

# **Treating timber: processes, solutions & new developments**

## **Setting the bar: fixing and maintaining standards for treated timber**

# Hyne and Son - Tuan

## Preservative Treated Timber Manufacturers



# Hyne Preservative Treated Products

## Termite Resistant Framing

Suitable in interior applications  
South of the Tropic of Capricorn



Suitable all interior applications



## Termite and Fungal Resistant Framing

Suitable in above ground  
exposed applications



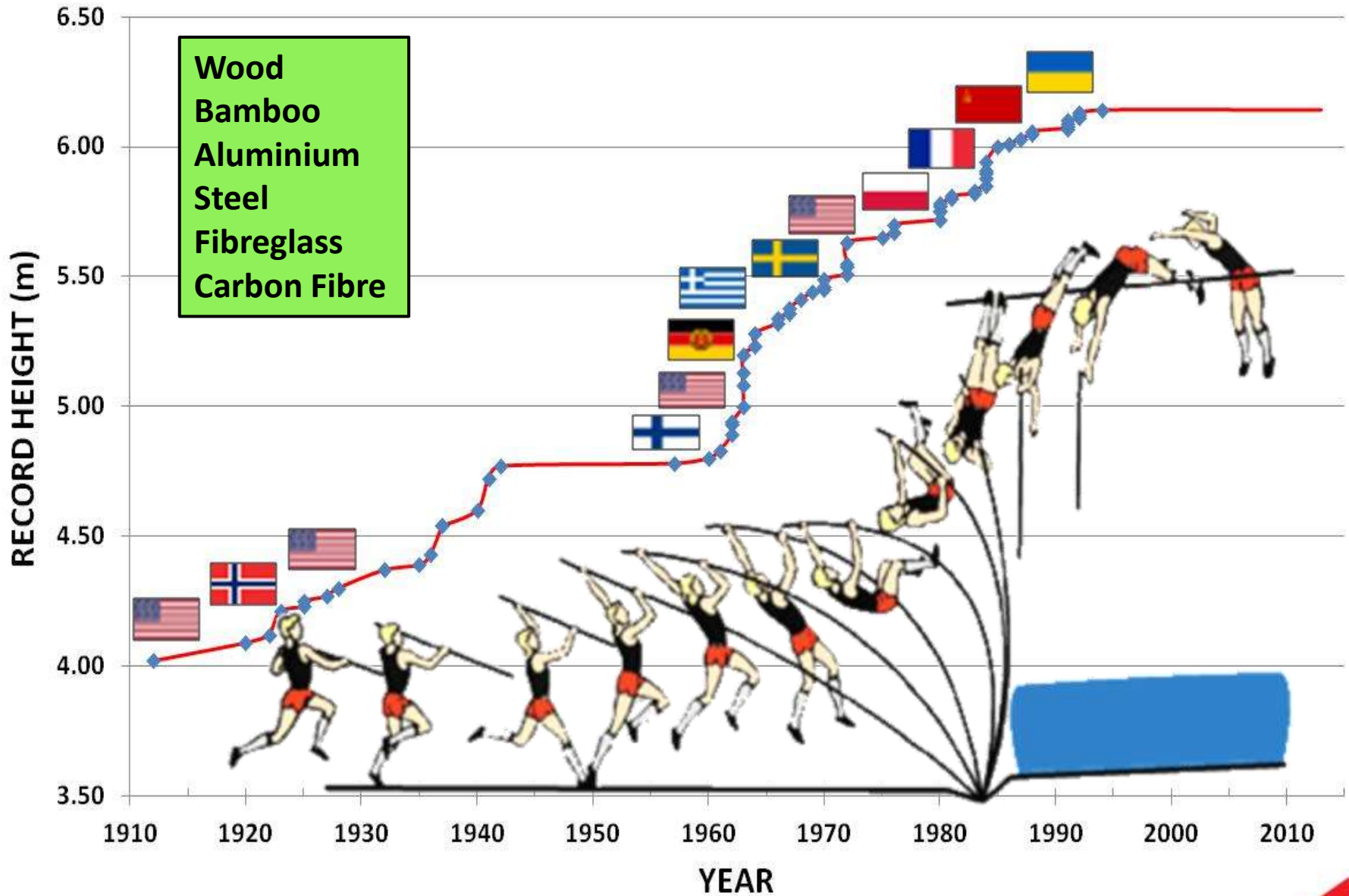


# “Setting the Bar”

- Introduction
- Structural Performance
- Durability Performance
- Manufacturers Role
- Challenges



# POLE VAULT WORLD RECORD HEIGHTS - MALE



# STRUCTURAL PERFORMANCE

# Christmas Morning 1974 - Darwin













# Cyclone Tracy 1974

- 71 deaths
- 70% of homes, destroyed or severely damaged.
- \$6 Billion worth of damage. (2011 \$)
- Wind speeds of 217 km/h were registered before equipment was destroyed.
- Tracy was a category 4 cyclone

*“Every type of housing was damaged by the cyclone, whether high-set, low-set, timber framed, brick, steel or concrete construction. Worse, even houses designed and supervised by professional engineers fared badly...”*

Impact statistics of *Tracy*.

R.H.Leicester & G.Reardon



# Structural Performance Challenge

- Timber structures need to survive cyclones
  - Prevent deaths
  - Minimize property damage
- Engineered Timber House
  - Structural Design methods
  - Tie down systems
  - Bracing systems
  - Reliable timber products
  - Structural timber systems (Trusses)

# A Team Effort

- Research (CSIRO, Cyclone Testing Station, TRADAC)
- Regulators
- Certifiers
- Designers
- Builders
- Sawmills
- Truss & Wall Frame Plants
- Carpenters
- Owners, Occupants

# How did we go?

<b>Year</b>	<b>Cyclone Name</b>	<b>Category</b>	<b>Deaths (No.)</b>	<b>Damage (2011 \$ Billion)</b>
1971	Althea	4	3	\$ 1.4
1974	Tracy	4	71	\$ 6.0
1986	Winifred	3	3	\$ 0.3
2006	Larry	4	0	\$ 1.7
2011	Yasi	5	0	\$ 3.6

<http://www.australiangeographic.com.au/journal/timeline-australias-worst-cyclones.htm>





# How did we go?

## **YASI 2011 Category 5**

**CYCLONE TESTING STATION - JCU - TECHNICAL REPORT NO. 57**

**Tropical Cyclone Yasi - Structural damage to buildings**

“The average Damage Index for Post-80s buildings was significantly lower than that for Pre-80s buildings”

## **LARRY 2006 Category 5**

**CYCLONE TESTING STATION - JCU - TECHNICAL REPORT NO. 51**

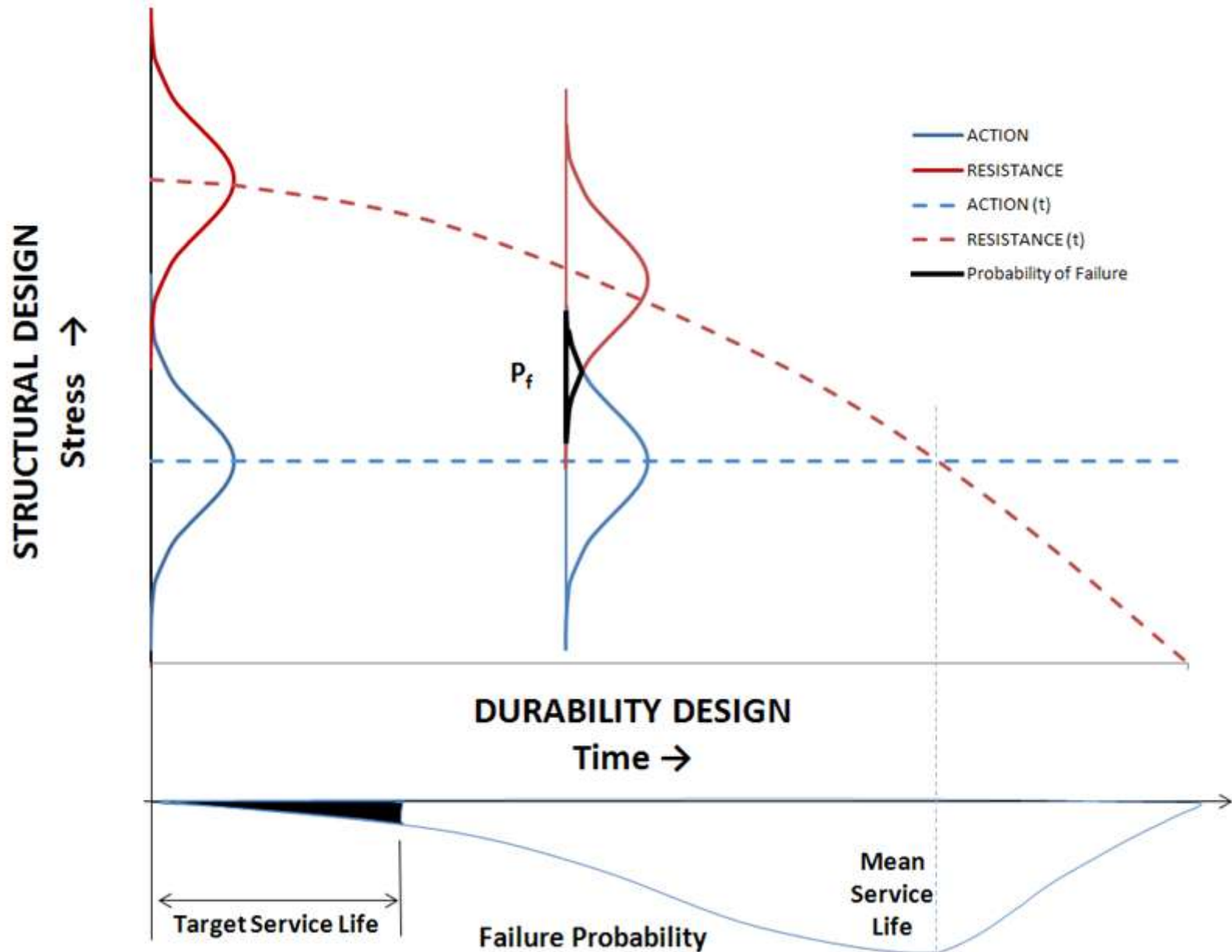
**Tropical Cyclone Larry - Damage to buildings in the Innisfail area**

“Wind damage was more wide spread among buildings that were built prior to the release of the Queensland Home Building Code Appendix 4 (1981)”

# DURABILITY PERFORMANCE



# Durability Performance and Structural Performance



# Durability Performance?

- No Cyclone Tracy to prompt improved Durability Performance
- Timber durability failures are occurring.
- Why?
  - Building regulations? (Regulators)
  - Product/Design Standards? (Standards Australia)
  - Product quality? (Manufacturers)
  - Building practice? (Builder)
  - Building maintenance? (Home Owner)
- Time to act?
- Lessons from Structural Performance
  - Common goal
  - Team effort
  - No easy fixes, hard work, an engineering approach

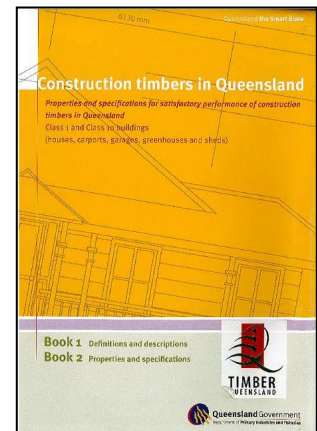
# One Goal – Durable Timber Structures

- General terms  
Timber structures last.  
Timber structures meet community expectations.

- BCA terms  
Timbers structures meet the BCA objectives and functional statements, for a specified design life

Design Life is stated,

- in guidance terms in ABCB “Durability in Buildings”
- specifically in BCA primary references, e.g. (CTIQ)
- implied in the BCA via requirements for design events.



*Greetings from*  
**URANGAN.**



THE PIER, URANGAN, HERVEY BAY, Q.



# Urangan Pier – Hervey Bay

- Built 1913 → 1917
- Originally 1120 m long
- Sugar, timber and coal export
- Closed 1985
- 250 m demolished
- Restored & reopened 1999



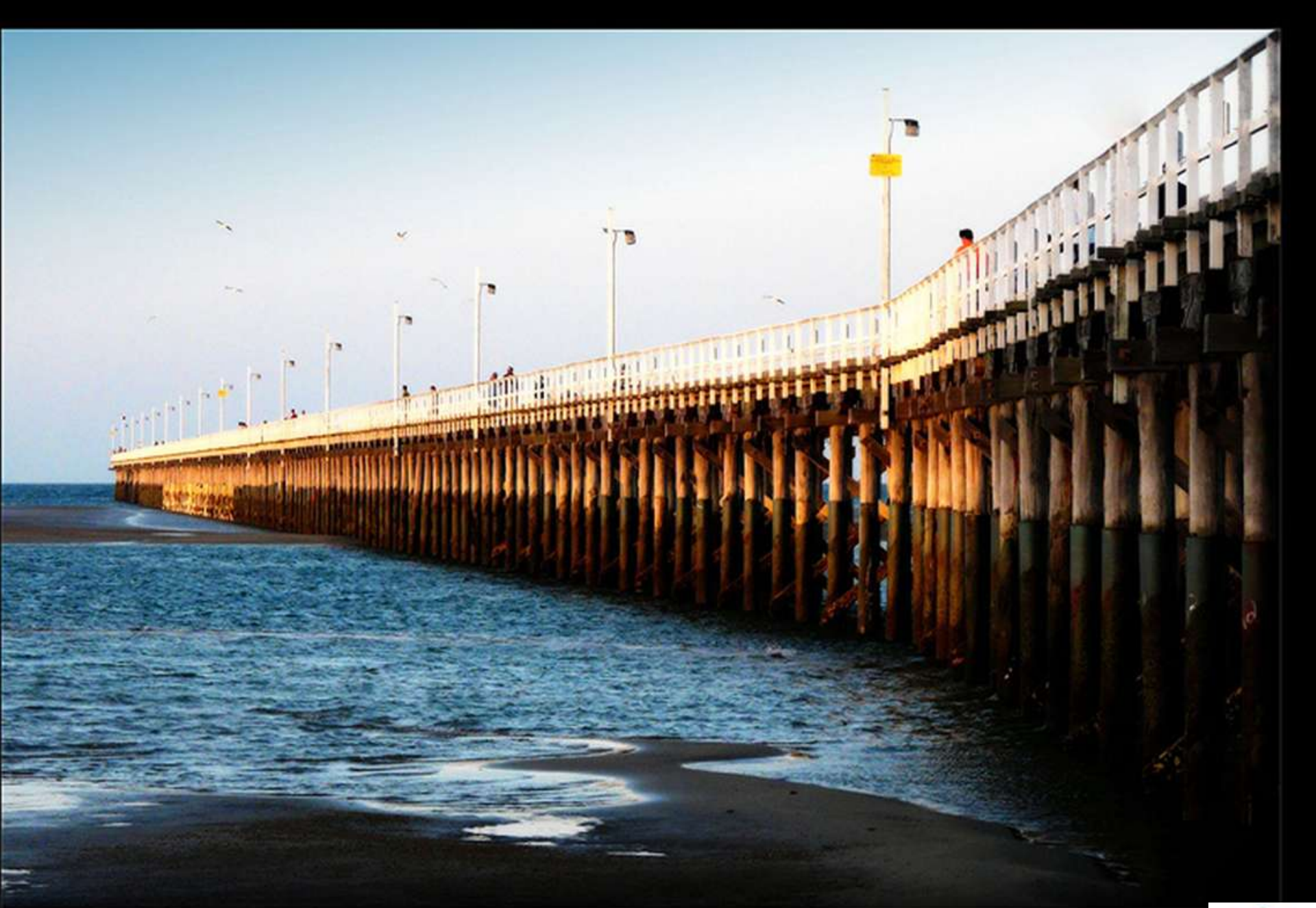
# Urangan Pier Details



- Well designed
- Good timber
- Well built
- Well maintained
- 100+ service life







URANGAN PIER

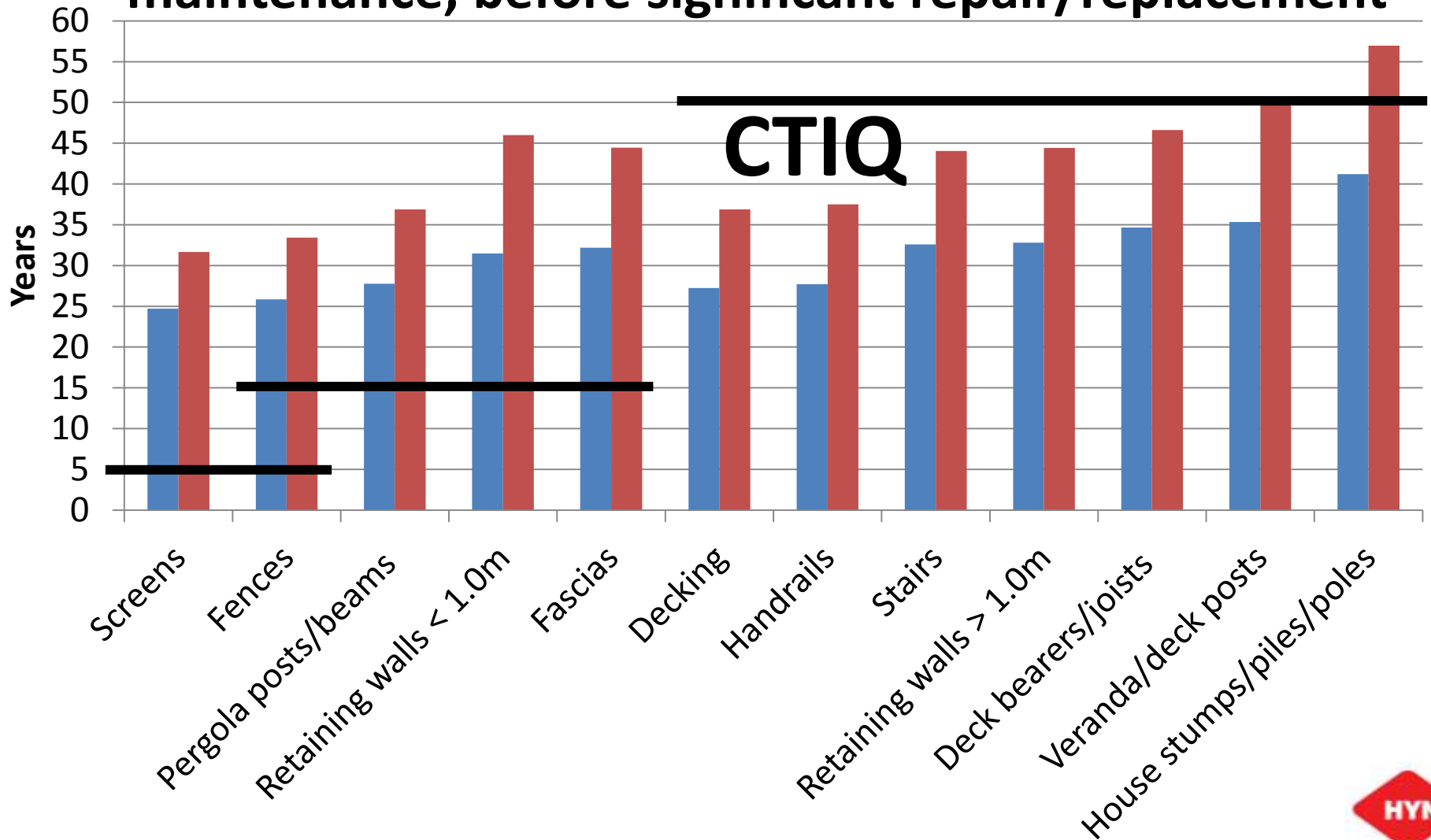


# Durable timber structures. How?

- Understanding community expectations
- Quality building regulations
- Reliable timber products
- Reliable design methods/information
- Good building practice
- Quality building audits
- Good maintenance practices
- Underpinned by good research

# Understand Community Expectations

95%ile and Ave service life expectations with routine maintenance, before significant repair/replacement



# BCA – Durability of Timber Structures

## Primary References

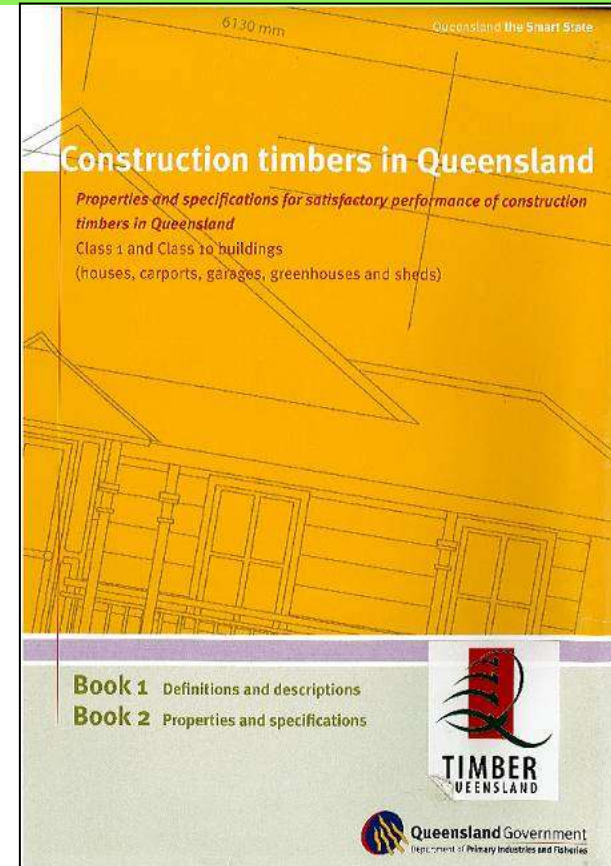
- AS 1720 Engineering Design
- AS 1684 Residential Design
- AS 3660 Termite Management
- Construction Timbers in Queensland

## Secondary Reference

- AS1604 Preservative Treated Timber

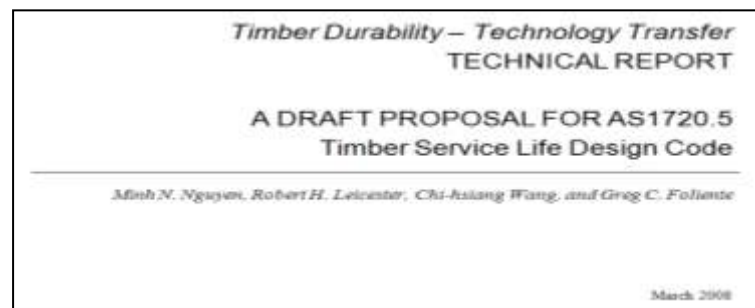
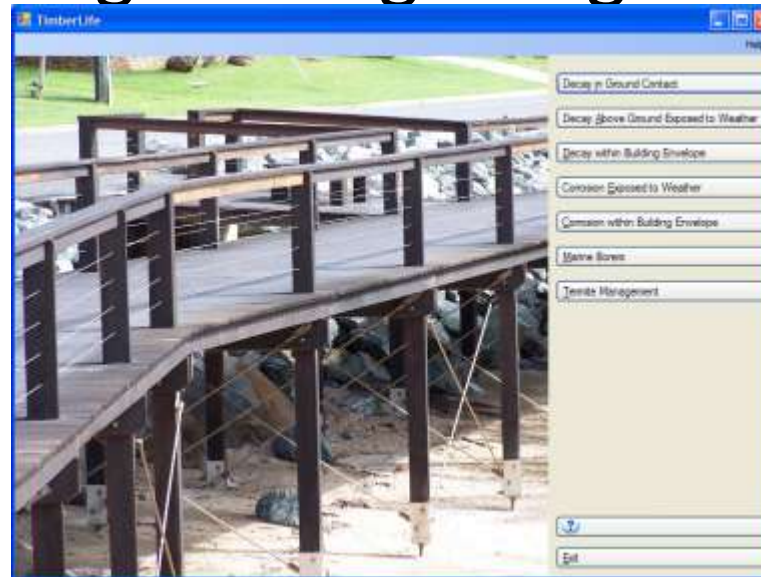
## Other Design Methods

- Durability Design Software – Timber Life
- Timber service life design guide
- Draft AS1720.5 Engineering Design



# FWPA Design for Durability Project

- Durability Design Software – Timber Life
- Timber service life design guide
- Draft AS1720.5 Engineering Design
  - Decay
    - Above ground
    - In ground
  - Marine borers
  - Fasteners



# Marine Borer Data



Figure 6.3.1. Marine borer hazard zones. Zone G is the most hazardous.

# Decay Data

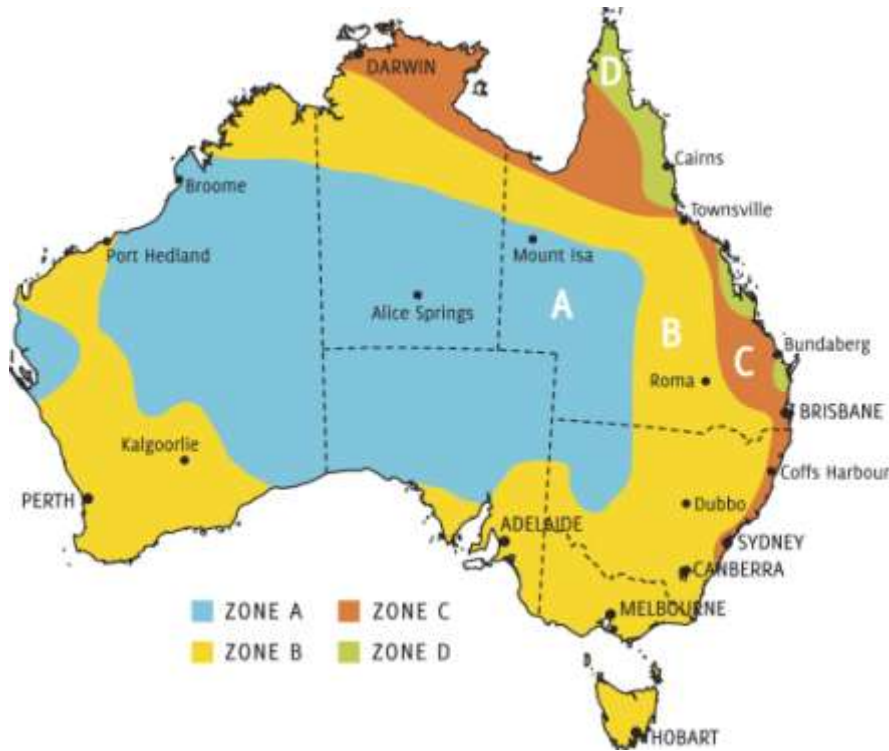


Figure 4.3.1 In-ground decay hazard zones

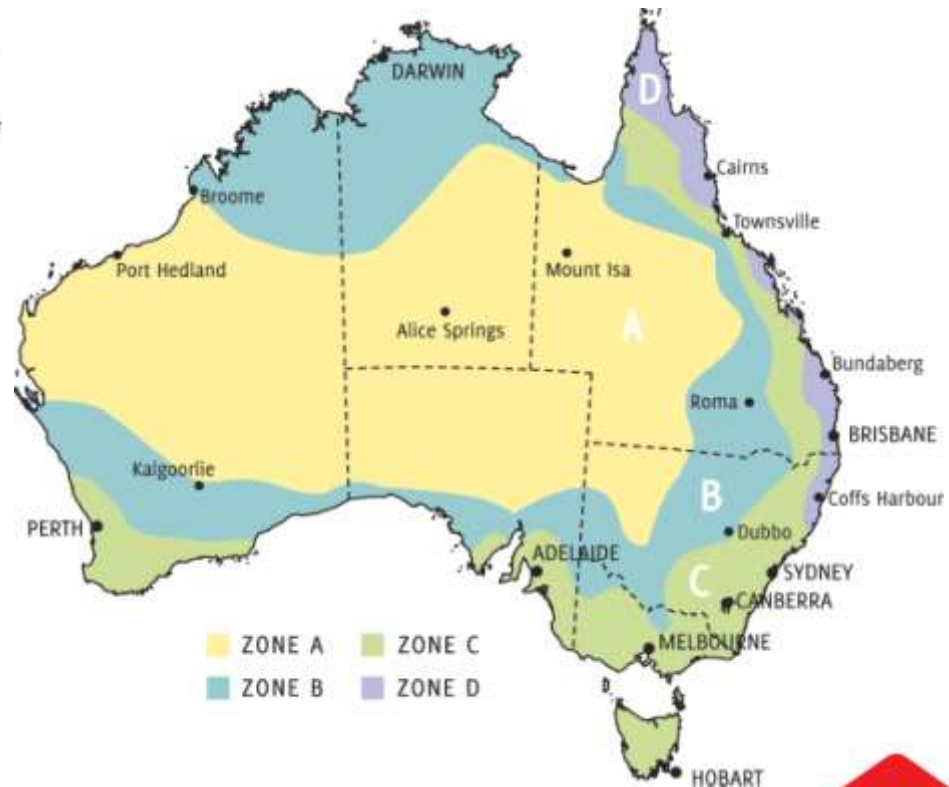


Figure 5.3.1. Above-ground decay hazard zones. Zone D is most ha:



# Corrosion of Fasteners in Timber



**Figure 7.2.1.1** Embedded corrosion hazard zone map. Zone C is most hazardous



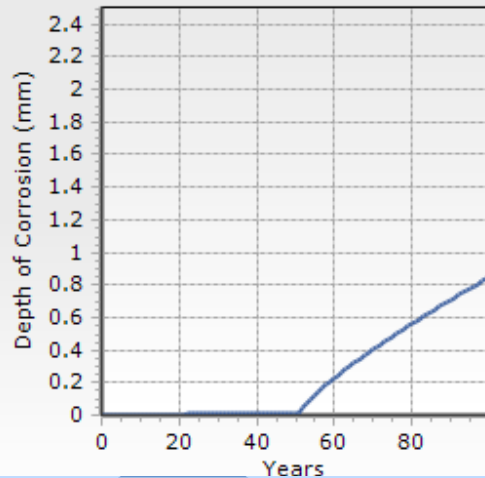
**Figure 7.3.1.1** Coastal Hazard Zones. Zone E has the greatest hazard.



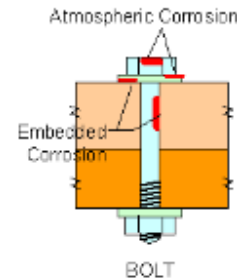
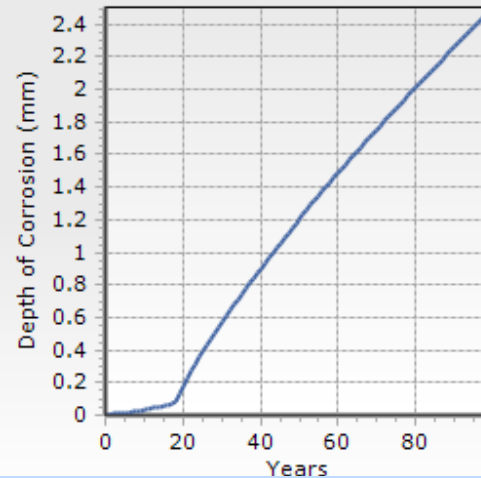
# Design Example : Bolted Timber Joint

Corrosion-time | Strength-time | Input Summary | Hazard Zone | Comments

### Atmospheric Corrosion



### Embedded Corrosion

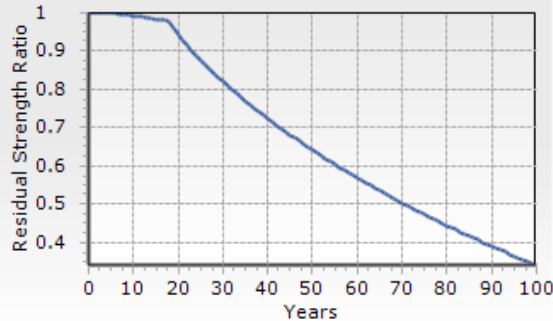


Corrosion-time | Strength-time | Input Summary | Hazard Zone | Comments

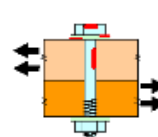
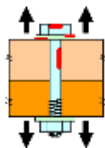
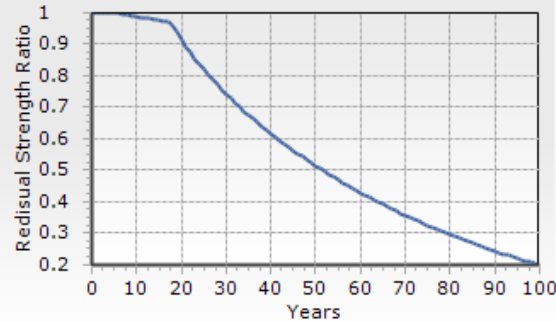
Corrosion-time | Strength-time | Input Summary | Hazard Zone | Comments

Description	Exposed To Weather
Hazard Zone (Atmospheric Corrosion)	D
Hazard Zone (Embedded Corrosion)	C
Connector Type	Bolt
Zinc Thickness (µm)	10
Steel Thickness (mm)	M12
Timber Treatment	Untreated or Non-CCA Treated Timber
Timber Species	Ironbark, red (broad-leaved)
Coastal Exposure	Partially Closed Bay
Site Classification	Open to Sea
Outdoor Microclimate	Sheltered or Partly Sheltered from Rain
Distance To Coast (km)	0.1
Industry Presence	Yes (within 20 km)
Industry Type	Light Industry (e.g. assembly plants)
Distance To Industry (km)	2

### Withdrawal Loading



### Lateral Loading



# ISO 15686 – Service Life Planning

## reference service life (RSL)

- service life of a product, component, assembly or system which is known to be expected under a particular reference set, of in-use conditions.

## estimated service life (ESL)

- service life that a building or parts of a building would be expected to have in a set of specific in-use conditions
- determined from reference service life data after taking into account any differences from the reference in-use conditions

$$ESL = RSL \cdot f_A \cdot f_B \cdot f_C \cdot f_D \cdot f_E \cdot f_F \cdot f_G$$

A: quality of the component

B: design level

C: work execution level

D: indoor environment

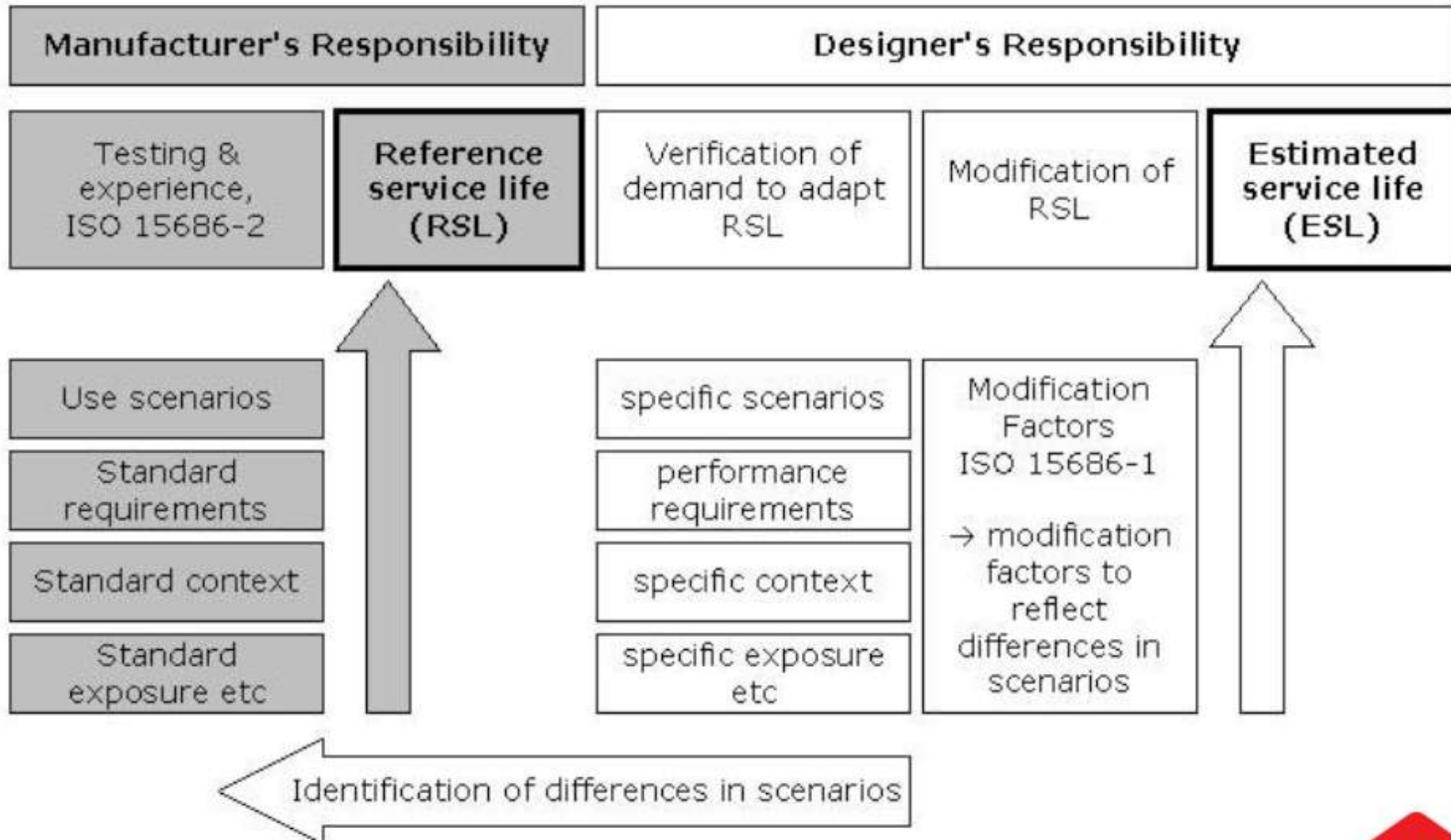
E: outdoor environment

F: in-use condition

G: maintenance level



# ISO 15686 – Service Life Planning



# Durability Design Methods - Evolution

## 1. Golden Rule Methods

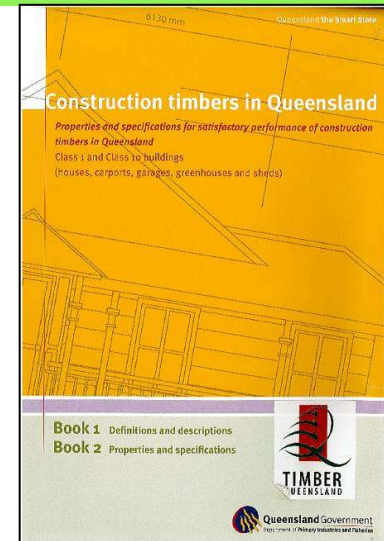
## 2. Prescriptive Methods

- AS1604 Treated Timber
- AS3660 Termite Management
- AS1684 Residential Design
- CTIQ Queensland Durability Design Method

## 3. Service Life Factor Method (ISO 15686)

## 4. Deterioration Rate Methods (Service Life, Structural Impact)

- AS1720.5 Service Life Design Code (Draft)
  - Timber Life Design Software
- AS1720.4 Fire Resistance of Structural Timber



# MANUFACTURERS ROLE



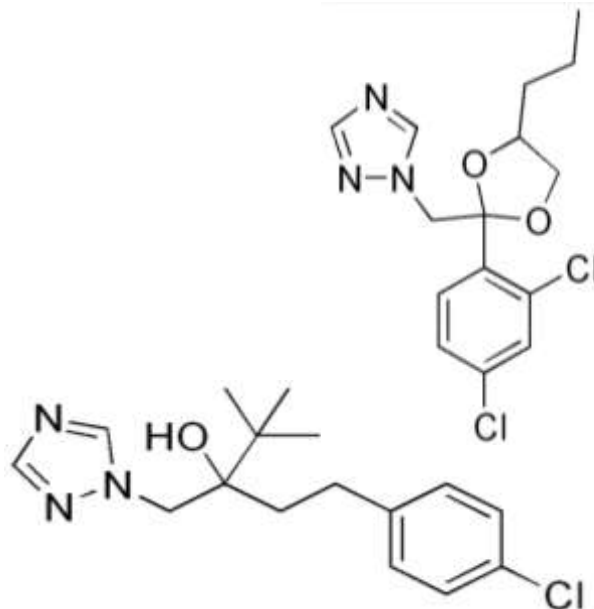
# Durable Products – Fit for Use

- Preservative chemical selection
- Preservative treatment process
- Process monitoring
- Product monitoring
- Product traceability
- Quality Compliance
- Product Information
- Research

# Organic Wood Preservatives

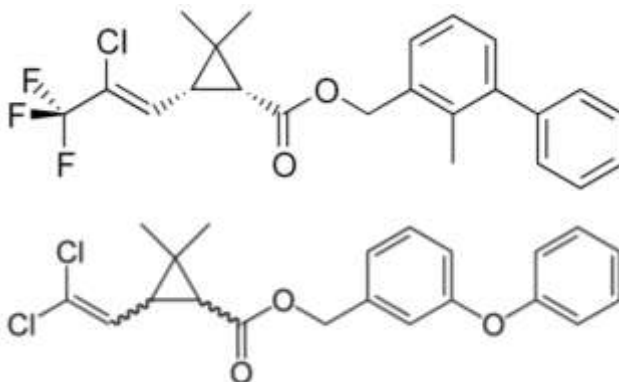
## Azoles (Fungicides)

- Propiconazole
- Tebuconazole



## Synthetic Pyrethroids (Insecticides)

- Permethrin
- Bifenthrin



# Why use organic preservatives?

- Reduced corrosion
- Safer for the environment. i.e. disposal via
  - Landfill, or
  - Incineration
- Safer for human contact



# Permethrin Use

- Insect Repellent clothing
- Flea control in dogs (collars)
- Household insect control
- Head lice and scabies treatment
- Insect repellent
- Agricultural use. Crop protection & parasite control
- Protecting timber from termites



# Which product has the most insecticide?



Hyne T2 Blue 70x45x350 0.037 grams

1 Exelpet Flea Colour = 7.2 m of T2 Blue 70x45

The image shows the packaging for an Exelpet Flea Collar. The top part is red with the brand name 'exelpet' in white. Below that, it says 'FLEABAN® 4 MONTH FLEA COLLAR FOR SMALL DOGS AND PUPPIES'. The active constituent is listed as '80g/kg PERMETHRIN 40:60'. There are two photos of dogs: a beagle puppy and a Jack Russell Terrier. Below the photos, there are three green checkmarks with text: 'Controls fleas for up to 4 months', 'Contains Herbal Perfume', and 'Essential Oils - Water Resistant'. At the bottom left, it says 'Suitable for:' followed by two small dog icons labeled 'PUPPY' and 'SMALL DOG (UP TO 10kg)'. At the bottom right, there is a photo of the red collar with a grey buckle, and the text '9.5g NET'.

Exelpet Collar

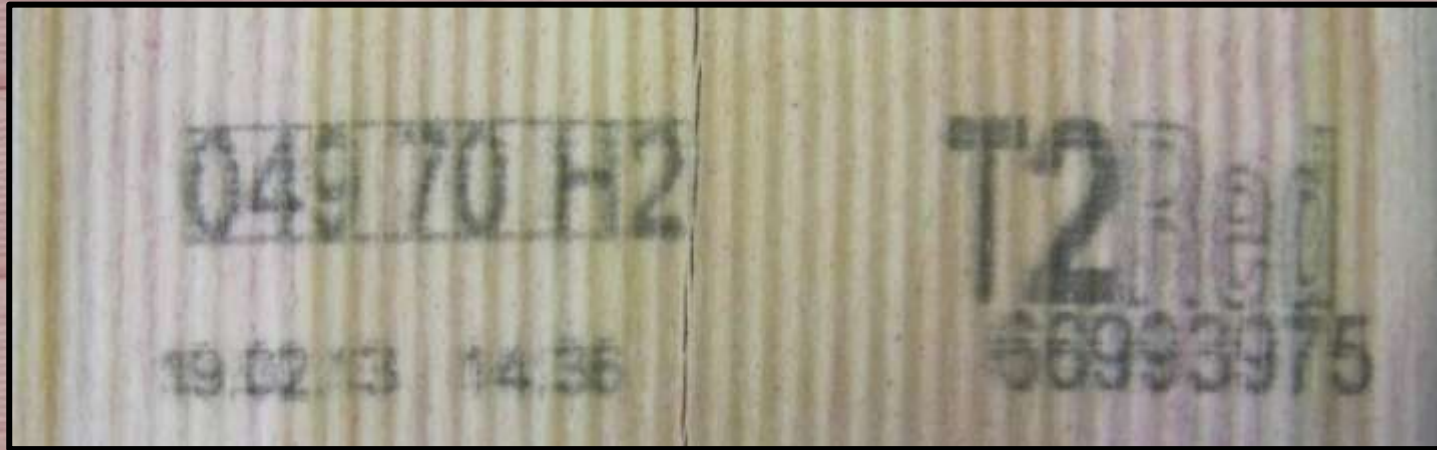
0.76 grams



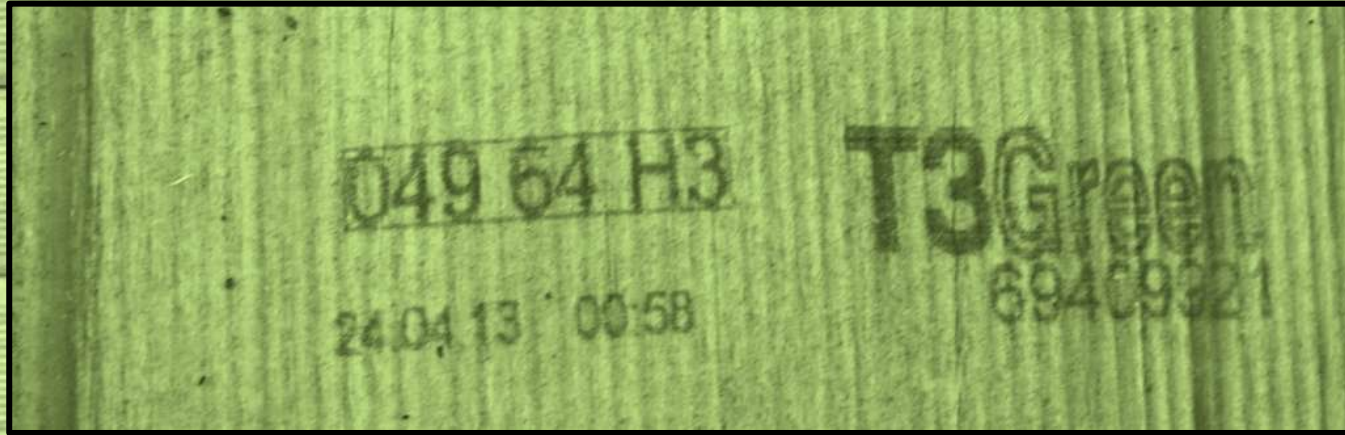
# Product Marking



# Product Marking



# Product Marking



# What do the numbers mean?

**049 74 H2 F**

049 Treatment Plant Number

74 Preservative Number (AS1604 Table C1)

H2 F Hazard Class (AS1604 Section 8)

**70183934**

Product Number

8 months file storage of every piece produced

300,000 products per week



# Product Traceability

The screenshot shows a software interface titled "Board Images". It features a toolbar with icons for Close, Pause, Prev, Next, Show Sol, Defects, Color, Trac, Thru, GA, Moist, Strength, Encoder, and Dwell. A file list table is visible, listing various files and their timestamps. A 3D model of a board is shown in the upper right, and a cross-section graph is in the lower right. The background displays a grid of board images with labels "MGP12" and "Grad=Dstbl".

File Name	Timestamp	ID
70183934.bcc	5/13/2013 5:13:18 PM	70183934
70183934.Display.zip	5/13/2013 5:13:22 PM	70183934
70183934.Boards.xml	5/13/2013 5:15:16 PM	70183934
39706326.WarpBct.xml	5/13/2013 5:13:38 PM	39706326
70183934.OptSol.xml	5/13/2013 5:15:16 PM	70183934
70183934.MoistureSol.xml	5/13/2013 5:15:16 PM	70183934
70183934.StrengthSol.xml	5/13/2013 5:15:16 PM	70183934
70183934.Bottom.BoardPrint...	5/13/2013 5:13:18 PM	70183934
70183934.Top.BoardPrint.Thu...	5/13/2013 5:13:18 PM	70183934
69981896.Top.BoardPrint.Thu...	5/13/2013 5:13:34 PM	69981896

**Current Storage Capacity**  
**8 months = 10 Million Products**

Length Pos (inches*1000)	Board/Deck (inches*1000)
0	0
20000	-300
40000	-450
60000	-480
80000	-350
100000	-200
120000	0



# Hyne Treated Product Testing

- Identify Heartwood/Sapwood (Spot Test)
- Identify preservative presence (Spot Test)
- Evaluate the chemical concentration in timber
- Evaluate the chemical concentration in solutions
- Research





# Sapwood / Heartwood Indicator Test



+ Variamine Blue  
RT Salt solution  
+ 4% ammonia  
solution



Heartwood and  
Sapwood are  
differentiated.



# Sapwood / Heartwood Indicator Test



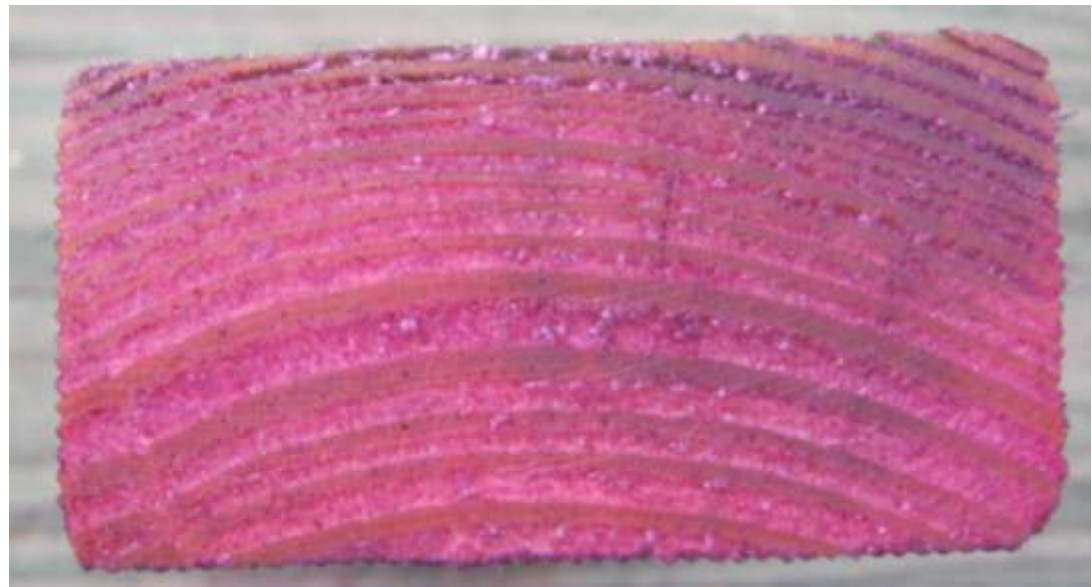
# Preservative Indicator Test



+ Pan Indicator



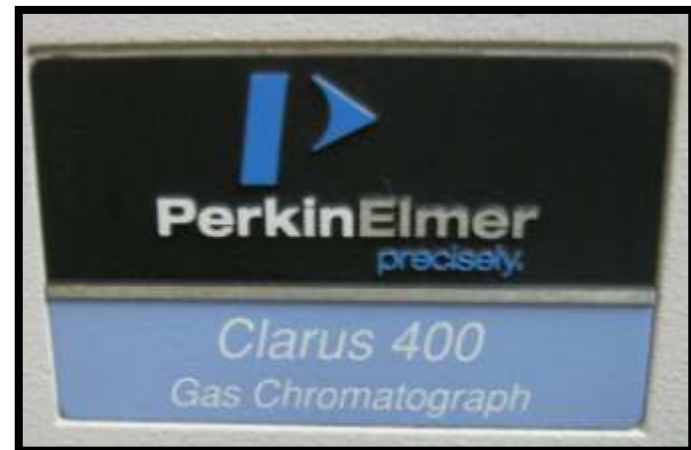
Preservative penetration is determined



# Preservative Indicator Test



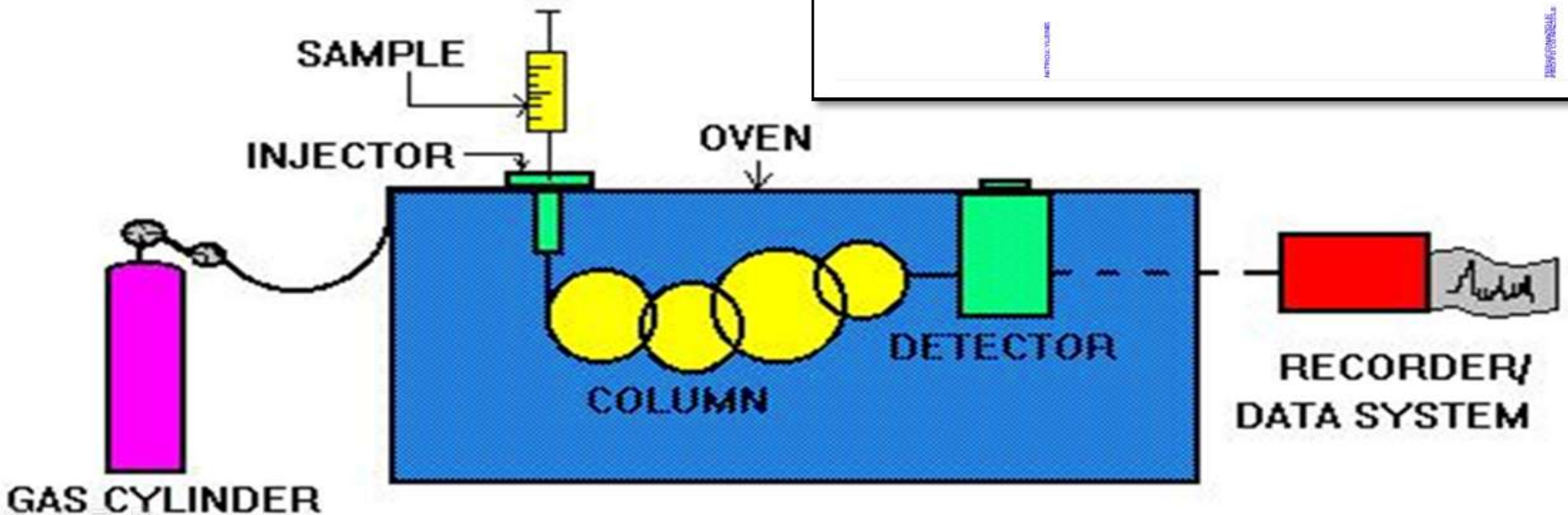
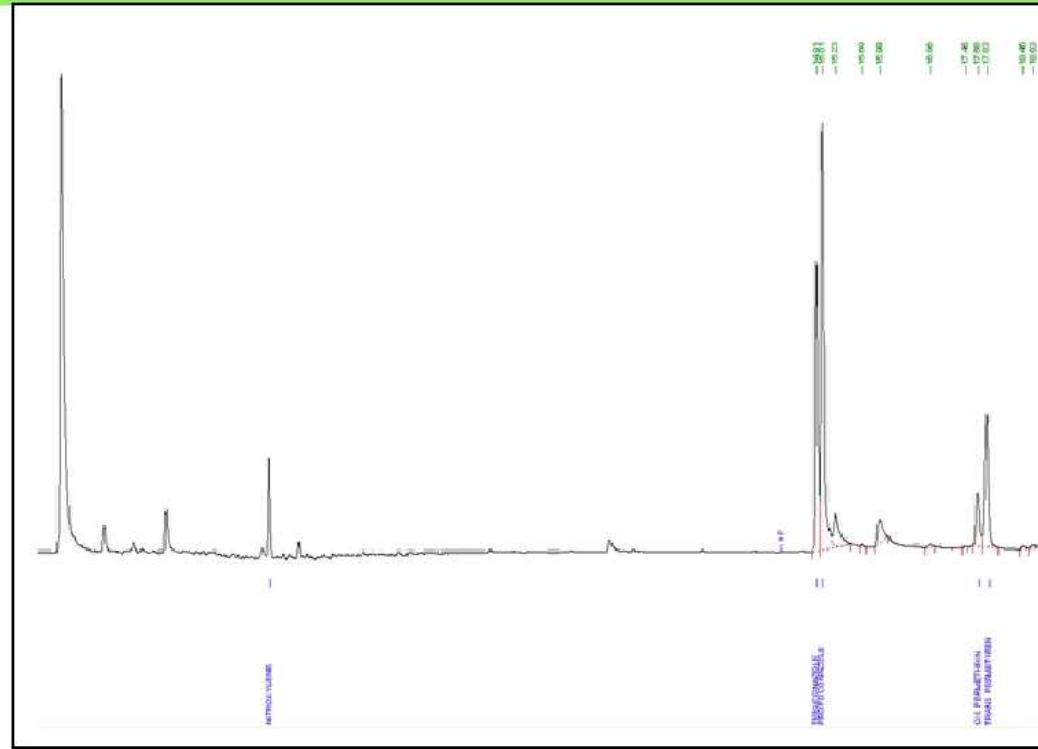
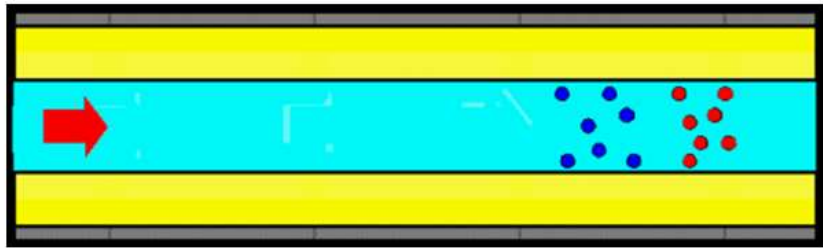
# Gas Chromatography



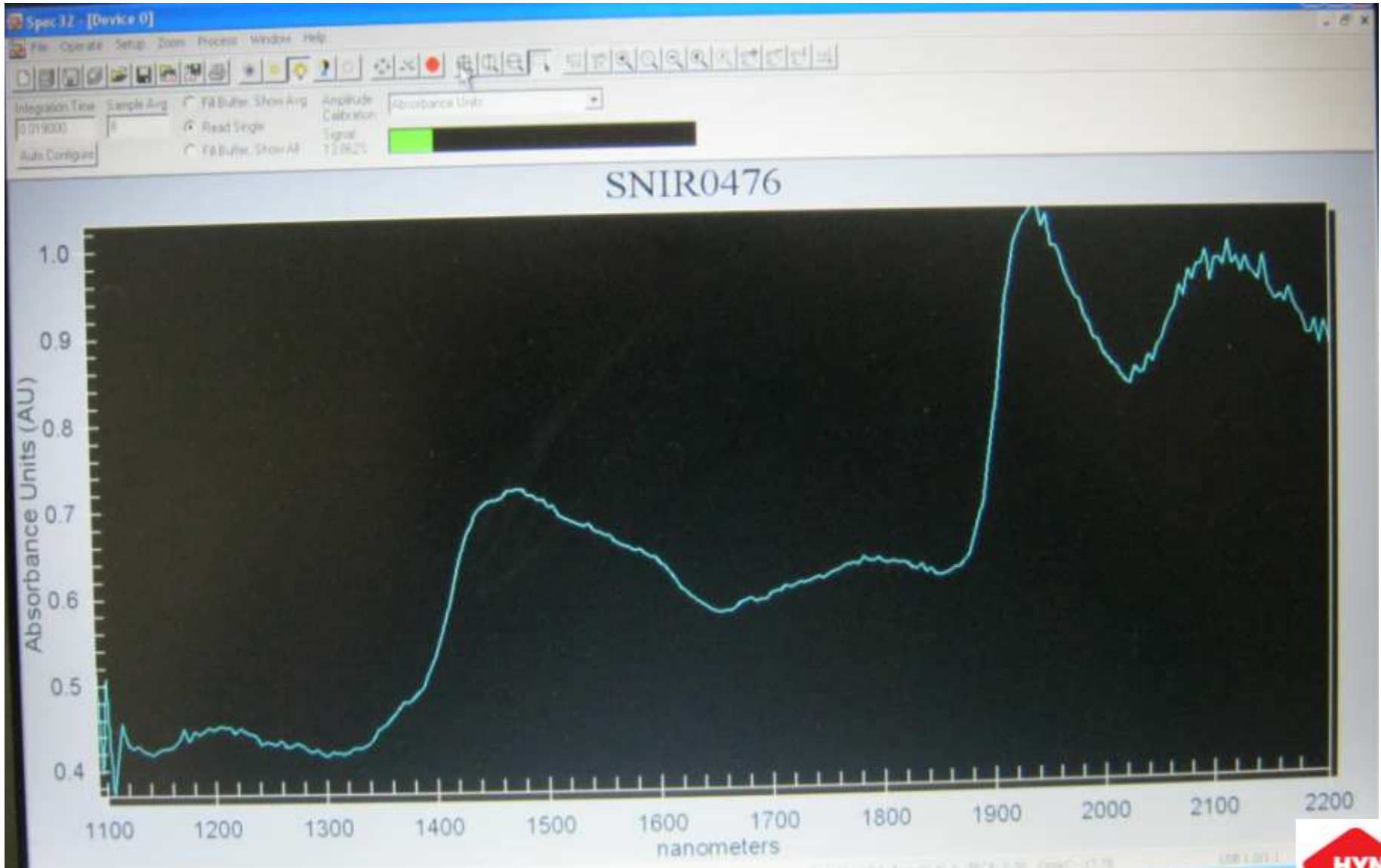
# Gas Chromatography



# Gas Chromatography



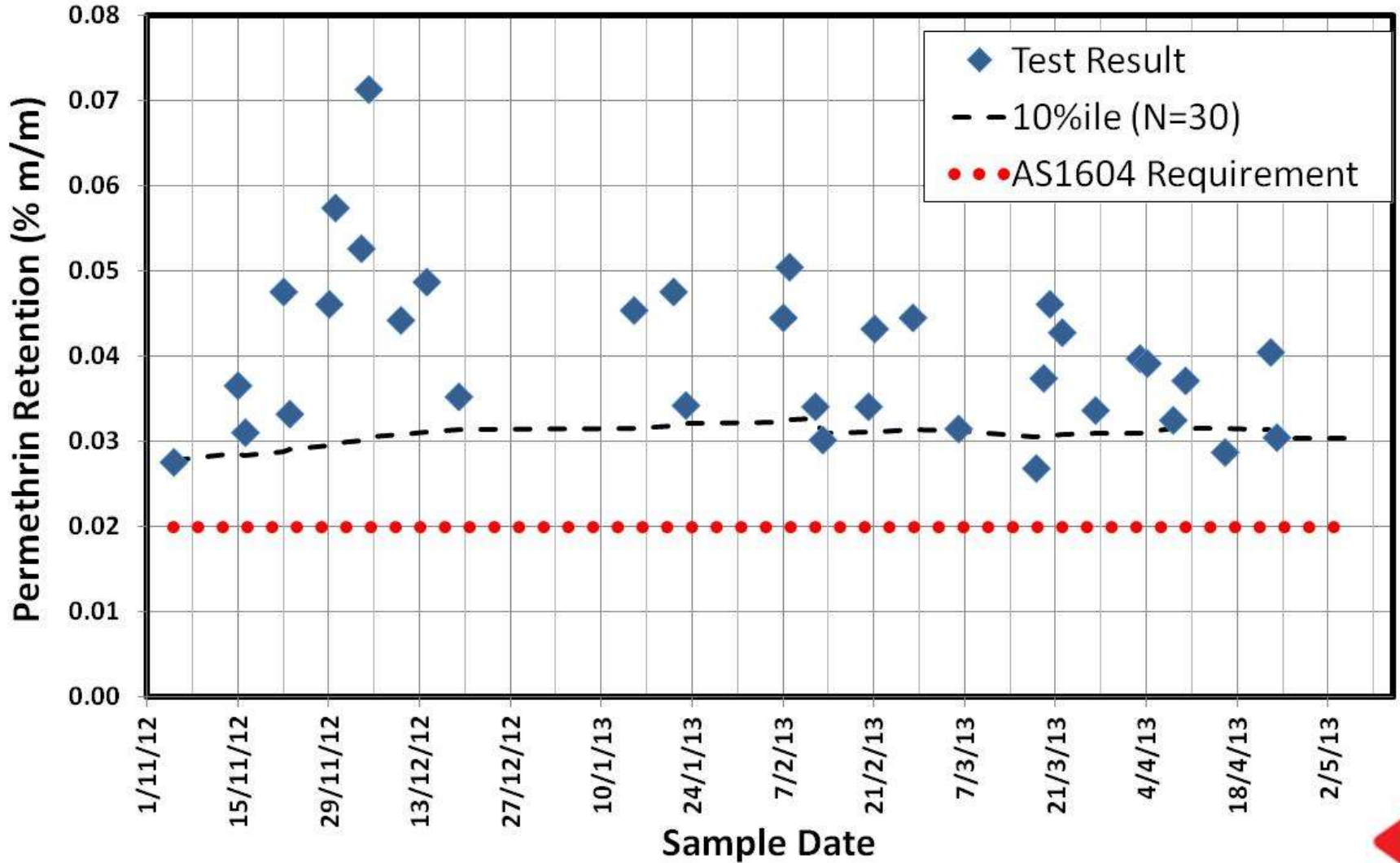
# Near Infra Red Testing





# Analysing Test Results – Control Charts

## T2 Red Permethrin Retention 1/11/12 - 6/5/13



# Termite Research

## Mastoterme

North of the tropic of Capricorn



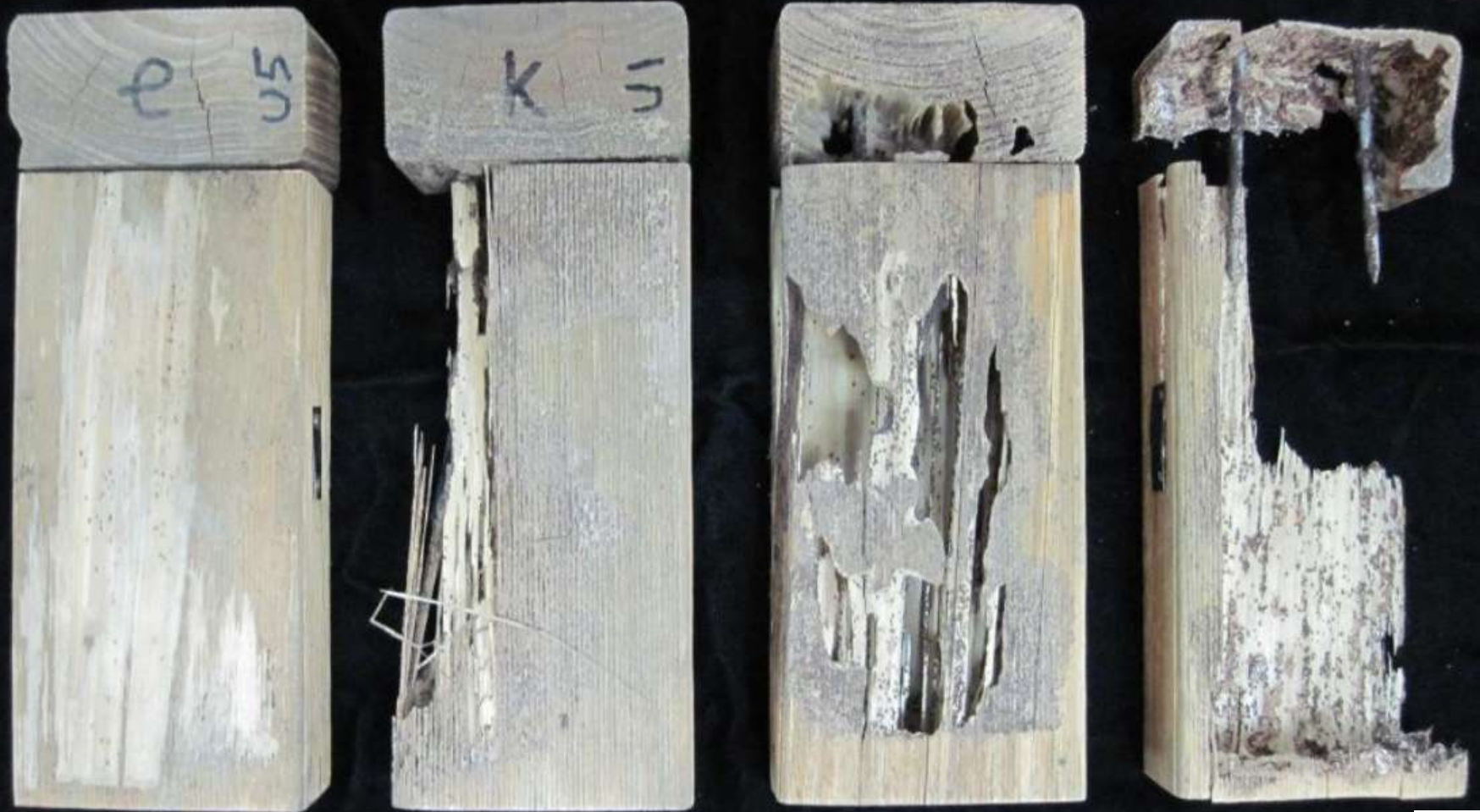
## Coptotermes



# Northern Territory Field Site



# Termite Trial Results



# Quality Compliance

- Hyne Quality Policy
- Compliance Practices (Testing, Analysis, Reports)
- Internal Hyne Audits
  - Site based audits
  - Cross site audits
- External Audits
  - Independent Consultant Audits
  - ISO 9001 Quality Management System (SAI-Global)
  - Product Certification (NCSI)



# Product Information

- Website [www.hyne.com.au](http://www.hyne.com.au)
- Technical Staff
- Phone: 1300 30 HYNE | 1300 30 4963
- Email: [info@hyne.com.au](mailto:info@hyne.com.au)
- Literature
  - MSDS
  - Brochures, Project Sheets, Guarantees,
  - Fixing Guides, Technical Data Sheets
  - Hyne Design 7 –Structural Timber Design Software



# Product Information

- Hyne ETP in weather exposed applications TDS6
- Hyne ETP Design for Durability TDS9

DIAGRAM 1 CAPPING DETAILS

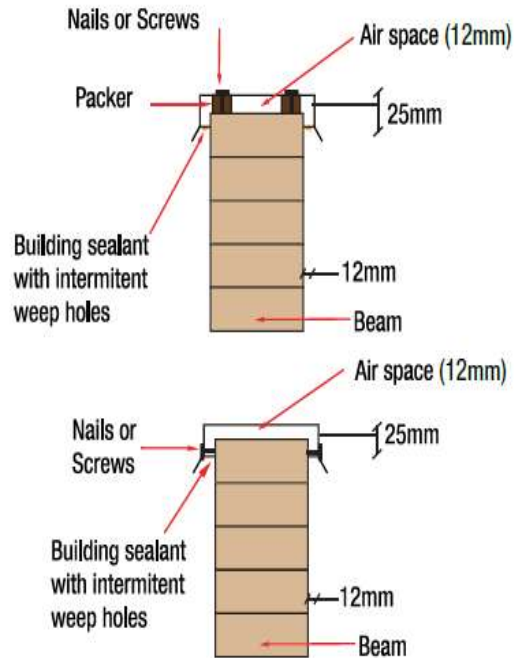


DIAGRAM 2 DETAILING TO AVOID MOISTURE TRAPS

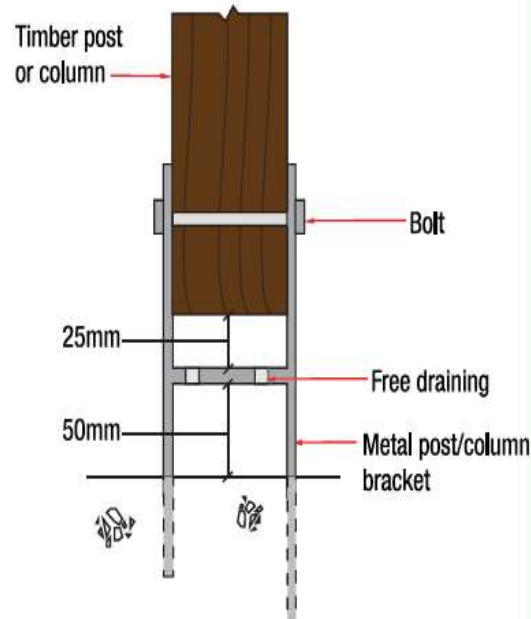
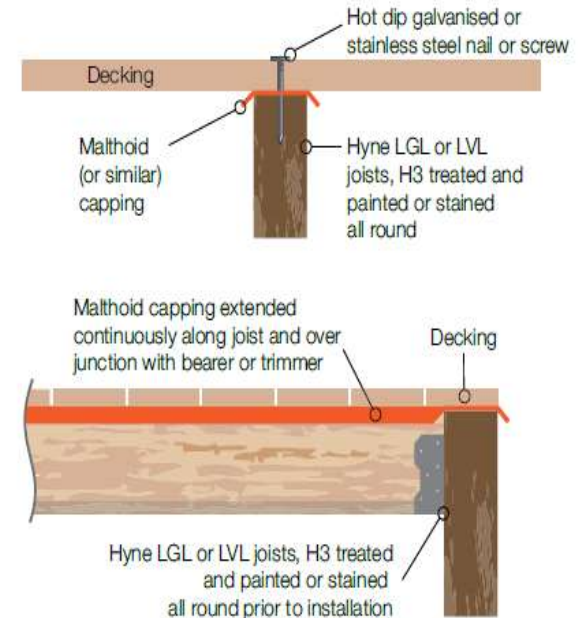


DIAGRAM 3 BEARER AND JOIST IN WEATHER EXPOSED DECK



# CHALLENGES



# Challenges

- Improve Building Regulations (Community expectations)
- Improve Australian Standards (Product & design standards)
- Improve Durability Design
  - Service Life and/or Deterioration rate methods
  - Durability of Timber Joints and Connectors
  - Design methods appropriate to different designers
- Improve Products
- Improve Product Information (Installation/Maintenance )
- Improve Durability Research (Ask the right questions)
- Learn from our failures

# Seek Specialist Advice



# Seek Specialist Advice



# Thank you



[Geoff.Stringer@hyne.com.au](mailto:Geoff.Stringer@hyne.com.au)

