

# Resene

the woodcare the professionals use

Resene  
Coating Technologies 

## Protection of Wood by Coatings



## Basic Field Notes

Presented by:  
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# Your Presenter:

## **Current Position/s:**

Corrosion Consultant - Resene Engineered Coatings

Business Development - Resene Coating Technologies



## **Certifications/Qualifications:**

CBIP - Certified Coatings Inspector

ASSDA - Stainless Steel Specialist

ACA - Certified Corrosion Technologist

ACA - Certified HDG Inspector

**35+ Years in the Paint Industry**

# The purpose of this presentation is....

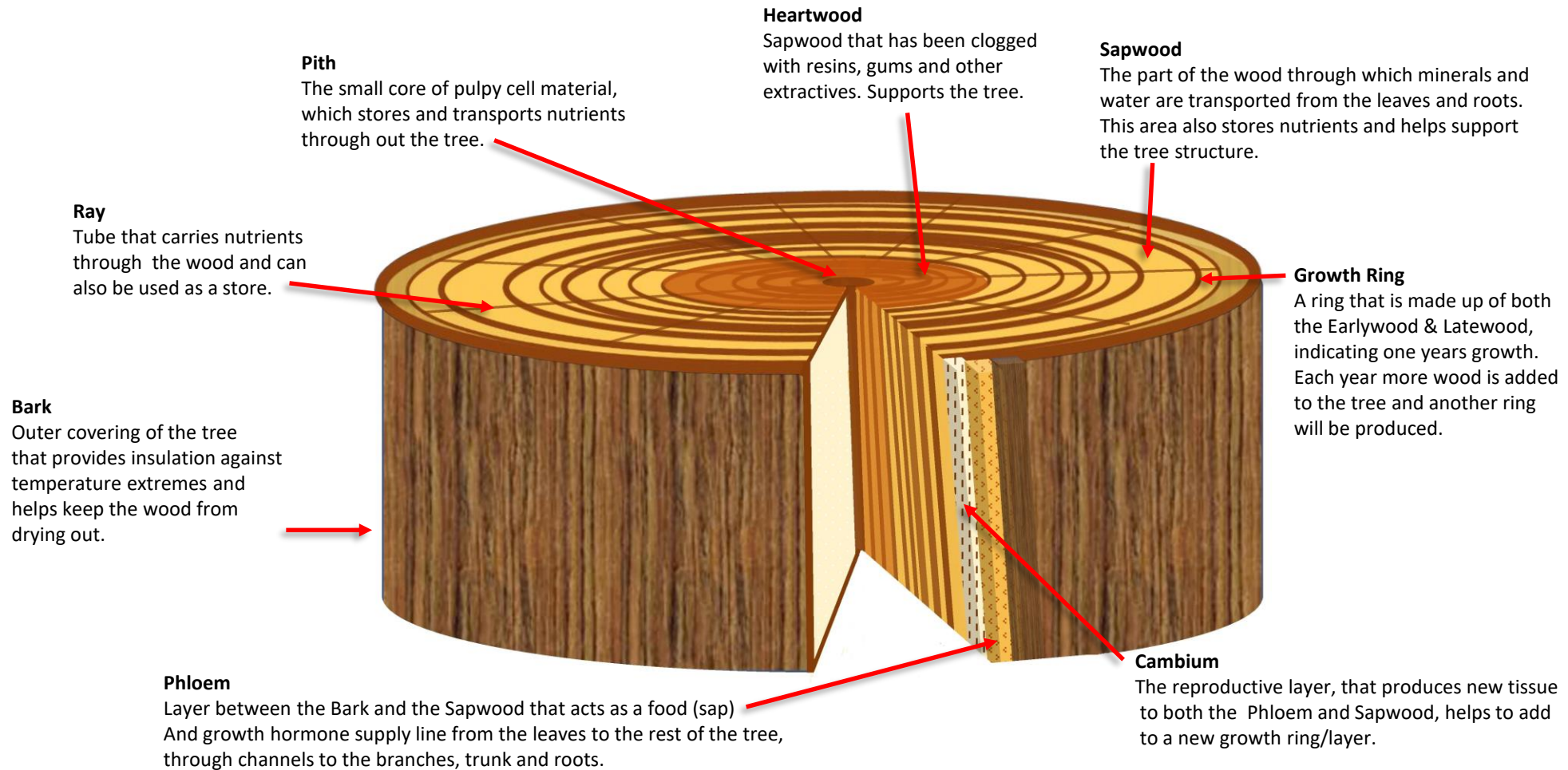
.....to overview the basics of wood and its structure, and timber protection buy use of coatings, during which we will look into the performance and what to expect during the life of that coating.

# Subjects to cover

- Inside the tree
- Softwood vs Hardwood
- Earlywood vs Latewood
- Cutting the log
- Timber & Movement
- Cell Penetration
- Why we coat timber
- Bare timber exposure
- Options to coat timber
- Effect of angle of exposure
- Paint splitting
- BRANZ literature



# Inside the tree



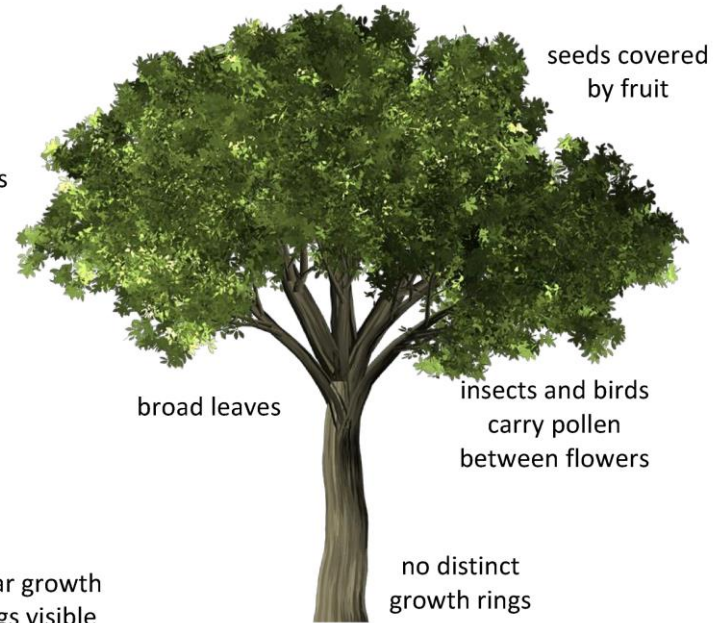
# Softwood vs Hardwood



A softwood (cone) tree and a hardwood (flowering) tree



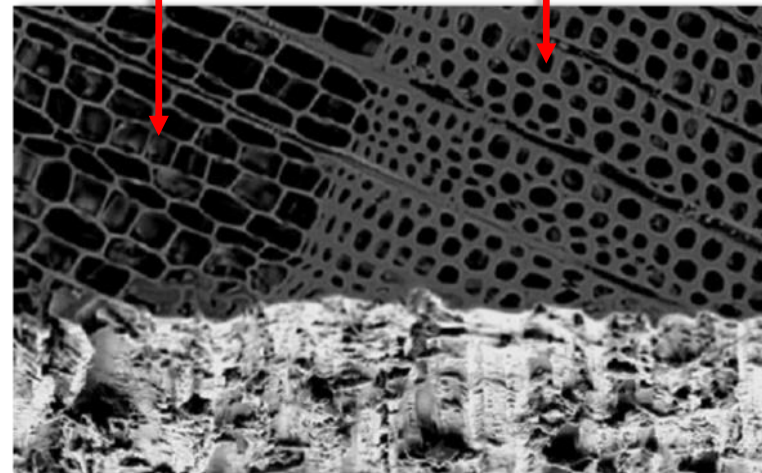
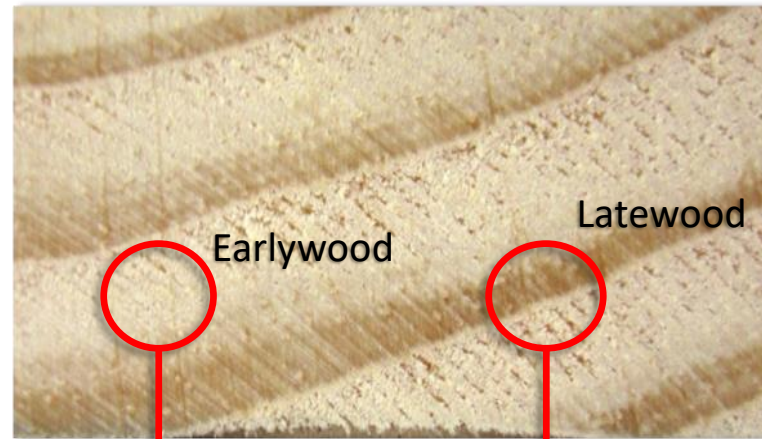
**Softwoods** (cone trees)  
Usually evergreen e.g. Pine tree



**Hardwoods** (flowering trees)  
Often deciduous

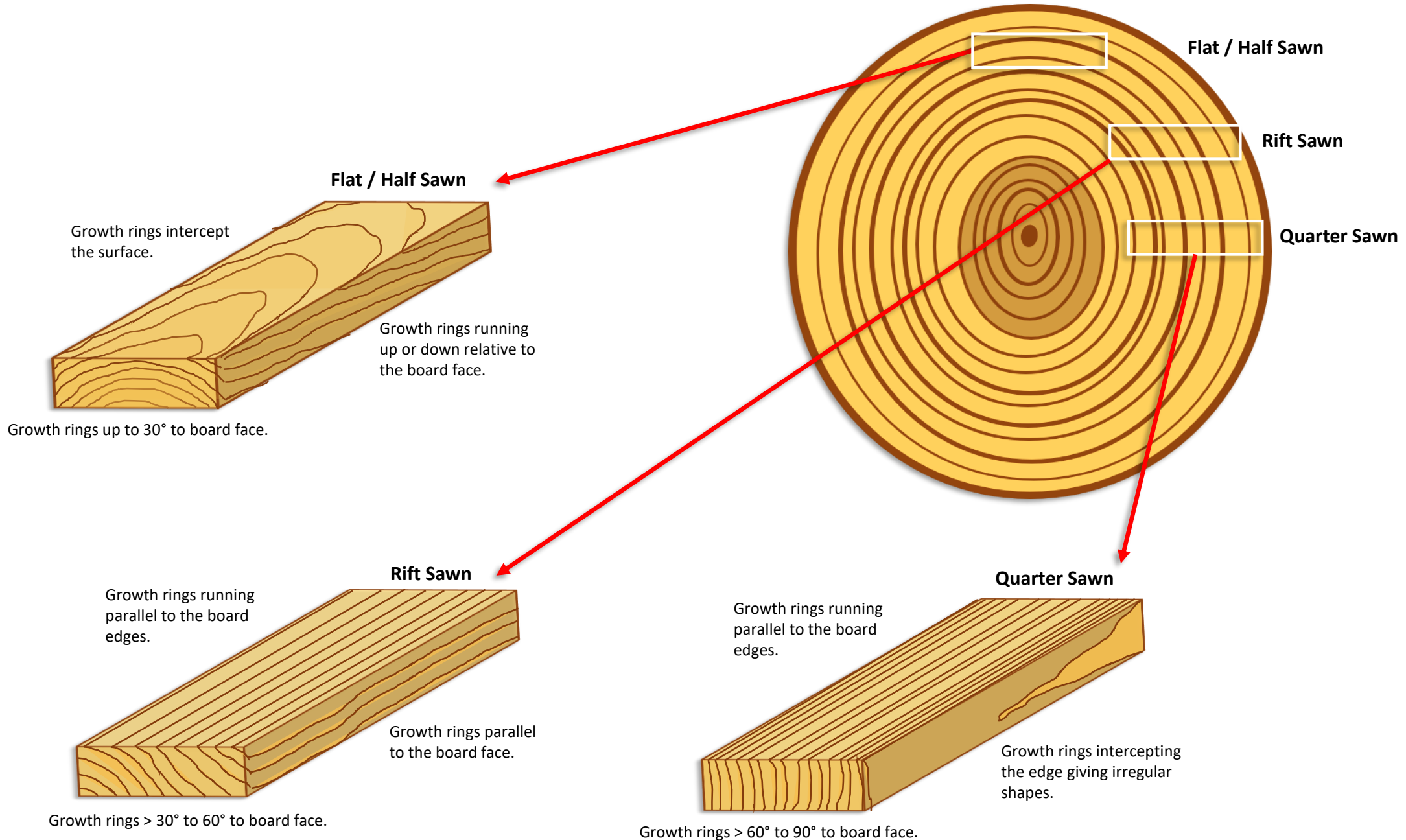


# Earlywood VS Latewood



# Cutting the Log





**Flat / Half Sawn**

Growth rings intercept the surface.

Growth rings running up or down relative to the board face.

Growth rings up to 30° to board face.

**Flat / Half Sawn**

**Rift Sawn**

**Quarter Sawn**

**Rift Sawn**

Growth rings running parallel to the board edges.

Growth rings parallel to the board face.

Growth rings > 30° to 60° to board face.

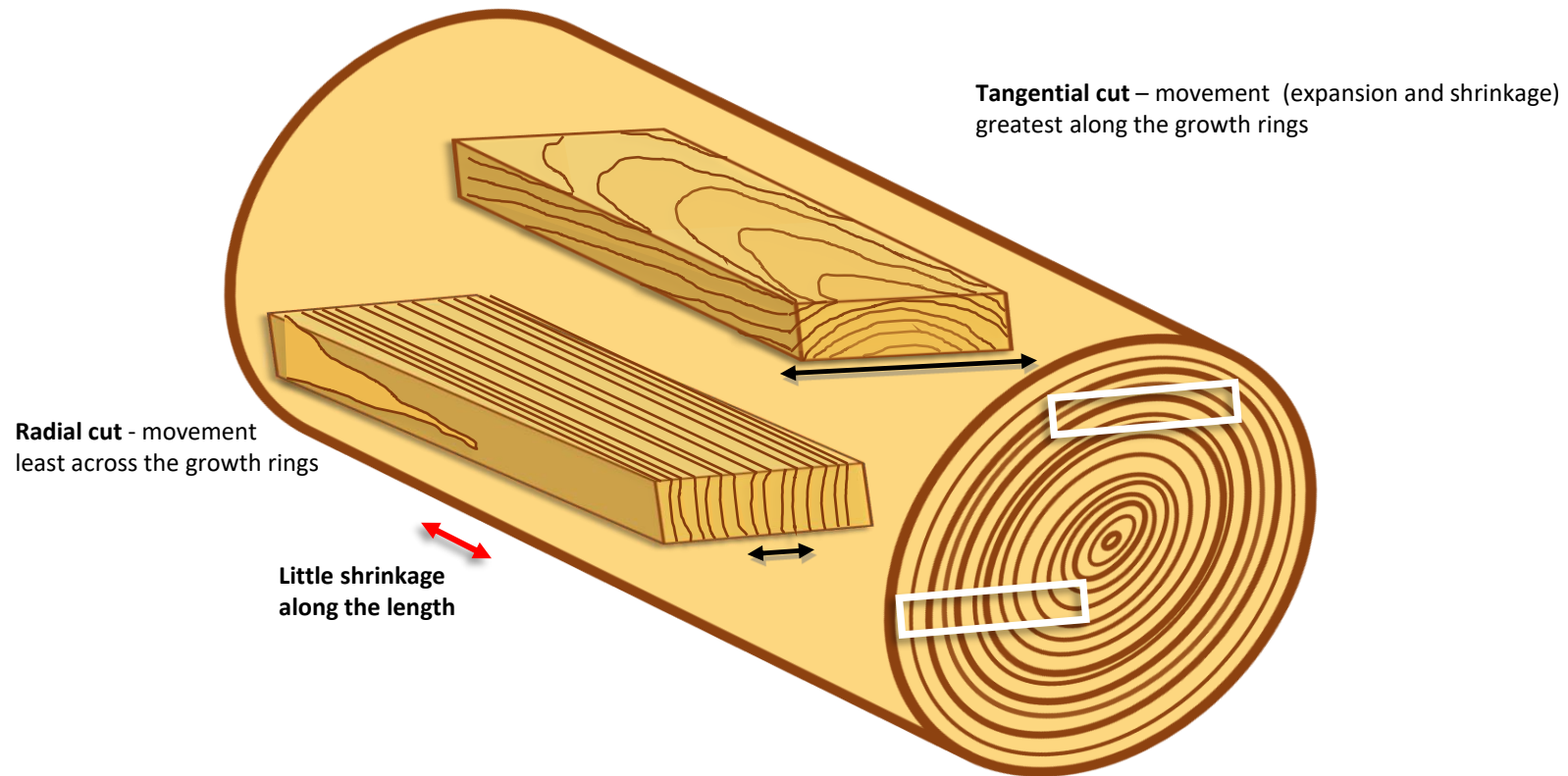
**Quarter Sawn**

Growth rings running parallel to the board edges.

Growth rings intercepting the edge giving irregular shapes.

Growth rings > 60° to 90° to board face.

# Timber & Movement



**Typical moisture change movement in weatherboards** - BRANZ Timber Cladding Guide

Assumes moisture content change of 6% (18 - 12%) in 200mm wide boards

*Approximate timber shrinkage or expansion (mm)*

Species	Radial	Tangential
Radiata Pine	1.4 mm	3.1 mm
Macrocarpa	1.2 mm	2.1 mm
Douglas Fir	1.9 mm	3.3 mm
Larch	1.3 mm	3.3 mm
Western Red Cedar (New Zealand)	1.4 mm	2.2 mm
Western Red Cedar (imported)	0.8 mm	1.7 mm

Timbers natural **moisture content** varies during the year and as an example for pine it can vary from **11% to 18%** summer to winter.

General EMC figures (1) for selected locations are:

Locality	Summer EMC %	Winter EMC %	Yearly Mean EMC %
<u>Auckland</u>	<u>13</u>	<u>19</u>	15
Hamilton	14	20	16
New Plymouth	15	18	16.5
Napier	11	16	13
Palmerston North	11	18	15
Wellington	15	18	16
Nelson	12	17	14
Blenheim	11	18	13
Hokitika	17	21	18
Christchurch	12	19	15
<u>Dunedin</u>	<u>14</u>	<u>15.5</u>	14
<u>Alexandra</u>	<u>10</u>	<u>19.5</u>	13
Invercargill	13.5	18	16

6 %

1½ %

9½ %

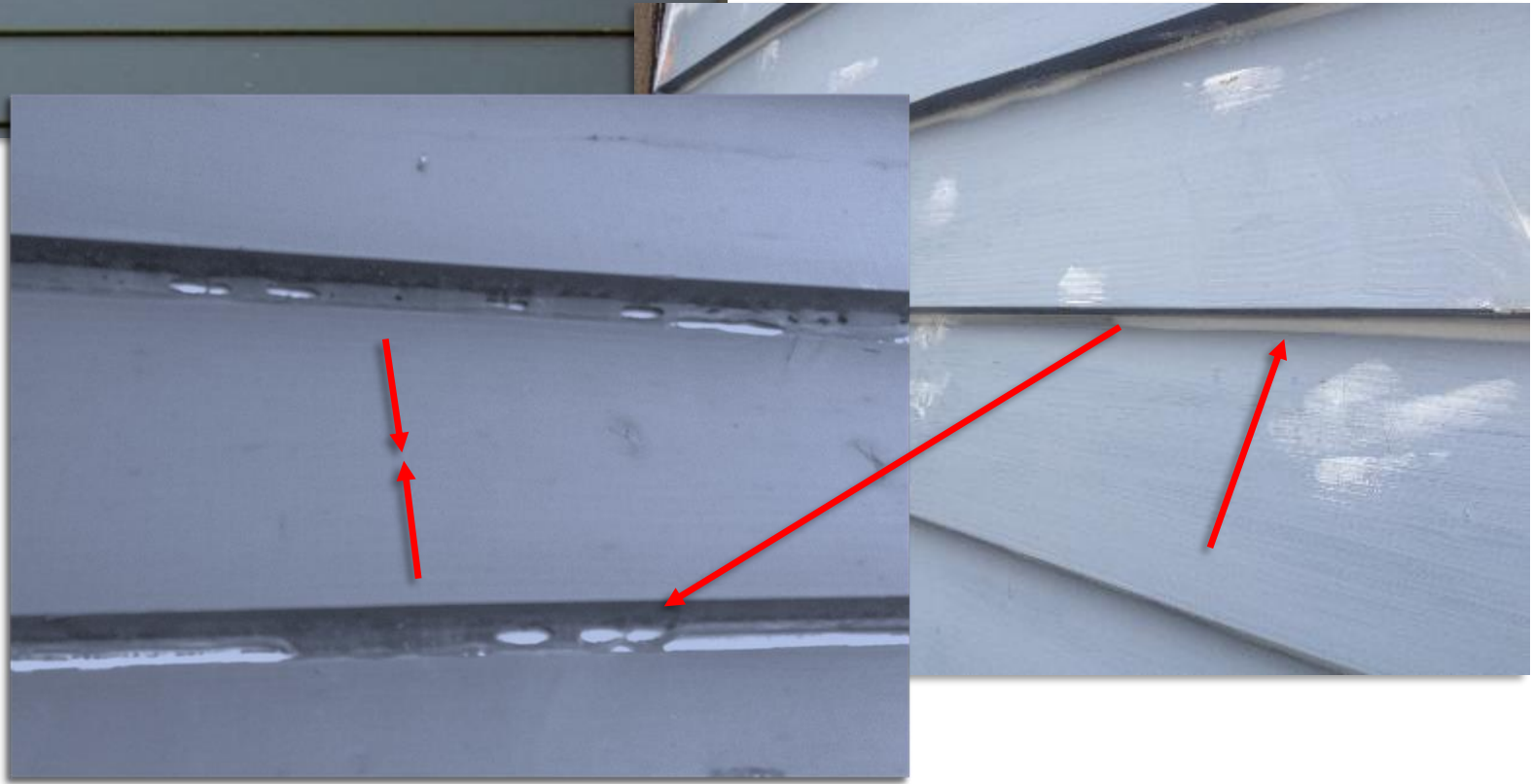
Note (1) These EMCs are for timber protected from rain but exposed to the outside (commonly called outside under cover). The EMC within an intermittently heated building will tend to be lower and is also affected by the timber species.



**NOTE:**

Tangential shrinkage across a **flat-sawn** board face is almost twice the radial shrinkage across a quarter-sawn board.

An example, there is 1% movement for every 3% change in EMC below 30%, so in Auckland that would mean a 140 mm wide ½ sawn board could shrink **2.8mm**





**Bow**

Is a curve down the length of the timber face.

**Crook**

A curve along the edge of the time side.

**Kink**

A small crook in on a small part of the timber length, usually due to a knot.

**Cup**

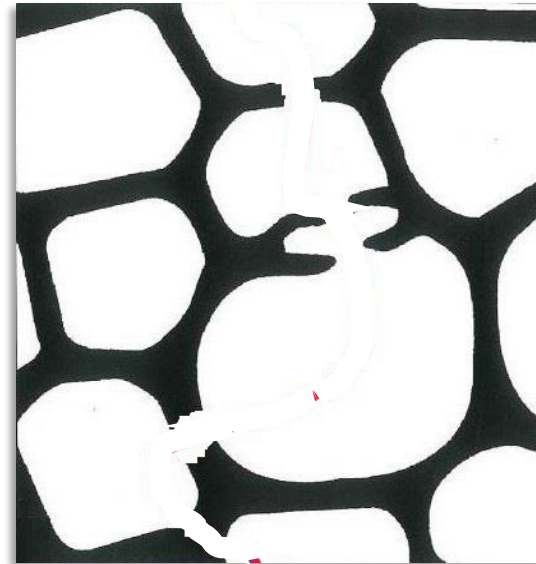
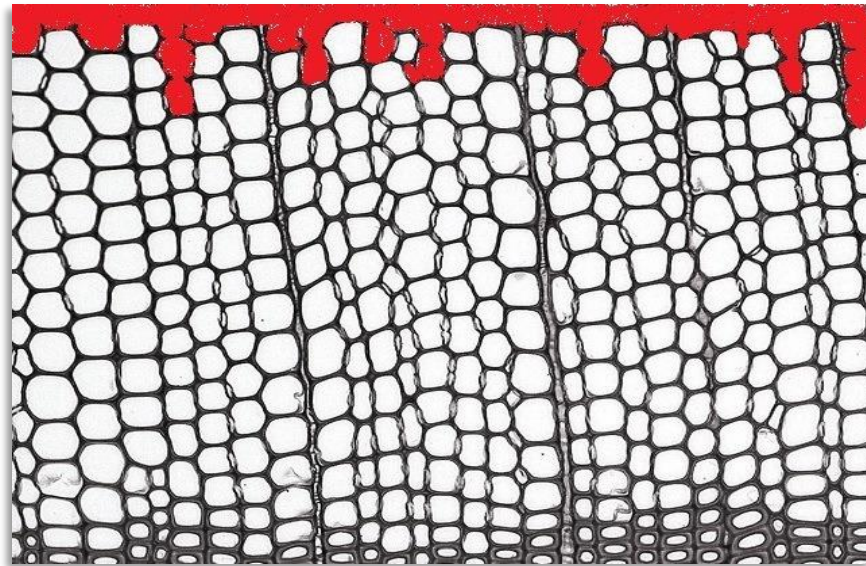
A curve along the face of the timber.

**Warp**

A twist in the wood, from one end to the other.

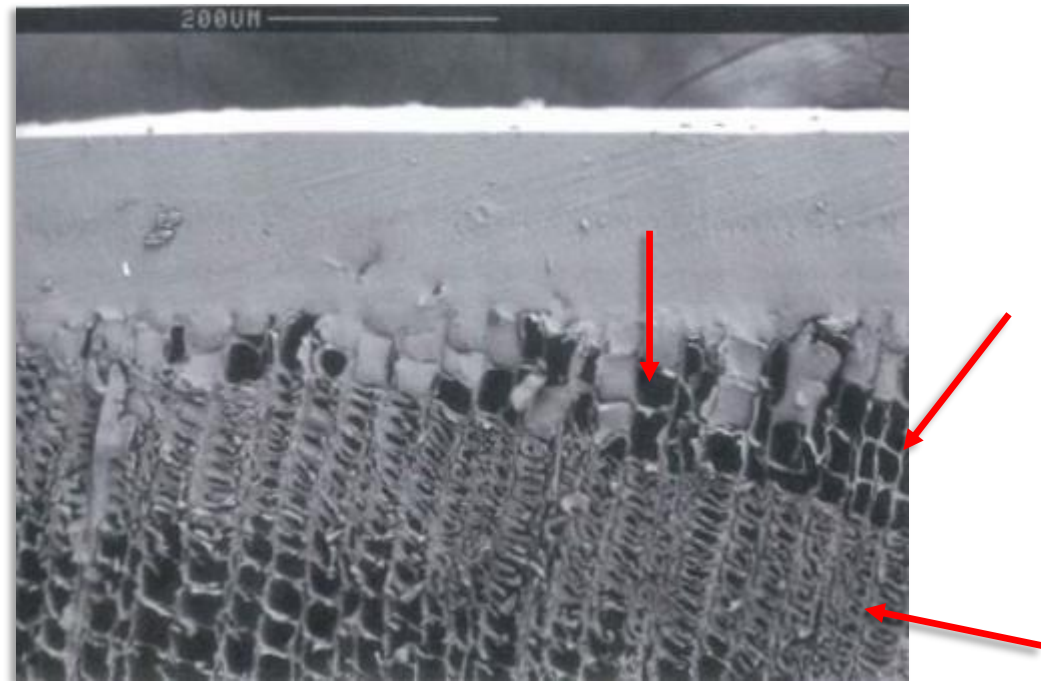
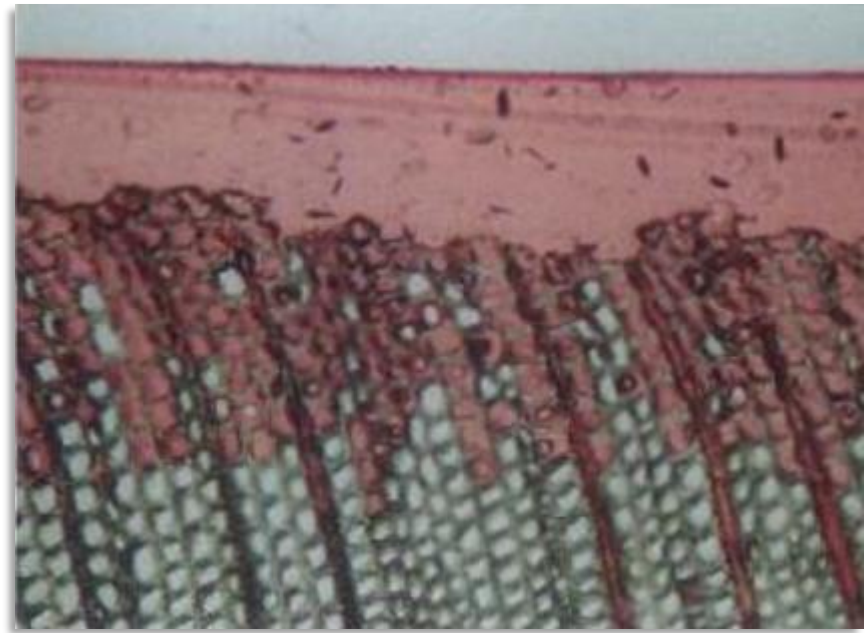
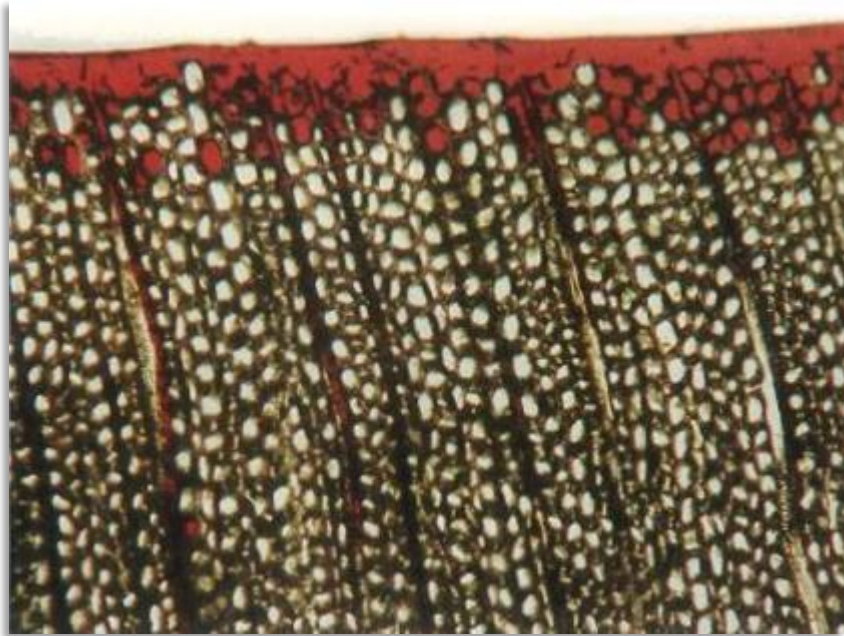
# Timber Cell Penetration

Polymers are large molecules (irrespective of whether they are dissolved in organic solvent, water or in dispersed form) and thus cannot diffuse through intact cell walls, whereas some solvents or oils are generally small molecules and can move through the cell walls. When coatings are applied to timber the solvent/water quickly penetrates the cells and cell walls leaving behind the polymer in the outer layers.

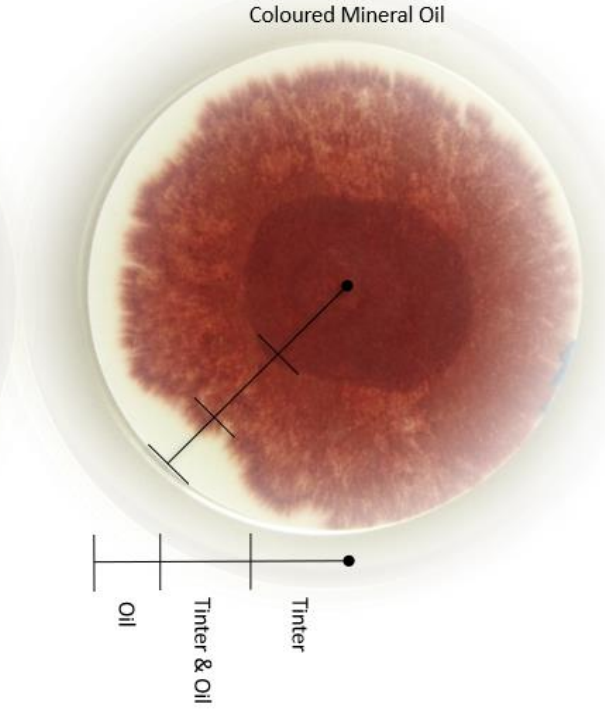
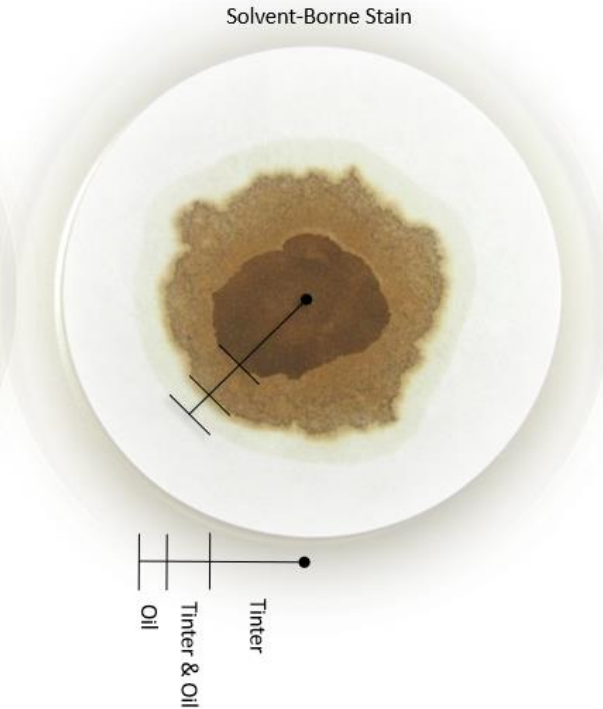
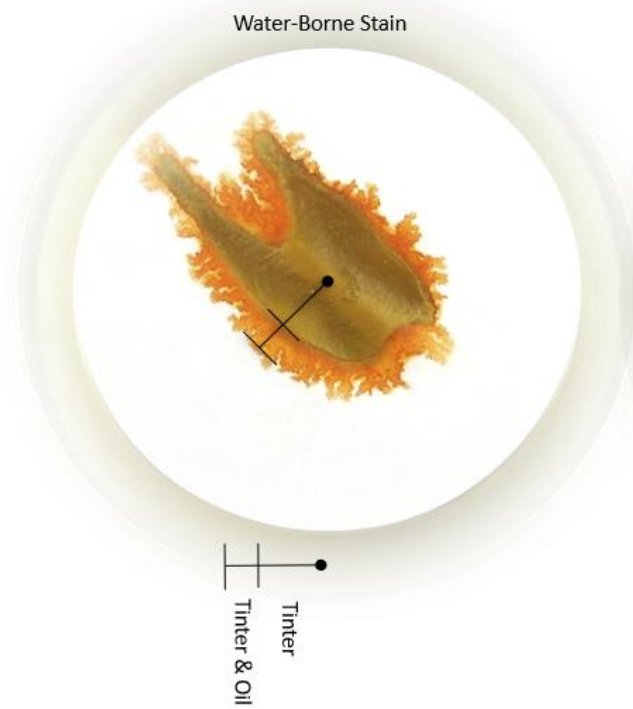


Mechanical damage to the timber surface that disrupts deeper wood cells will therefore aid polymer penetration





# Penetration of Stains / Oils





The outer bark helps protect the tree from the effects of the environment, especially UV light that can cause break down of the timber cells.

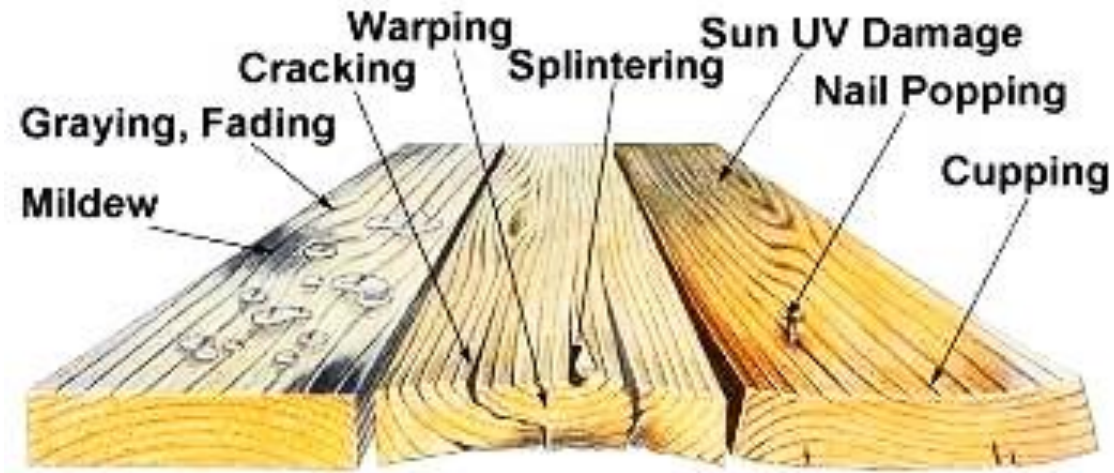
Once milled and turned into building materials the inner timber, heart wood and sap wood that were safely protected by the bark are now exposed to the effects of the environment.

**So to help protect the timber from the environment, we need to treat it and so we oil, stain or paint the timber.**

# Coating Options

- 1.** Do Nothing
- 2.** Oil it with a Vegetable Oil – clear and coloured
- 3.** Oil it with a Mineral Oil – clear and coloured
- 4.** Stain it with a Film forming stain – coloured
- 5.** Stain it with a Penetrating Stain – coloured
- 6.** Polyurethane it – clear or slightly coloured
- 7.** Solid Paint

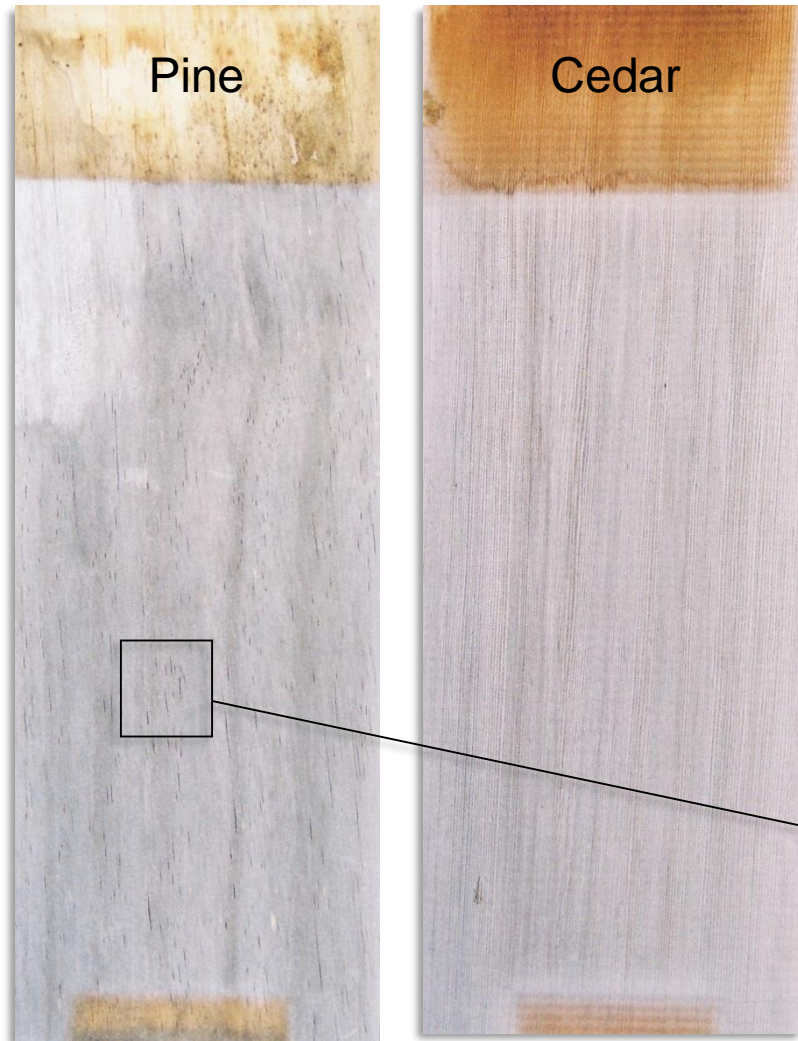
# What are we trying to do?



# Protection Options

**It is important to understand each option has its pros and cons and it is up to the customer / owner / specifier to fully understand the properties of what option that they choose.**

# 1. Do Nothing



If we do nothing then the timber will be exposed to the elements. The UV will break down parts of the wood cells weakening the fibres and turning them grey. Rapid moisture uptake and evaporation will cause excessive movement resulting in checking, cracking and splitting of the timber as well as helping with mould growth and onset of other fungal attack. In a lot of cases the building code requires that you must apply a treatment, e.g. stain or paint.



## 2. Oil it with a Vegetable Oil – clear or semi transparent coloured

People oil a timber and think that they are keeping it alive.

The wood is dead once you cut the tree down.

Oil can help give it a deeper glow and bring out the natural colours of the timber however vegetable oils, (those based on plants e.g. linseed oil, rape seed oil, flax seed oil) can act as feed stock for moulds.

To try and over come this issue they are more refined and have fungicides added to them however nothing last forever and these break down.

Additionally these oils dry by oxidation and over time form a type of hard film which can crack and split allowing water in.

Usually used in a clear natural finish or sometimes with pigments to help with reducing UV damage.

**Durability: ~ 6 months – 1 Year**



One, Two & Three months exposed exterior on untreated Pine timber – mould growth development



Linseed Oil + fungicides



Pine

Soya Bean Oil + fungicides



Cedar



### 3. Oil it with a Mineral Oil – clear and coloured – semi transparent

Mineral oils are petrochemical based. They are highly refined oils which never “dry”. The advantage of this is that they penetrate into the timber cell structure (giving the appearance of the surface being dry) and provide some moisture resistance making the timber more dimensionally stable. For this reason architects and cedar timber suppliers like to use mineral oils. This oil has additional fungicides to help the wood resist some mould growth and also a very small amount of a resin to help hold any colour pigments on the surface of the timber (if tinted/coloured).

Used in its clear form or tinted with colour pigments to offer some resistance to the effects of UV. A common brand is the Wood-X (made by Resene for Herman Pacific / Wood-X Limited)

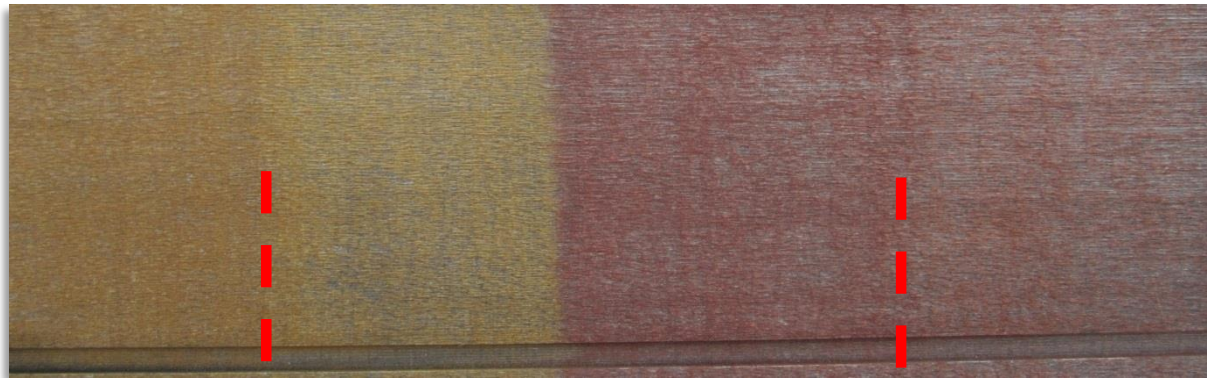
- **Important note's,**

Typically, can only be overcoated with itself as it does not generally accept stains or paints over the top, as it is a non-drying oil.

For application there can be a 6 – 20 weeks between each application, as it needs to penetrate into the timber before you put another coat.

**Durability: Outer face of timber ~18 – 24 months and longer in some environments and internally within the timber.**

Wood Oils give a beautiful glow to timber when applied and slowly weather over time.



Wood-X

other

Wood-X

other

## 4. Stain it with a Film Forming Stain – semi transparent

Prior to the development of the Woodsman and other semi-transparent penetrating oil stains, the market was supplied with “Film Forming Stains”.

An example of a common film forming stain (Traditional Timber Stain) in the hey day was Gold-X NF-11, and in fairness most other brands of *Timber Stain* were similar.

These stains were semi transparent and were based on oils, such as, refined linseed oil, fungicides and coloured pigments. When applied they did not really “penetrate” instead they sat on top of the timber and formed a film.

Flaking caused an issue for preparation and re-staining, as how do you prepare a coating that has areas flaking and areas, while not peeling at present but also has damaged fibres underneath it?

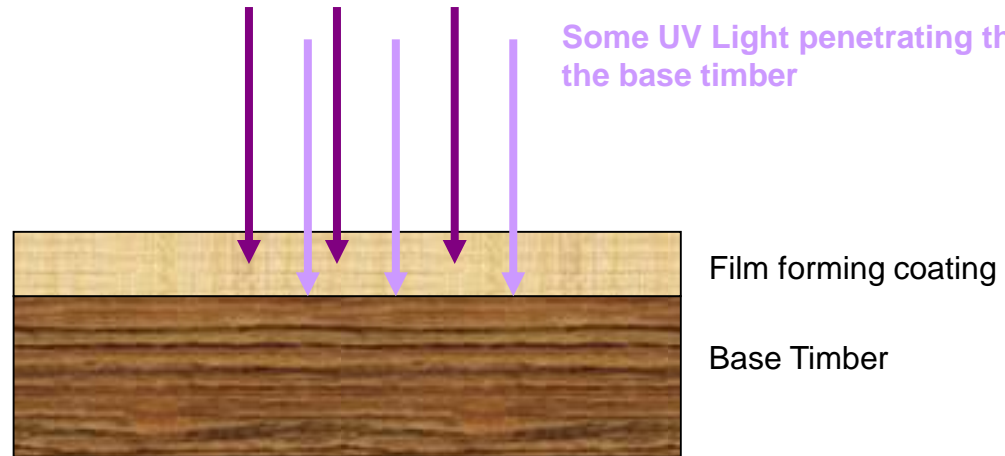
The same can be said of more modern offers from other paint company’s on so called “Clear or Coloured Semi Transparent” film forming coatings that are failing by the same mode

**Durability: 2 – 5 Years and longer in sheltered faces.**



Some UV Light being absorbed by UV absorbers

Some UV Light penetrating through the coating to the base timber



## 5. Stain it with a Penetrating Stain – semi transparent

More natural looking stains, which have subsequently gained wide popularity over the last few decades.

The penetrating stain is designed to penetrate, (where possible) into the very top cell layer of the timber and does not form an actual film (as in varnish, traditional timber stain or paint film).

The oils within it penetrate into the outer call layer of the timber, the pigments sit on top of the timber. Additionally fungicides help offer resistance to moulds etc and in some cases waxes are added to offer additional water repellence properties.

While the penetrating stain types do not last as long as the earlier film forming type stains, as their break down is by surface erosion, the trade off is that penetrating type stains are considerably cheaper (material and labour costs) and quicker to reapply, with minimal surface preparation required beforehand.

**Durability: 2 summers 18 – 24 months and longer in sheltered faces**

Note: The following affects are the same for Penetrating Oils or Stains



# Erosion of penetrating clear/stain finish on timber weatherboards

## CAUSES

- ↓ UV light deterioration
- ↓ Moisture penetration and timber swelling
- ↓ Mould growth

## CAUSE

**UV light deterioration**

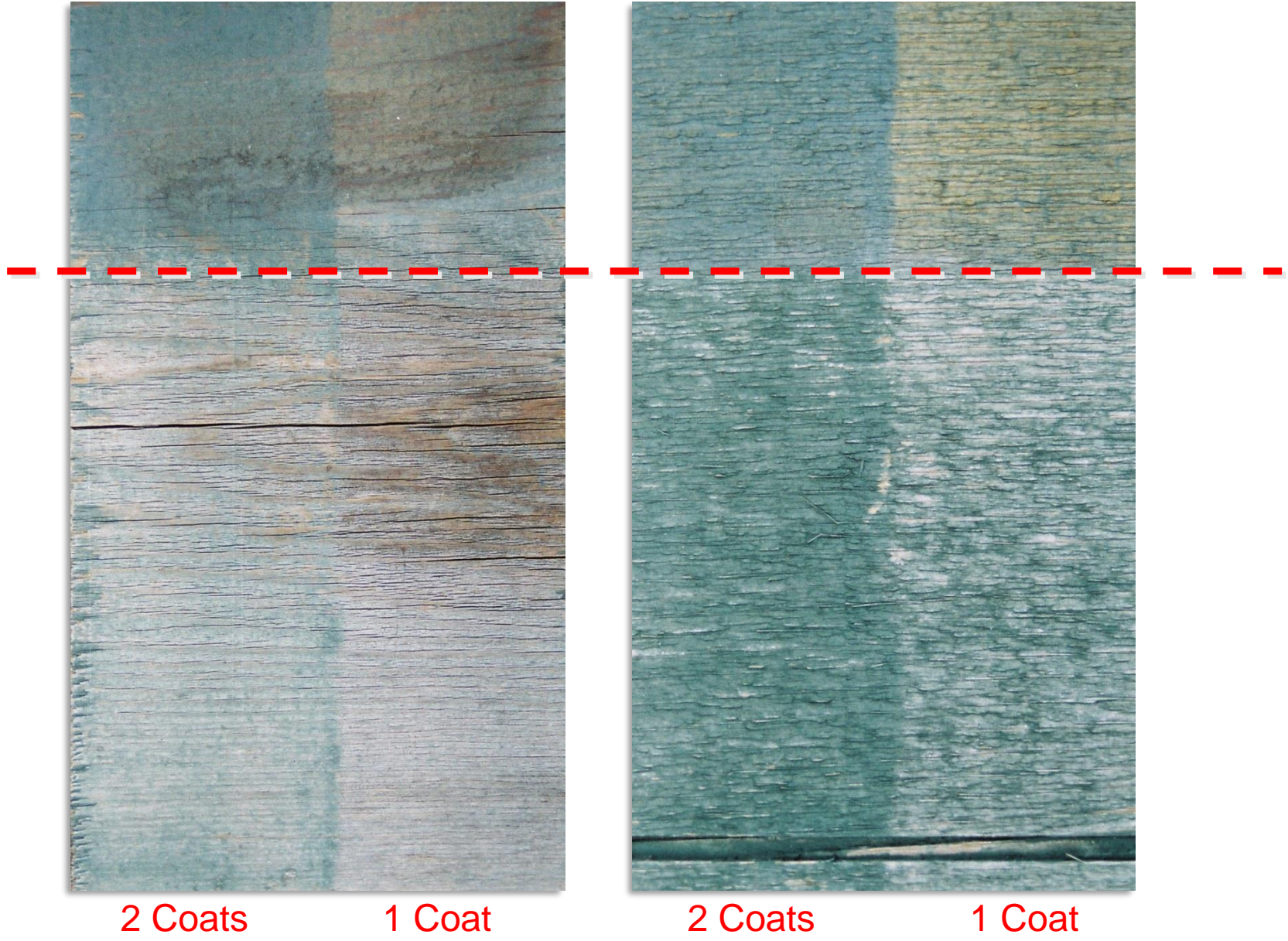
## REPAIR

- clean down the surface and re-apply penetrating stain with at least two coats, brushing on evenly and maintaining a wet edge to avoid a visible line from overlapping once the stain has dried



Dressed (Smooth)

Band Sawn



2 Coats

1 Coat

2 Coats

1 Coat



Latewood bands are very dense. Stain will not penetrate as much in this area of the timber. Therefore penetrating type stains sit onto of this area and will weather off before the softer Earlywood, more porous bands of the grain.

Note: The following affects are the same for Oils or Stains



Colour affect – grain cut



Colour affect – timber colour



1 coat

2 coats



Colour affect – poor application / overlap



Dressed

Band sawn



Plywood – early & latewood

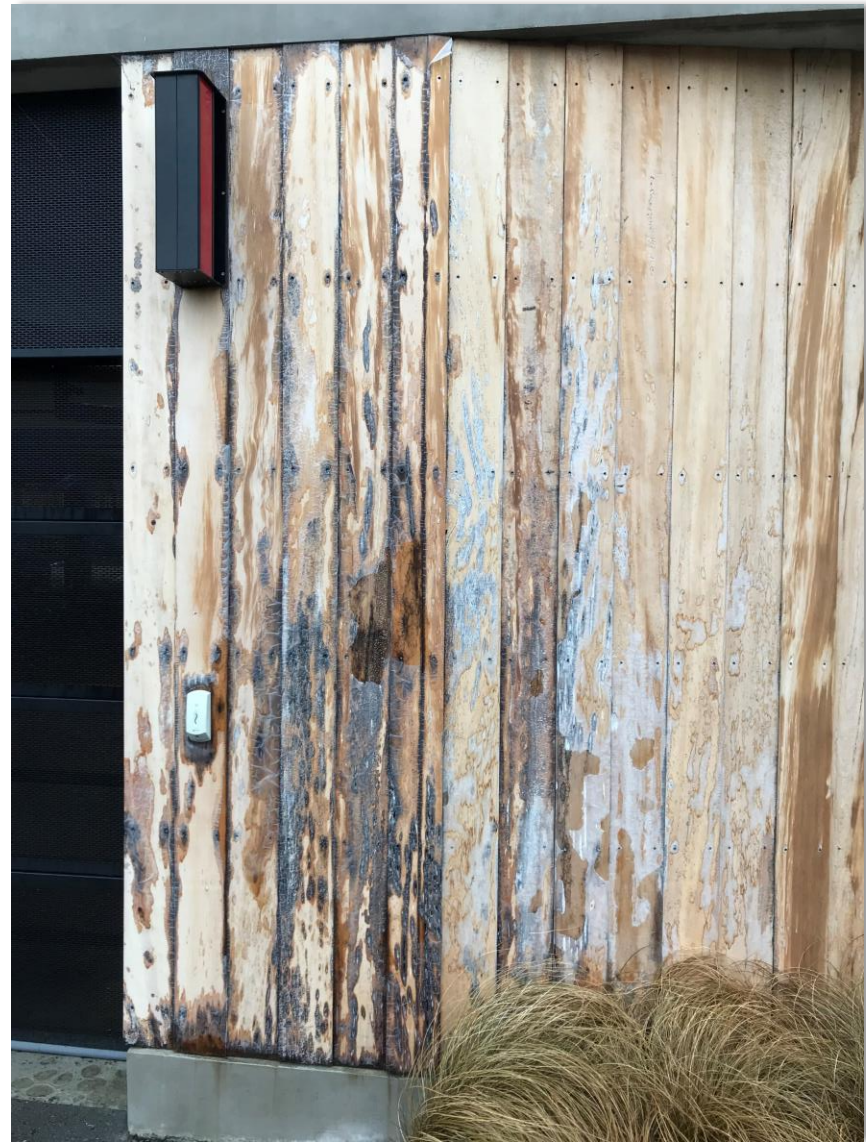
## 6. Polyurethane it – clear finish

If we place a clear coating over the timber (for exterior application/exposure) then the ultra violet radiation (UV) from the sun can penetrate the clear film and cause damage to the Lignin within the timber cell and thus weaken and breakdown the structure of the timber itself.

Ways to try and reduce this damage have been to put UV absorbers into the clear coatings and then apply many coats in an effort to try and build up, from a cross sectional point of view, the amount of UV absorbers available within the film matrix. In some cases additions of “trans-oxide” pigments (yellow in appearance) have also been used to help with this.

Though they do work, they do not stop all the UV and breakdown over time will still occur, resulting in splitting, cracking and peeling as with the Film Forming Stains previously mentioned.

Durability: **DON'T DO IT**     ~1 – 2 Years and longer in sheltered faces.





## 7. Solid Paint

Pigmented paints provide a solid film with the pigments making them opaque to UV light therefore protecting the timber from the damaging effects of the UV's damaging effects.

Additionally if using a white or light coloured paint then you can also get the addition of some reflection of the heat carrying / generating IR light (inferred), helping to keep the timber cool and thus reduced temperature changes, resulting in less dimension movement, resulting in better long term durability.

Sharp edges need to be removed from timber to reduce the paint film from pulling back during application (when the paint is wet) and the right thickness is applied so as to ensure that the then dried paint film can move and flex with the timber.

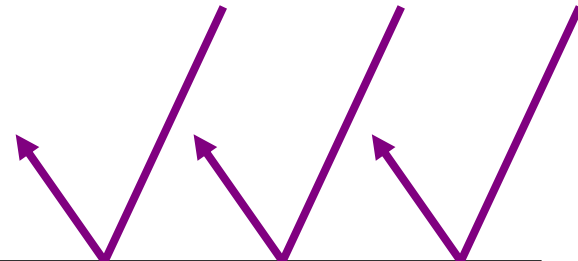
Additional to this and a rule of thumb the more gloss the better the flexibility of the paint film.

**Durability: 7 – 10 years and longer in sheltered faces**



UV Light being reflected off

Slows water vapour movement into the timber

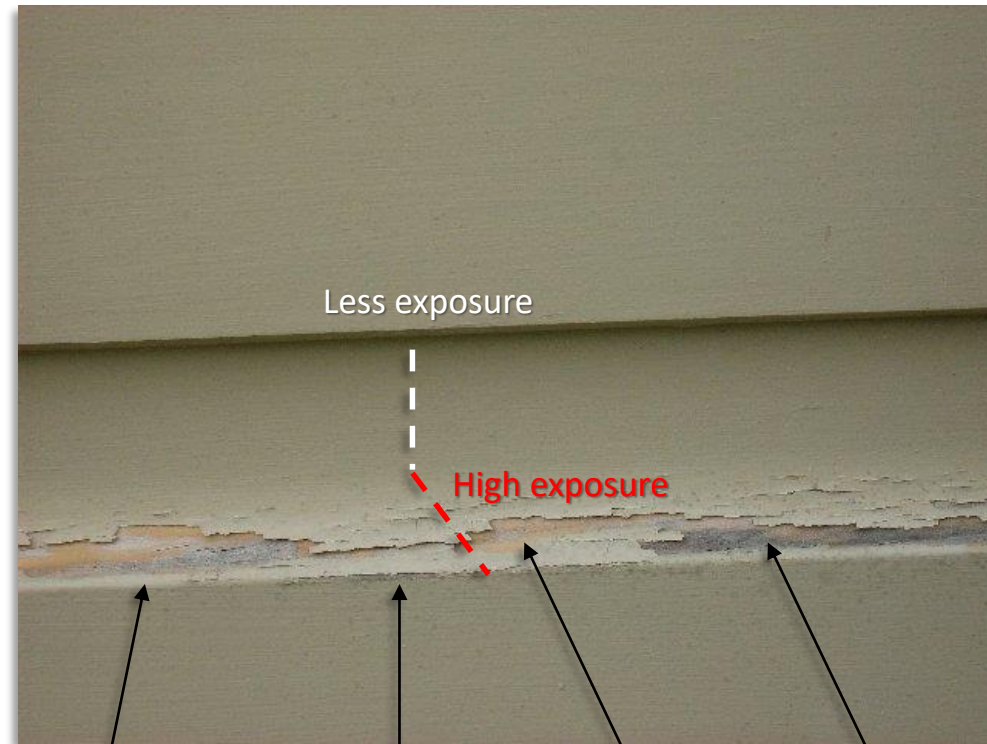
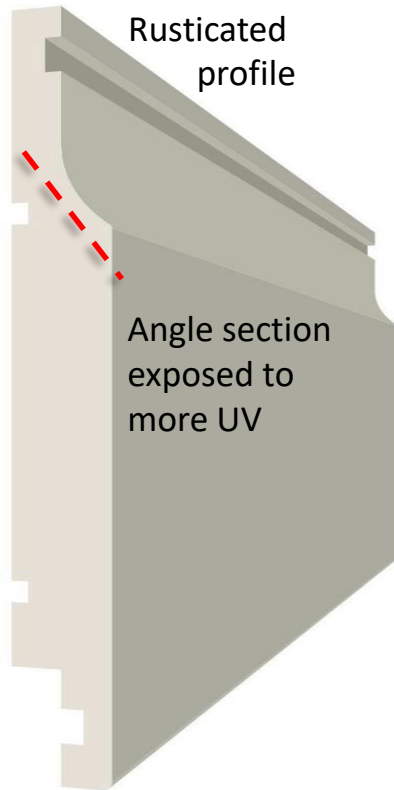


Solid Paint

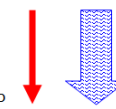
Base Timber

# Another look at exposure and breakdown

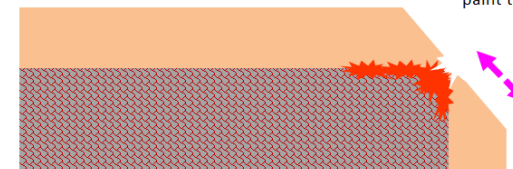




1. Paint pulls back from a sharp edge due to surface tension when in its wet stage.

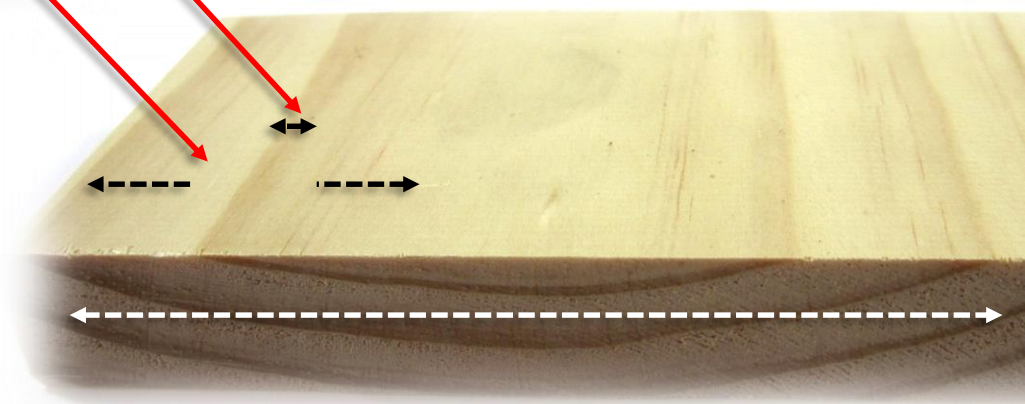


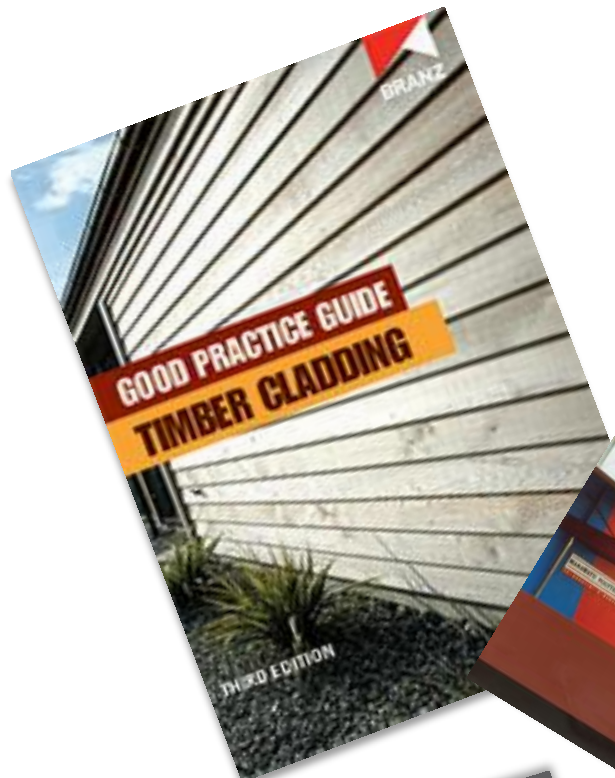
2. The dry paint film is thinner and therefore easier to form breaks caused by base metal expansion or moisture vapour penetration causing corrosion, which then expands causing the paint to split even more.





Earlywood      Latewood





BRANZ Shop



Just a small selection of what is available at the BRANZ Shop

# Overview

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That's the end  
&  
thanks for your attendance.

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