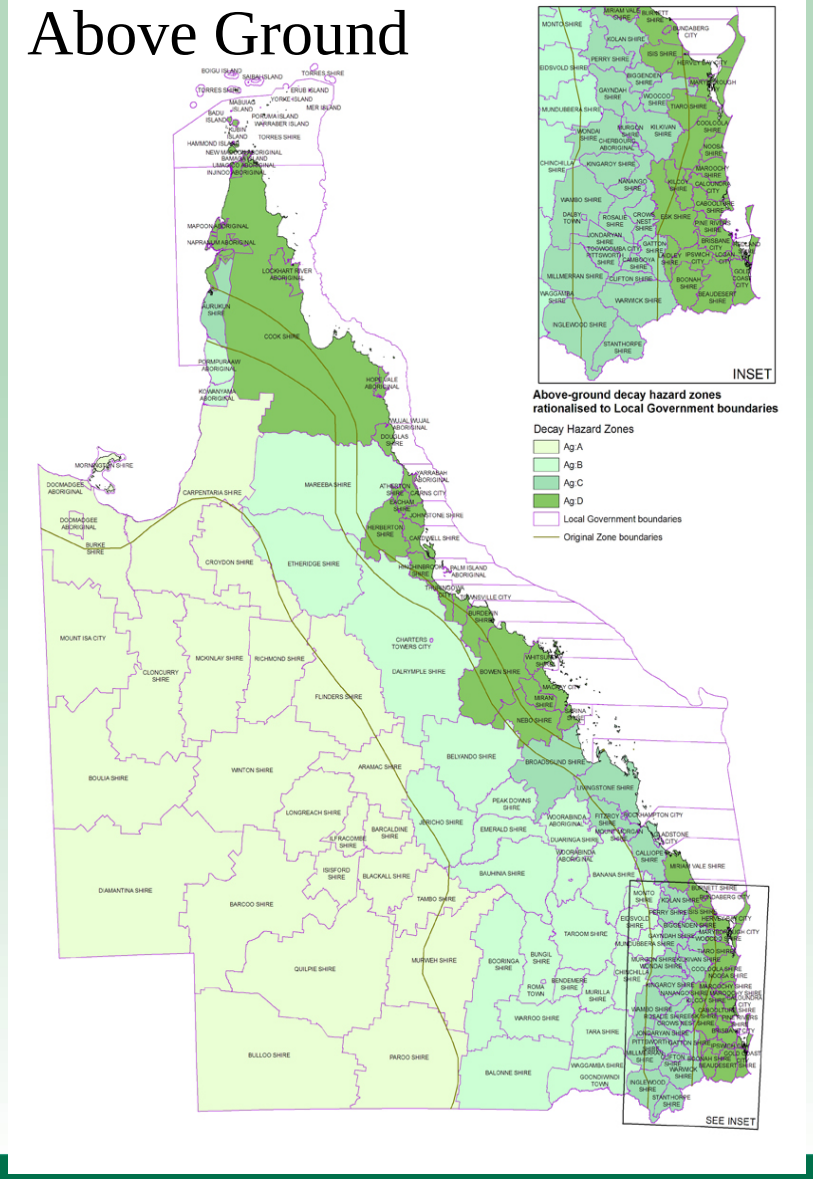
***CTIQ reflects the performance expectations implicit in the BCA as at 2006.***

# **Book 1** – Target Design Life

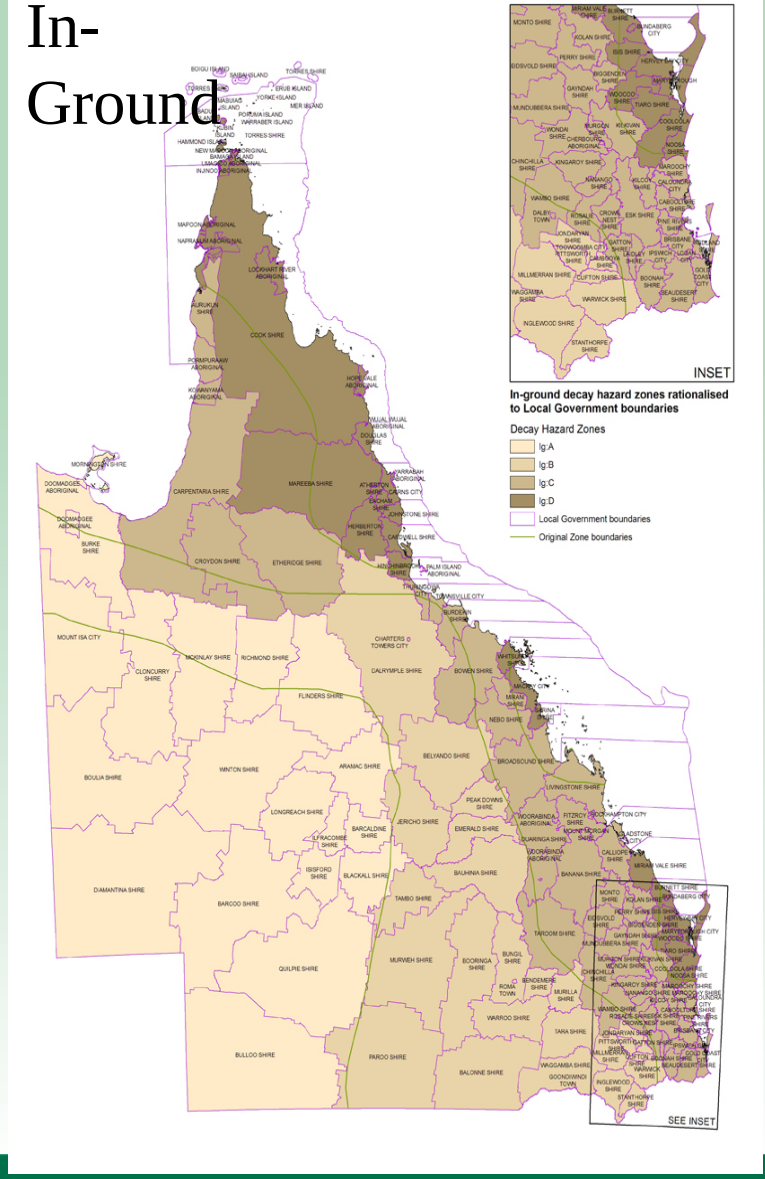
| **Building member** | **Environment** | **Target design life (yrs)** | **Application** (Column no. in Schedules A, B and C) |
|---|---|---|---|
| architraves | protected | 15 | 12 |
| balusters | exposed | 50 | 16 |
| | protected | 50 | 15 |
| barge boards | exposed | 15 | 13 |
| battens | between stumps | 5 | 11 |
| | under lining or cladding | 50 | 15 |
| | external wall | 15 | 13 |
| | greenhouse | 15 | 13 |
| | pergola | 15 | 13 |
| | roof, ceiling | 50 | 15 |
| beams | exposed | 50 | 16 |
| | protected | 50 | 15 |
| bearers | exposed | 50 | 16 |
| | protected | 50 | 15 |

# **CTIQ – Book 1** – Hazard Zones

Above Ground




In-Ground



# CTIQ - Layout – Book 2

**Schedule B - Part 1- nomenclature, origin and properties of Australian grown species.** *Page numbers refer to Book 1*

| 1 (p.9) | 2 (page 9) | 3 (page 9) | 4 (p.10) | 5 (p.10) | 6 (p.11) | | 7 (p.14) | | 8 (p.14) | | 9 (p.16) | 10 (p.17) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Strength groups (page 11) | | Joint groups (page 14) | | Natural durability ratings (page 14) | | | |
| Index number | Standard trade name | | Origin | Density (kg/m³) | S (green) | SD (dry) | J (green) | JD (dry) | Above-ground | In-ground | Lyctine susceptibility | Termite resistance |
| 331 | pends, southern | *Xanthostemon oppositifolius* | Qs | 1120 | (2) | (2) | — | 1 | 1 | 2 | NS | NR |
| 332 | pends, yellow | *Ristantia pachysperma* | Qn | 815 | (4) | (4) | — | 2 | (3) | 3 | NS | NR |
| 333 | peppermint, New England | *Eucalyptus nova-anglica* | Qs, A | 800 | 4 | 4 | — | 2 | (3) | 3 | S | NR |
| 334 | peppermint, Queensland | *Eucalyptus exserta* | Qncs | 1010 | (2) | (3) | — | 1 | 1 | 1 | S | R |
| 335 | pepperwood | *Cinnamomum laubatii* | Qnc | 480 | (7) | (8) | — | 4 | (4) | 4 | S | NR |
| 336 | persimmon, grey | *Diospyros pentamera* | Qncs, A | 735 | 5 | 4 | — | 3 | (4) | 4 | S | NR |
| 337 | pimplebark | *Balanops australiana* | Qnc | 965 | (4) | 3 | — | 2 | (4) | 4 | (s) | NR |
| 338 | pine, Benguet | *Pinus kesiya* | Qncs | 495 | (7) | (8) | — | 4 | (4) | 4 | NS | NR |
| 339 | pine, black | *Prumnopitys amara* | Qn | 495 | 6 | 7 | — | 4 | (4) | 4 | NS | NR |
| 340 | pine, brown | *Podocarpus grayi* | Qnc | 550 | (7) | (7) | — | 4 | (4) | 4 | NS | NR |
| | | *Prumnopitys ladei* | Qn | 705 | (5) | (6) | — | 3 | (4) | 4 | NS | NR |
| | | *Podocarpus elatus* | Qncs, A | 560 | (6) | (7) | — | 4 | (4) | 4 | NS | NR |
| 341 | pine, bunya | *Araucaria bidwillii* | Qns | 530 | 6 | 5 | 4 | 4 | 4 | 4 | NS | NR |
| 342 | pine, Caribbean | *Pinus caribaea var. caribaea* | Qncs, A | 545 | (6) | (6) | 4 | 4 | 4 | 4 | NS | R |
| | | *Pinus caribaea var. bahamensis* | Qncs | 545 | (6) | (6) | 4 | 4 | (4) | 4 | NS | R |
| | | *Pinus caribaea var. hondurensis* | Qncs | 575 | (6) | (6) | 4 | 4 | (4) | 4 | NS | R |
| | pine, cypress | see cypress | | | | | | | | | | |
| 343 | pine, hoop | *Araucaria cunninghamii* | Qncs, A | 560 | 6 | 5 | 4 | 4 | 4 | 4 | NS | NR |

**Properties**

**Schedule B - Part 2- applications and conditions for commercial mixtures of unidentified species.** *Page numbers refer to Book 1*

| 1 (p.9) | 2 (page 9) | 11 (p.31) | 12 (p.32) | 13 (page 33) | | | | 14 (page 34) | | | | 15 (p.35) | 16 (page 36) | | | | 17 (page 37) | | | | 18 (p.27) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 years | 15-year target design life | | | | | | | | | 50-year target design life | | | | | | | | | |
| | | | | Weather-exposed | | | | In-ground | | | | | Weather-exposed | | | | In-ground | | | | |
| Index number | Standard trade name | All above-ground applications | Protected | Above-ground decay hazard zone (page 19) | | | | In-ground decay hazard zone (page 22) | | | | | Above-ground decay hazard zone (page 19) | | | | In-ground decay hazard zone (page 22) | | | | Additional codes |
| | | | | Ag:A | Ag:B | Ag:C | Ag:D | Ig:A | Ig:B | Ig:C | Ig:D | | Ag:A | Ag:B | Ag:C | Ag:D | Ig:A | Ig:B | Ig:C | Ig:D | |
| 331 | pends, southern | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C2 | C3 | C4 | ✓ | ✓ | ✓ | ✓ | ✓ | C1 | C7 | C8 | C9 | |
| 332 | pends, yellow | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C5 | C5 | C5 | C5 | ✓ | ✓ | X | X | X | H5 | C8 | X | X | |
| 333 | peppermint, New England | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C5 | C5 | C5 | C5 | ✓ | ✓ | X | X | X | H5 | C8 | X | X | |
| 334 | peppermint, Queensland | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C1 | C8 | C8 | C8 | |
| 335 | pepperwood | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C5 | C5 | C5 | C5 | ✓ | ✓ | X | X | X | H5 | X | X | X | |
| 336 | persimmon, grey | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | C5 | C5 | C5 | C5 | ✓ | ✓ | X | X | X | H5 | X | X | X | |
| 337 | pimplebark | ✓ | C16 | ✓ | ✓ | ✓ | ✓ | C5 | C5 | C5 | C5 | C16 | ✓ | X | X | X | H5 | X | X | X | |
| 338 | pine, Benguet | ✓ | ✓ | C16 | C16 | C16 | C16 | H4 | H4 | H4 | H4 | ✓ | H3,C16 | H3,C16 | H3,C16 | H3,C16 | H5 | H5 | H5 | H5 | A5 |
| 339 | pine, black | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | H4 | H4 | H4 | H4 | ✓ | H3 | H3 | H3 | H3 | H5 | H5 | H5 | H5 | |
| 340 | pine, brown | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | H4 | H4 | H4 | H4 | ✓ | H3 | H3 | H3 | H3 | H5 | H5 | H5 | H5 | |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | H4 | H4 | H4 | H4 | ✓ | H3 | H3 | H3 | H3 | H5 | H5 | H5 | H5 | |
| | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | H4 | H4 | H4 | H4 | ✓ | H3 | H3 | H3 | H3 | H5 | H5 | H5 | H5 | |
| 341 | pine, bunya | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | H4 | H4 | H4 | H4 | ✓ | H3 | H3 | H3 | H3 | H5 | H5 | H5 | H5 | A4,A5 |
| 342 | pine, Caribbean | ✓ | ✓ | C16 | C16 | C16 | C16 | H4 | H4 | H4 | H4 | ✓ | C16 | H3,C16 | H3,C16 | H3,C16 | H5 | H5 | H5 | H5 | A5 |
| | | ✓ | ✓ | C16 | C16 | C16 | C16 | H4 | H4 | H4 | H4 | ✓ | C16 | H3,C16 | H3,C16 | H3,C16 | H5 | H5 | H5 | H5 | A5 |
| | | ✓ | ✓ | C16 | C16 | C16 | C16 | H4 | H4 | H4 | H4 | ✓ | C16 | H3,C16 | H3,C16 | H3,C16 | H5 | H5 | H5 | H5 | A5 |
| 343 | pine, hoop | ✓ | ✓ | C16 | C16 | C16 | C16 | H4 | H4 | H4 | H4 | ✓ | C16 | H3,C16 | H3,C16 | H3,C16 | H5 | H5 | H5 | H5 | A4,A5 |

**Application**

## Fold-out guides for PART 1 of the Schedules

Tan highlight indicates **hardwood** | Yellow highlight indicates **softwood**

— dash | Indicates no reliable data available at time of publication

**Column 4—Origins**

| Code | Geographical source | Code | Geographical source |
|---|---|---|---|
| A | Non – Queensland states | NA | North America |
| N | New South Wales | E | Europe |
| Qs | Southern Queensland | AF | Africa |
| Qc | Central Queensland | NZ | New Zealand |
| Qn | Northern Queensland | AP | Asia / Pacific areas |
| S | South Australia | | |
| T | Tasmania | | |
| V | Victoria | | |
| W | Western Australia | | |

**Column 5—Density and utilisation**

| Density range | Hardness | Remarks - relative to high wear applications |
|---|---|---|
| < 480 kg/m³ | Very soft | Very poor resistance to indentation – covered flooring only |
| 485 – 560 kg/m³ | Soft | Poor resistance to indentation – light traffic floors only (bedrooms) |
| 565 – 800 kg/m³ | Firm | Suitable for domestic flooring |
| 805 – 960 kg/m³ | Hard | Excellent resistance to indentation and wear; suitable for feature floors, step treads, benchtops |
| > 965 kg/m³ | Very hard | As above – some species are difficult to work and require sharp tools |

**Column 6—Strength groups**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Unseasoned strength group | | | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
| Seasoned strength group | SD1 | SD2 | SD3 | SD4 | SD5 | SD6 | SD7 | SD8 | |
| **Visual grades** | **Stress grades** | | | | | | | | |
| Structural 1 | F34 | F34 | F27 | F22 | F17 | F14 | F11 | F8 | F7 |
| Structural 2 | F34 | F27 | F22 | F17 | F14 | F11 | F8 | F7 | F6 |
| Structural 3 | F27 | F22 | F17 | F14 | F11 | F8 | F7 | F5 | F4 |
| Structural 4 | F22 | F17 | F14 | F11 | F8 | F7 | F5 | F4 | — |
| Structural 5 | — | — | — | — | F7 | F5 | F4 | — | — |

**Column 7—Joint groups**

There are six joint groups for unseasoned timber ranging downwards from J1 (strongest) to J6

There are six joint groups for seasoned (dry) timber ranging downwards from JD1 (strongest) to JD6

**Column 8—Interpreting natural durability ratings**

| Durability class | Above-ground life expectancy | In-ground life expectancy |
|---|---|---|
| 1 | > 40 years | > 25 years |
| 2 | 15 to 40 years | 15 to 25 years |
| 3 | 7 to 15 years | 5 to 15 years |
| 4 | Less than 7 years | Less than 5 years |

**Column 9—Interpreting lyctine susceptibility codes**

| Code used in schedules | Lyctine susceptibility status |
|---|---|
| NS | Non – susceptible to lyctine attack |
| (s) | Considered (in legal terms) lyctine susceptible |
| S | Confirmed lyctine susceptible |

**Column 10—Interpreting termite resistance codes**

| Code used in schedules | Termite resistance status |
|---|---|
| R | Highly resistant |
| NR | Low OR no resistance OR no reliable data available |

## Fold-out guides for PART 2 of the Schedules

Blue highlight indicates **hardwood** | Yellow highlight indicates **softwood**

✓ Approved Subject to conditions of use and treatment requirements specified in Part 1 | x Not approved

**Columns 12 to 17—Conditions of use codes**

| Code | Condition | Code | Condition |
|---|---|---|---|
| C1 | Desapped for in-ground contact if untreated | C11 | Pole frame construction poles must be set in stirrups |
| C2 | Minimum dimension – 100 x 100 mm | C12 | Single species only, free of heart |
| C3 | Minimum dimension – 150 x 150 mm | C13 | Desapped where in-ground-min diameter 200 mm |
| C4 | Minimum dimension – 200 x 200 mm | C14 | Desapped where in-ground-min diameter 300 mm |
| C5 | Round timber only– treatment H4 min | C15 | Desapped where in-ground-min diameter 400 mm |
| C6 | Round timber > 200 mm diameter – H4 min | C16 | Seasoned |
| C7 | Round timber > 200 mm diameter – H5 min | C17 | weather exposed door jambs & mullions must comply with industry recommendations |
| C8 | Round timber > 100 mm diameter – H5 min | H3 | Minimum H3 level of preservative treatment |
| C9 | Round timber > 400 mm diameter – H5 min | H4 | Minimum H4 level of preservative treatment |
| C10 | Part seasoned – max MC 20% | H5 | Minimum H5 level of preservative treatment |

**Column 18—Advisory Codes**

*Advisory codes provide general information relevant to particular species*

| Code | Condition | Code | Condition |
|---|---|---|---|
| A1 | High shrinkage | A6 | Included bark sometimes present |
| A2 | Density, hardness & strength vary with origin and species | A7 | Finishes sometimes affected by resin bleed |
| A3 | Gum veins common | A8 | Latex canals common |
| A4 | Paint / protect against Queensland pine beetle | A9 | Corrodes ferrous fastenings when wet |
| A5 | Usually knotty | | |

**Columns 13 to 17—Decay hazard zones**

| Above-ground decay hazard zones | | In-ground decay hazard zones | |
|---|---|---|---|
| Ag:A | Least potential for above-ground decay | Ig:A | Least potential for in-ground decay |
| Ag:B | Lower than Ag:C – greater than Ag:A | Ig:B | Lower than Ig:C – greater than Ig:A |
| Ag:C | Lower than Ag:D – greater than Ag:B | Ig:C | Lower than Ig:D – greater than Ig:B |
| Ag:D | greatest potential for above-ground decay | Ig:D | greatest potential for in-ground decay |

**Columns 11 to 17—Applications**

| Column | |
|---|---|
| 11 | 5 year target design life applications |
| 12 | 15 year target design life applications: protected, non-structural building applications |
| 13 | 15 year target design life applications: weather-exposed, structural and/or non-structural building applications |
| 14 | 15 year target design life applications: in-ground, accessible, structural building applications |
| 15 | 50 year target design life applications: protected, structural and/or non-structural building applications |
| 16 | 50 year target design life applications: weather-exposed, structural and/or non-structural building applications |
| 17 | 50 year target design life applications: in-ground, structural building applications |

# Government Work

- If you are tendering/bidding on Government (QBuild/Project Services etc) work pay particular attention to the specifications relating to preservative treatment
- In some instances, even for fully enclosed framing, they may require a H3 treatment level

# Where to next?

- All relevant timber standards relating to durability must become performance based and reflect community and regulatory expectations
- To achieve this, they need to address service/design life performance and
- Be based on the science of reliability

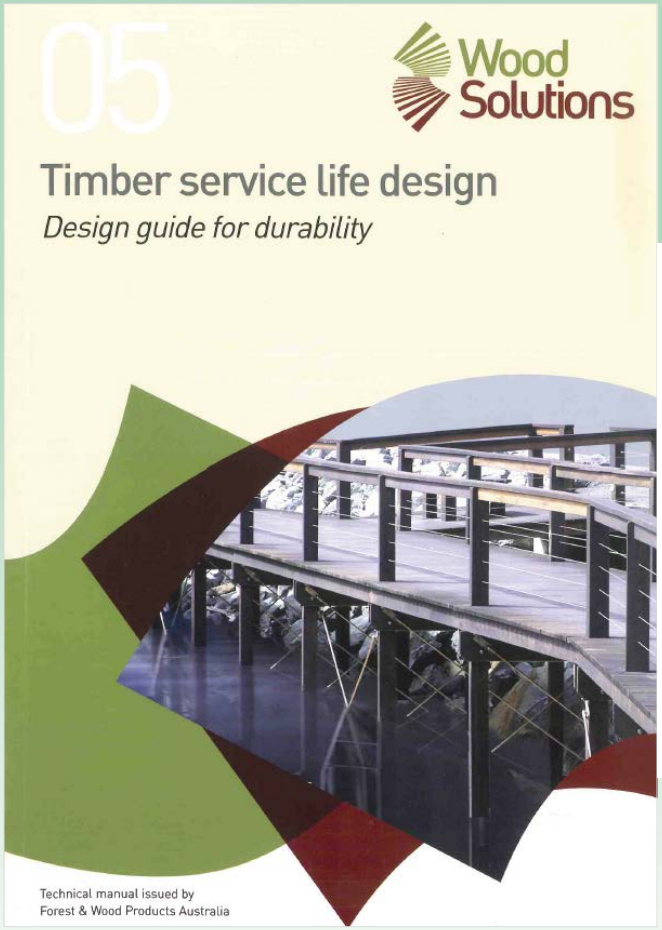
# What is Industry Doing?

- Change the ‘culture’ at corporate Industry and Standards Australia committee levels
- Push for transfer and adoption of science and technology from the R&D to Australian Standards and Regulations
- Needs whole of building/timber industry support to realize.

# Conclusion

- Timber has the ability to deliver design service life in a wide range of applications
- There are significant issues that need to be considered to appropriately design, specify and detail timber structures to ensure satisfactory durability performance
- These issues are well known, understood and documented for building industry use

# More Information




**Technical Design Guide**
**Timber Service Life Design**

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