



# Timber Conversion

# What is Tree Felling?

- ▶ Felling is the process of harvesting or cutting down individual trees.

<https://www.youtube.com/watch?v=4GYDSeminMc>



**Leave it to the Professionals!**

# Tree Felling Methods

- ▶ Axe
- ▶ Hand Saw
- ▶ Chain Saw
- ▶ Timber Harvester







# Timber Harvester

- ▶ <https://www.youtube.com/watch?v=QGtoJ85z2oQ>

# What is Timber Conversion?

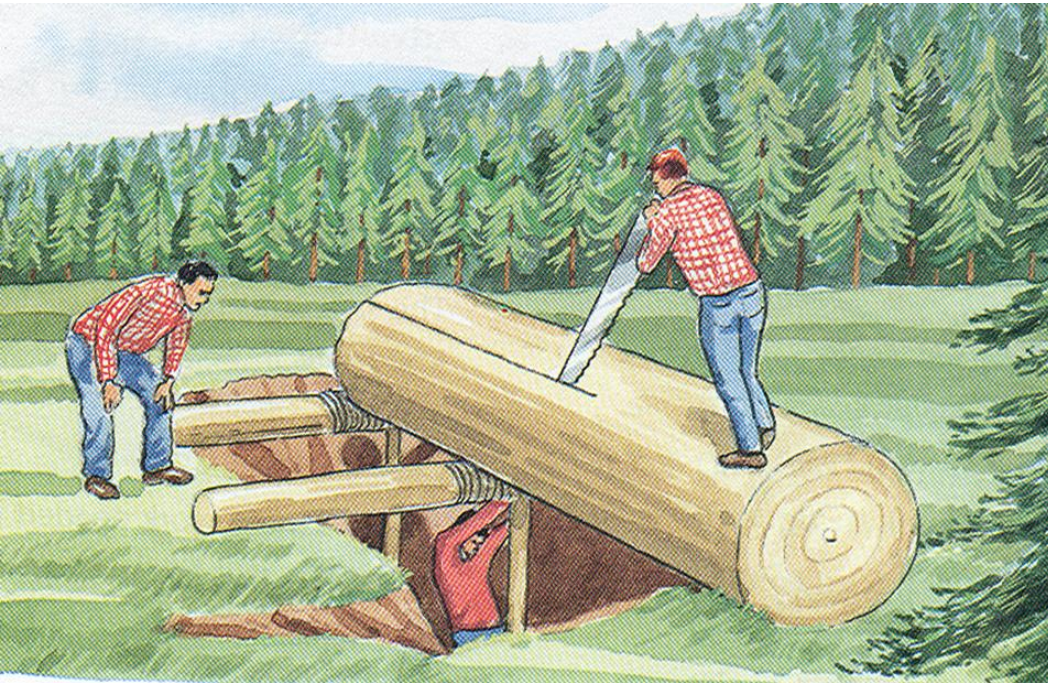
- ▶ Converting round logs into plank form.

## Reasons to convert timber

- ▶ Allows wood to dry faster
- ▶ Provides wood of usable size and shape
- ▶ Allows the quality of the timber to be seen



# Old vs. New



A Saw Pit

Bandsaw





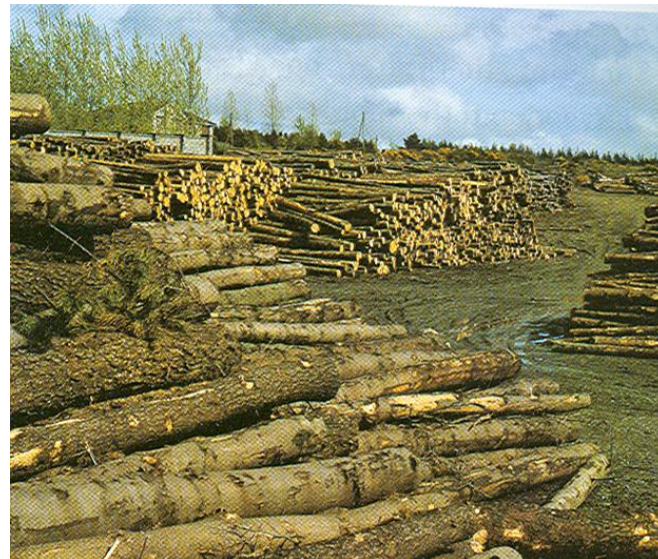
# Pit Saw



Timber Conversion

# Conversion Methods

- ▶ There is 3 methods of conversion
  - Through and Through Sawing (also called flat or plain sawing)
  - Tangential Sawing
  - Quarter Sawing (also called radial or rift sawing)







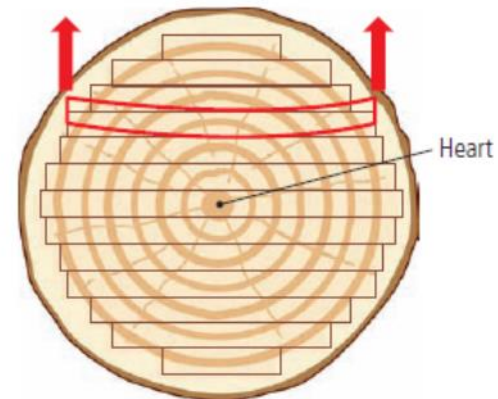
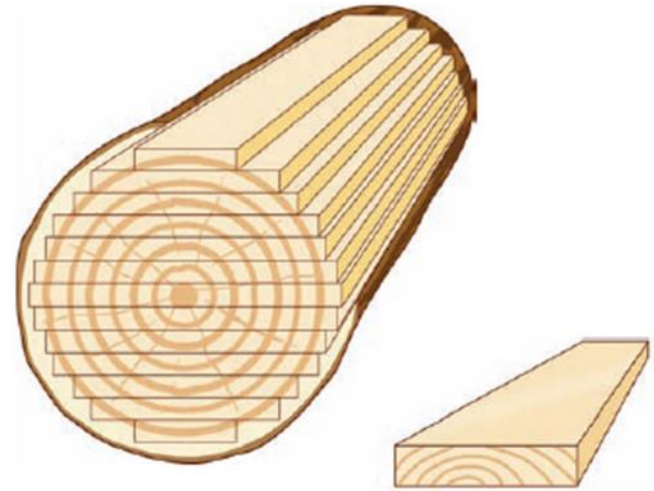
# Through and Through

## ▶ Advantages

- Low cost
- Little waste
- Fast and easy method

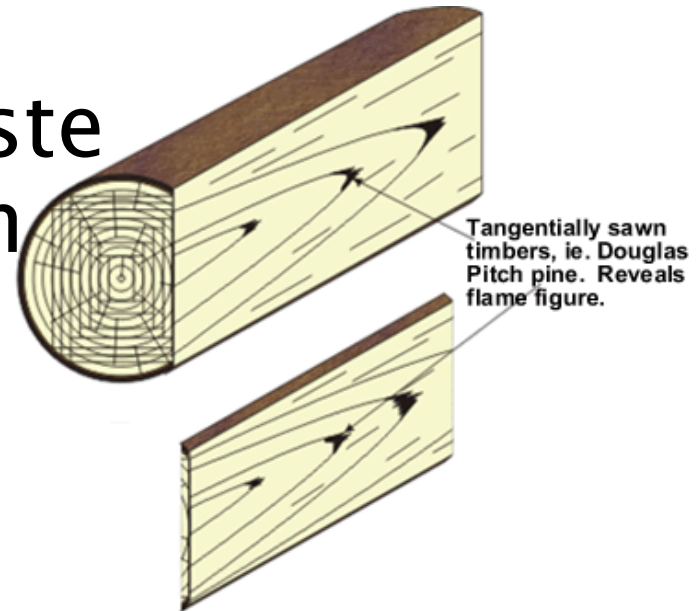
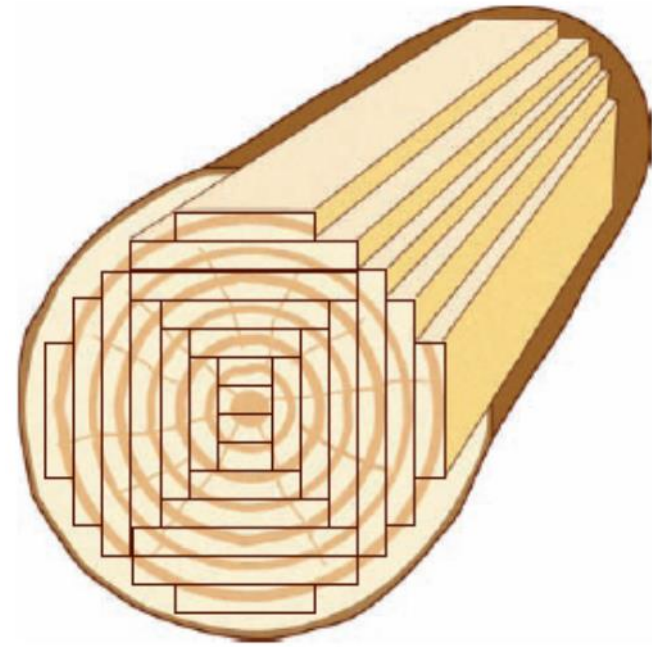
## ▶ Disadvantages

- Boards likely to cup



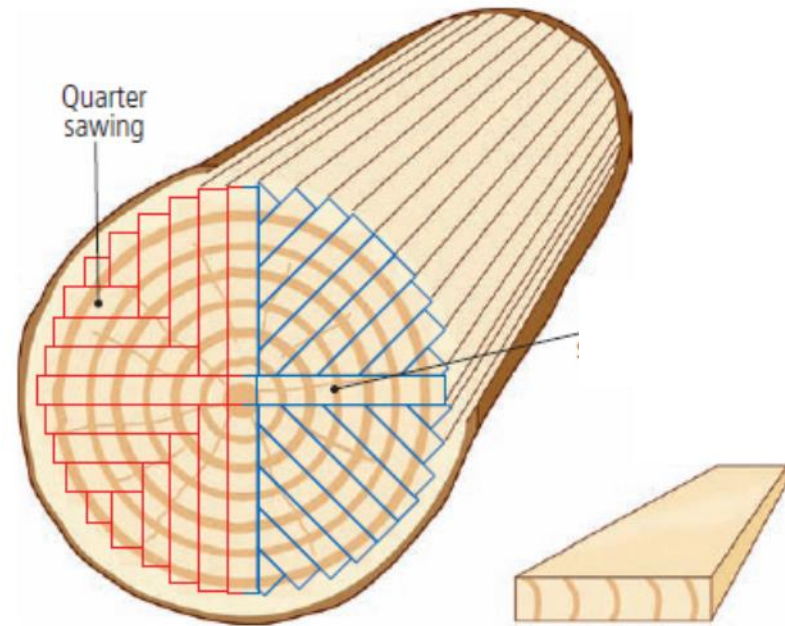
# Tangential Sawing

- ▶ The cut is made at a tangent to the annual rings of the log.
- ▶ Advantages
  - Cheap
  - Minimum waste
  - Flame pattern
- ▶ Disadvantages
  - Shrinkage
  - Distortion



# Quarter Sawing

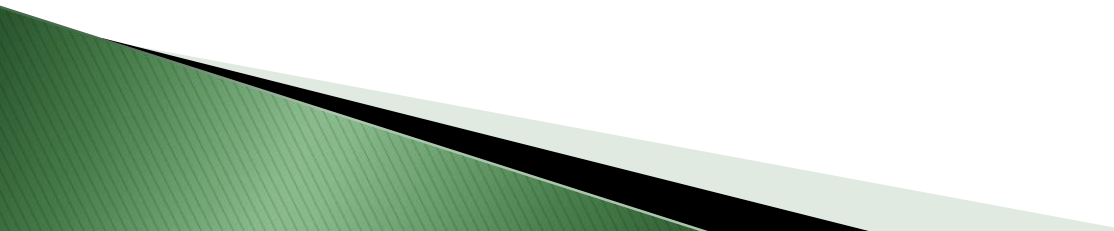
- ▶ Advantages
  - Best quality timber
  - Dries more stable
  - Produces silver grain
- ▶ Disadvantages
  - Expensive.
  - Waste quantity.
  - Handling time.



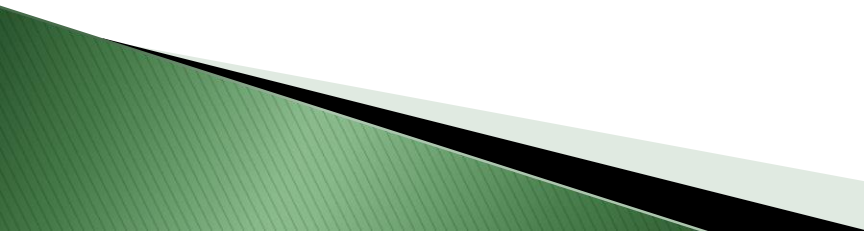
# Seasoning



# Timber Seasoning

- ▶ When timber is first felled it is known as green timber and has a very high moisture content – 50%
  - ▶ Before it can be used it must be dried
  - ▶ Aim of seasoning is to dry out the wood to a suitable moisture content of 20% or less
- 

# Reasons for Seasoning

- ▶ Seasoning is the controlled process of reducing the moisture content (MC) of the timber so that it is suitable for the environment and intended use.
  - ▶ Wood will dry naturally so seasoning helps us to control the process and keep the timber more stable and more useful.
  - ▶ Prevents a lot of fungal and insect attacks
  - ▶ It is less likely to distort or warp later
  - ▶ After seasoning timber is easier to work with, because it is lighter, harder and stronger.
- 

# Moisture Content

% Moisture content	Situation
22% - 20%	Limit of air seasoned wood.
20%	Limit for the occurrence of dry rot.
16%	Outdoor furniture.
12% - 14%	Occasionally heated areas.
11% - 13%	Heated areas.
9% - 11%	Very heated areas.

# Humidity

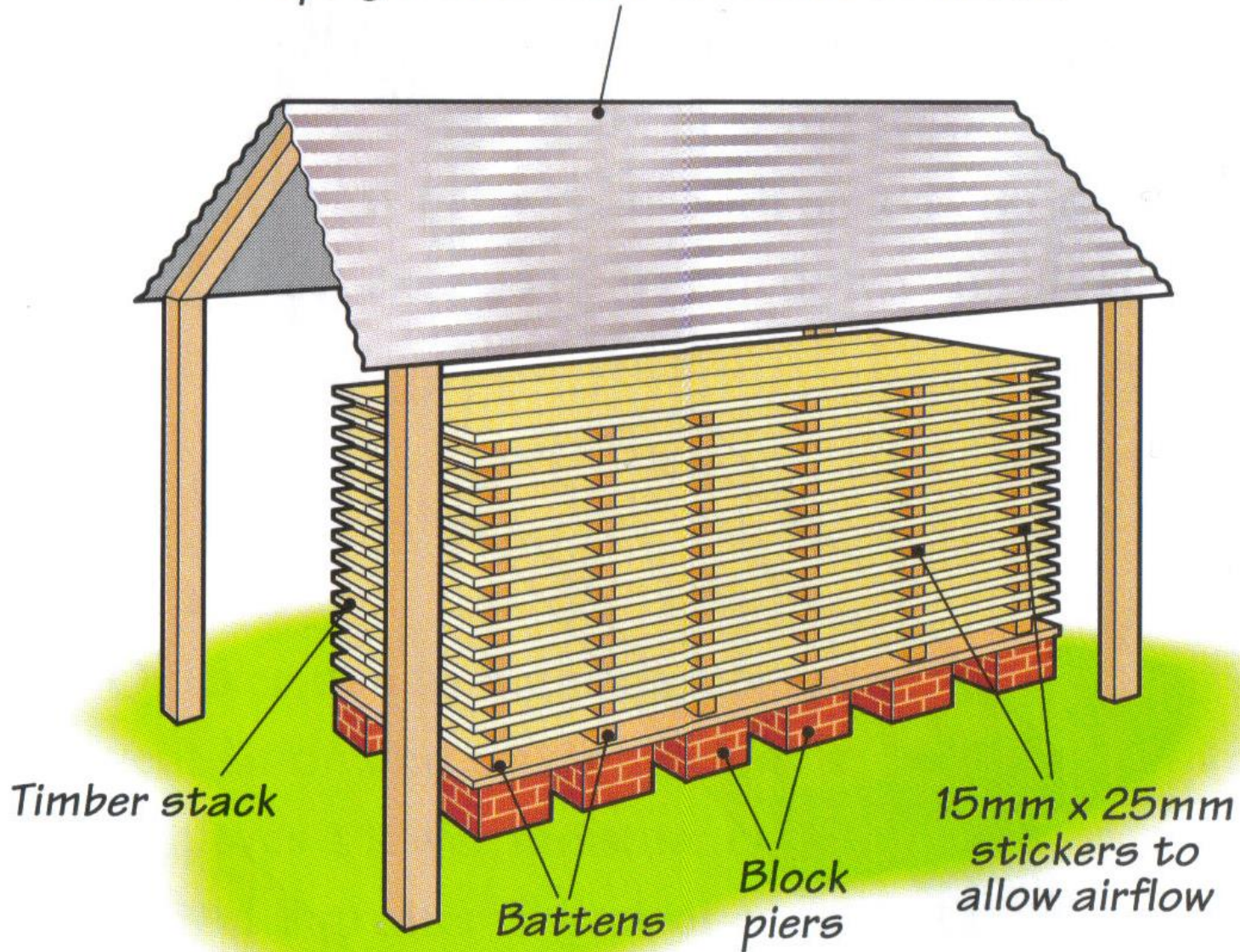
- ▶ The amount of moisture (water vapour) in the air
- ▶ Wood will continue to shrink or grow to reach Equilibrium Moisture Content. This means that it acclimatises to its surrounding environment. For example if a piece of timber with a moisture content of 12% is placed in a room with a moisture content of 20% the moisture level in the timber will rise until it reaches 20%.

# Types of Seasoning

- ▶ Natural / Air Seasoning
- ▶ Kiln Seasoning

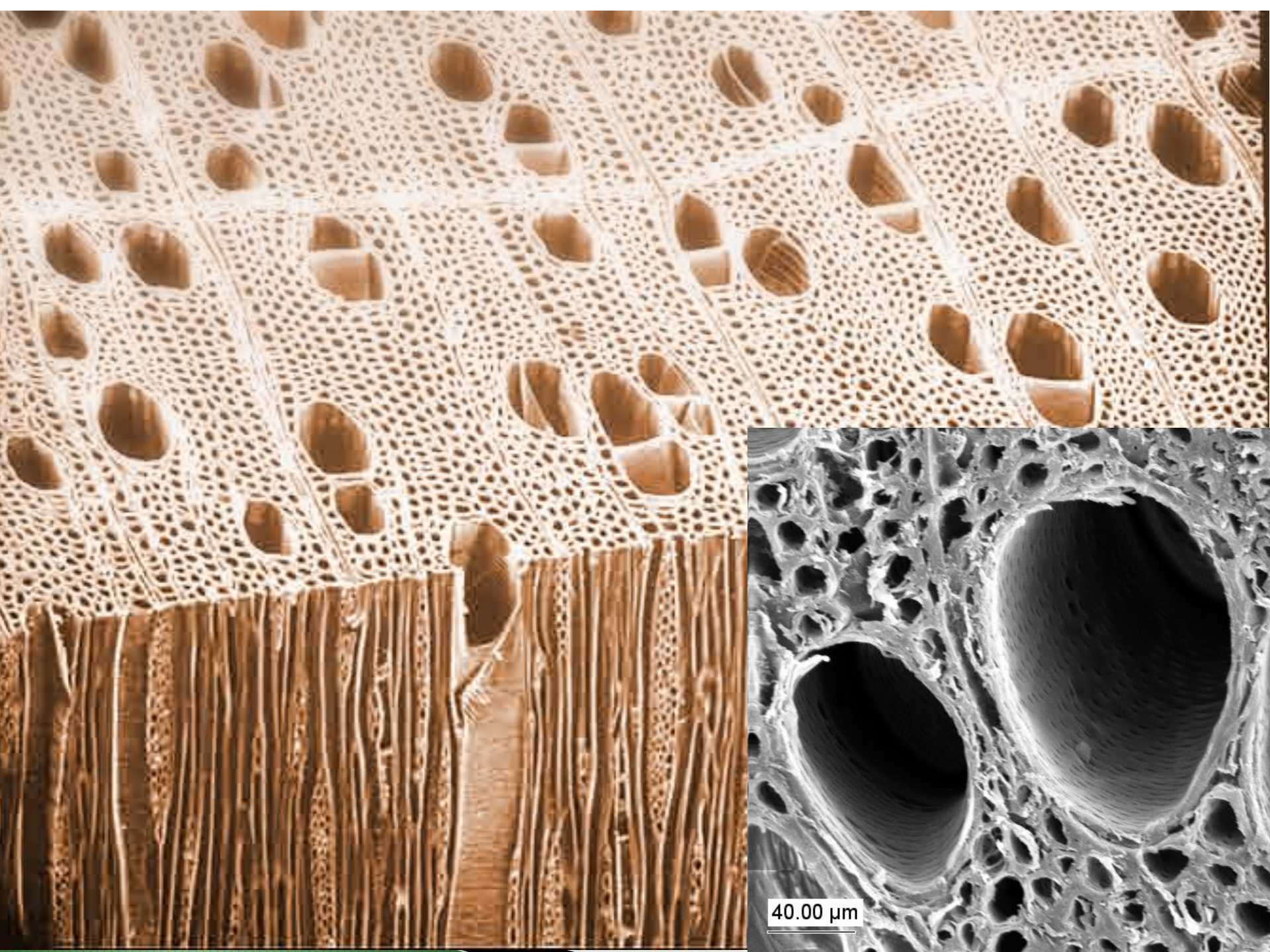
# Air Seasoning

*Sloping roof to allow rainwater to run off*



# Air Seasoning

- ▶ With this process the timber is roughly sawn to size and stacked using spacers called stickers, with the timber stacked in the open air.
- ▶ Spacing is achieved by using timber battens. The stickers should be spaced close enough to prevent bowing (600 to 900 mm centres) This allows the free movement of air.
- ▶ The stack should be protected from the direct influence of the elements.
- ▶ The ends of the beams must be painted to prevent splitting.





# Air Seasoning

## ▶ Advantages

- No expensive equipment needed
- Small labour cost once stack is made
- Environmentally friendly– uses little energy

## ▶ Disadvantages

- Slow drying rate
- Large area of space required for a lot of timber
- Only dries the timber to approximately 20% M.C. so leaving it open to some insect and fungal attacks while it is only suitable for outdoor joinery

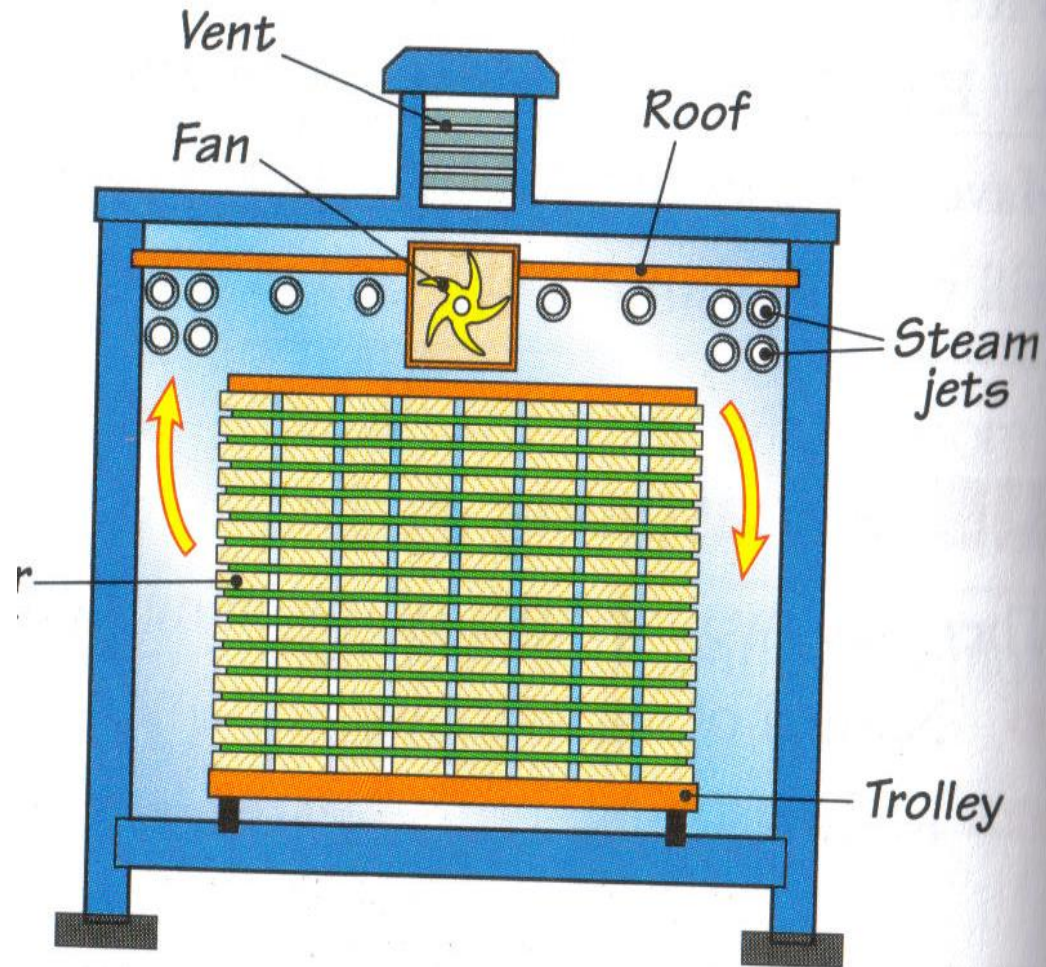
# Kiln Seasoning

- ▶ There are two main types of kiln used in artificial seasoning
  - Compartmental Kilns
  - Progressive Kilns.
- ▶ Both methods rely on the controlled environment to dry out the timber and require the following factors:
  - ▶ Forced air circulation by using large fans, blowers, etc.
  - ▶ Heat of some form provided by piped steam.

- ▶ Humidity control provided by steam jets.
- ▶ The amount and duration of air, heat and humidity again depends on species, size, quantity, etc. In general, the atmosphere in the kiln at first will be cool and moist. The temperature is gradually increased and the humidity reduced until the required moisture content is achieved.

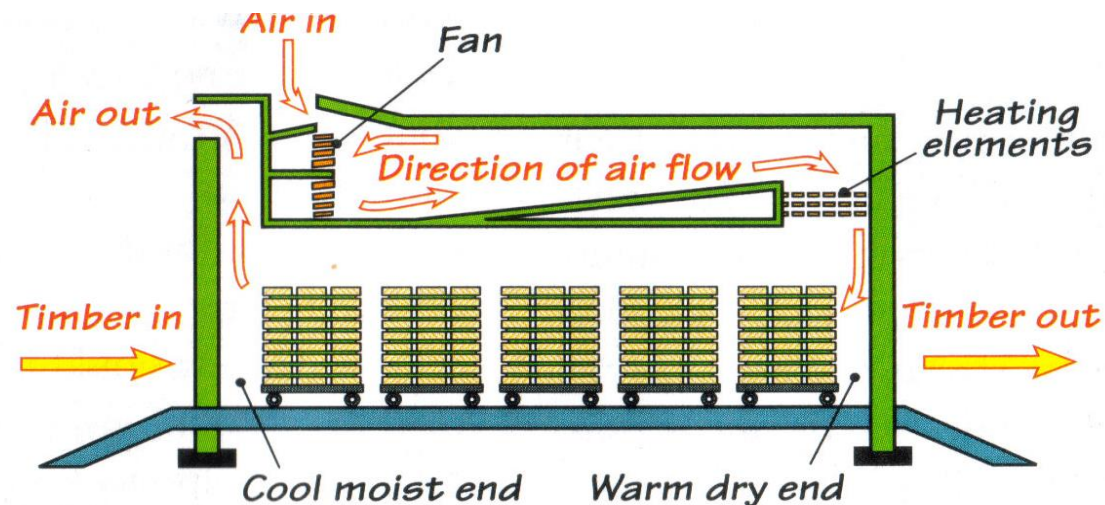
# Compartmental Kilns

- ▶ This kiln is a single enclosed container or building, etc.
- ▶ The timber is stacked in the same manner as air seasoning
- ▶ Whole stack is seasoned using a programme of settings until the whole stack is reduced to the MC required.



# Progressive Kilns

- ▶ A progressive kiln has the stack on trolleys that 'progressively' travel through a sequence of chambers.
- ▶ Each chamber has varying atmospheres that change the MC of the timber stack as it travels through.
- ▶ Advantages of this system– has a continuous flow of seasoned timber coming off line



# Kiln Seasoning

## ▶ Advantages

- Quicker due to higher temperatures, ventilation and air circulation
- Achieve a lower moisture content
- Defects associated with drying can be controlled
- Allows more precise rates of drying for various timber species and thickness of boards

## ▶ Disadvantages

- Is expensive
  - Requires supervision by a skilled operator
  - Uses a lot of energy
- 

# Finding the MC

- ▶ A moisture meter is most commonly used to establish the MC of a particular batch of timber. These meters are usually attached to two probes which send an electrical signal through the wood. Water is a conductor of electricity and therefore – the more water present the higher the conductivity and this can be read from the display.
- ▶ Another method of establishing the MC is to remove random samples from the stack. Each of the samples are placed on a micro scales and their weight recorded. The samples are then placed in an oven or microwave until the moisture has evaporated. The samples are then weighted again and their dry weight recorded. The %MC is obtained by the formulae



$$\frac{\text{Wet weight} - \text{dry weight}}{\text{dry weight}} \times 100 = \%MC$$

# Finding the MC

- ▶ Find the percentage moisture content of the following sample of wood given the following information;

$$\text{Wet weight} = 224\text{g}$$

$$\text{Dry weight} = 200\text{g}$$

- ▶  $\frac{\text{Wet weight} - \text{dry weight}}{\text{dry weight}} \times 100 = \%MC$

- ▶  $\frac{224 - 200}{200} \times 100 = \%MC$

- ▶  $\frac{24}{200} \times 100 = \%MC$

- ▶  $0.12 \times 100 = \%MC$

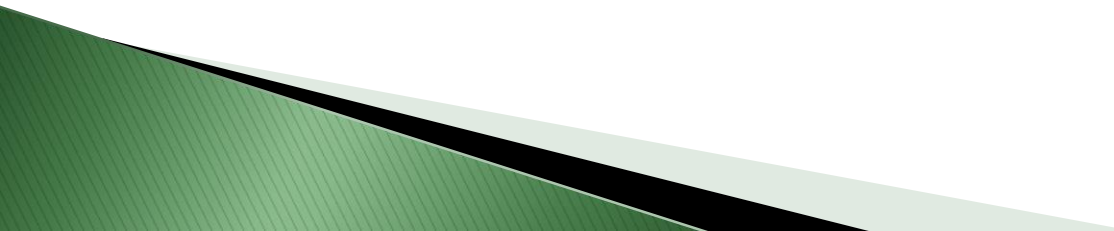
- ▶  $MC = 12\%$



# Timber Defects



# Defects

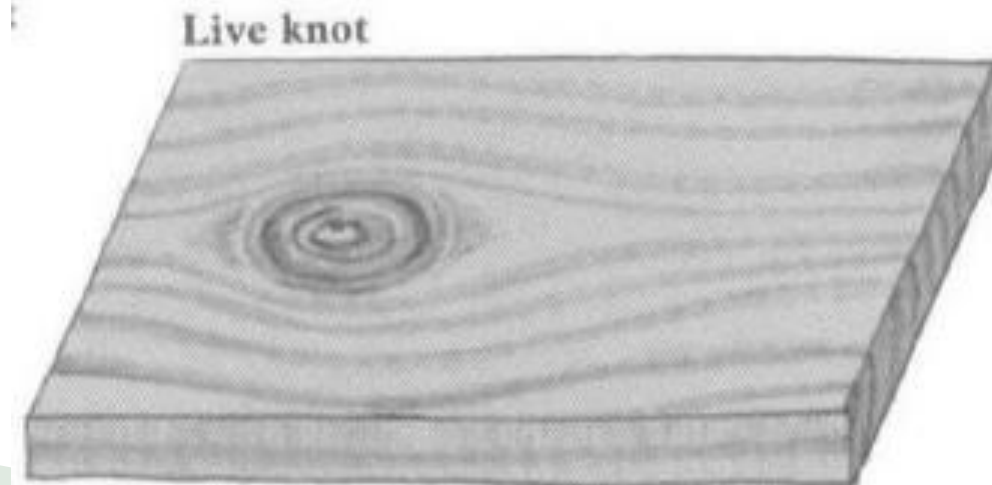
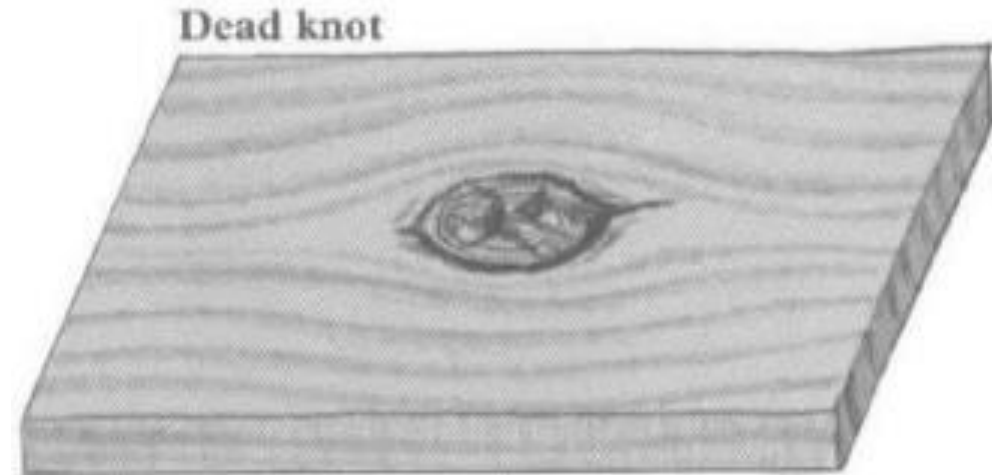
- ▶ Defects in timber can occur naturally (during the growth of a tree) or artificially (as a result of incorrect stacking or seasoning)
  - ▶ Some defects can be decorative and very pleasing to the eye, so these will be kept
  - ▶ Others may cause problems during the manufacture of a project, such defects must be overcome
- 

# Natural Defects

- ▶ Occur during the growth of a tree
  - Knots
  - Resin pockets
  - Shakes
  - Waney Edge

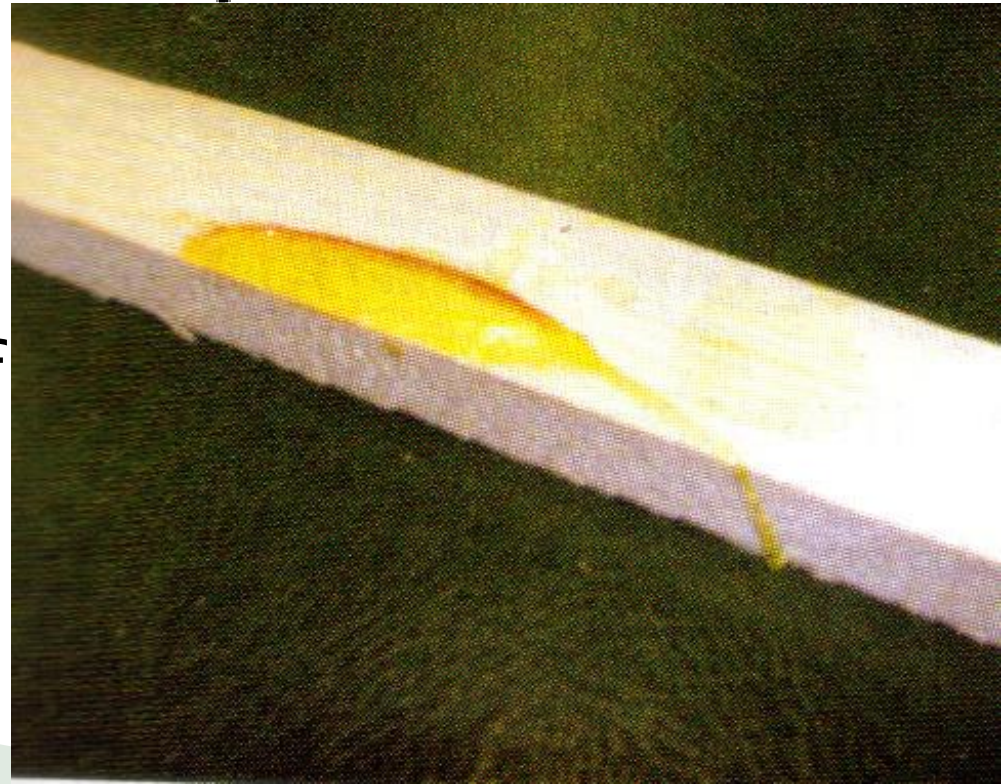
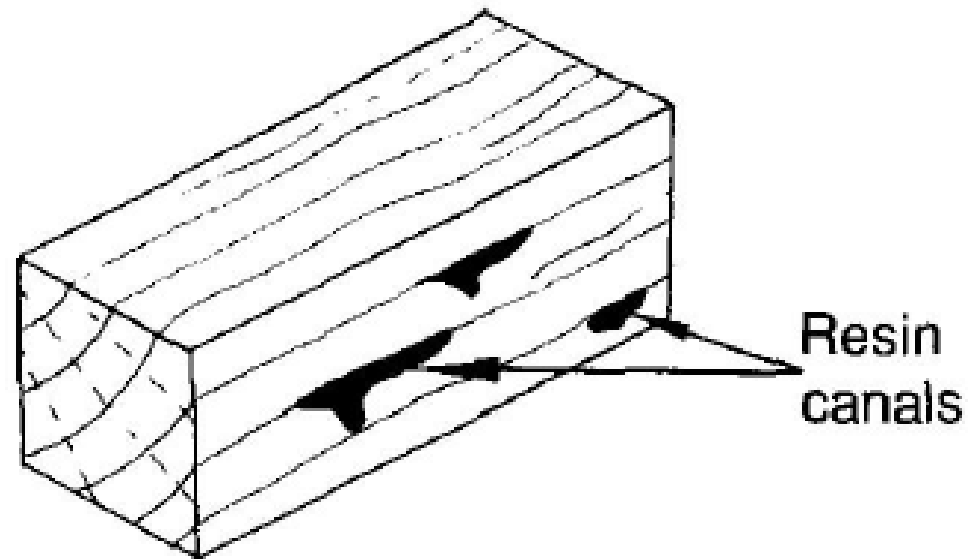
# Knots

- ▶ Knots form where branches of a tree are cut off or stop growing
- ▶ Loose knots are called Dead Knots – branch has stopped growing before tree is felled
- ▶ Other knots are called Live Knots
- ▶ All knots reduce the strength of timber
- ▶ Knots are difficult to work



# Resin Pockets

- ▶ Most common in conifers
- ▶ Forms in internal cracks in the wood
- ▶ Cracks caused by high wind or extremes in temperature
- ▶ Reduce the strength of the timber

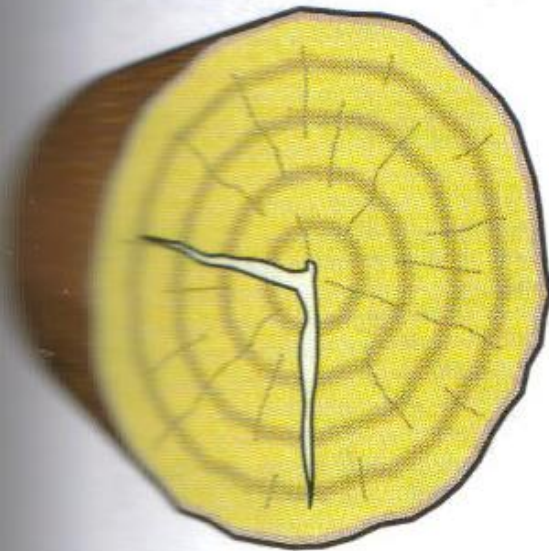




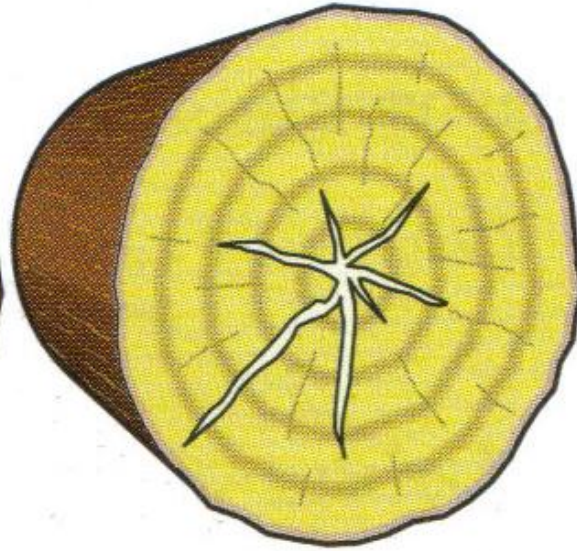
# Radial Shakes

- ▶ Occur in the direction of the rays
- ▶ They include heart shakes, star shakes and frost shakes

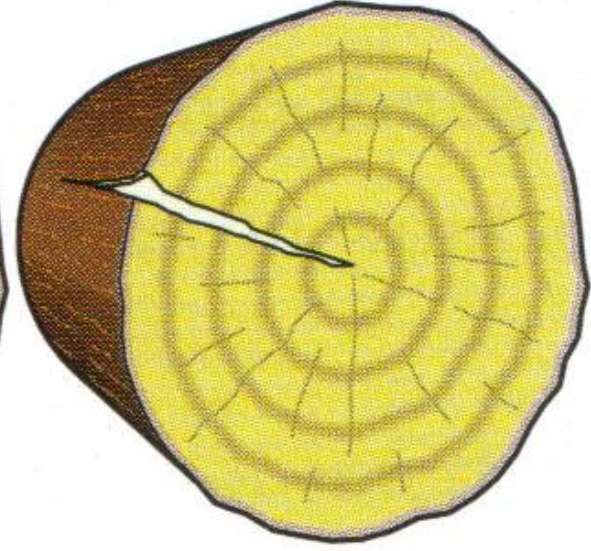
*Wood splits inwards,  
the result of very harsh  
weather conditions*



*Heart shake*



*Star shake*

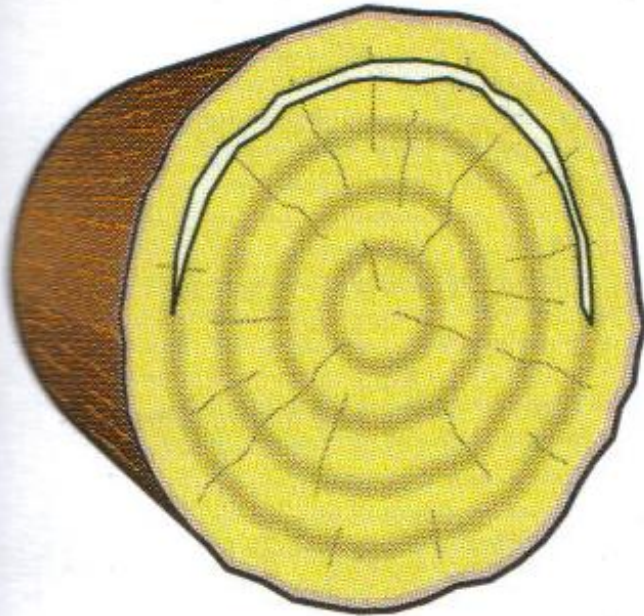


*Frost shake*

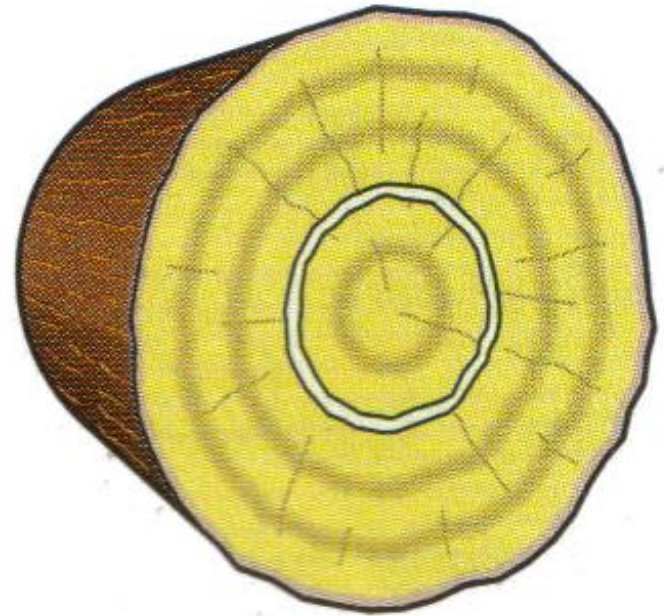
# Tangential Shakes

- ▶ Occur in the direction of the annual rings

*Winter wood separates  
from summer wood*



*Cup shake*

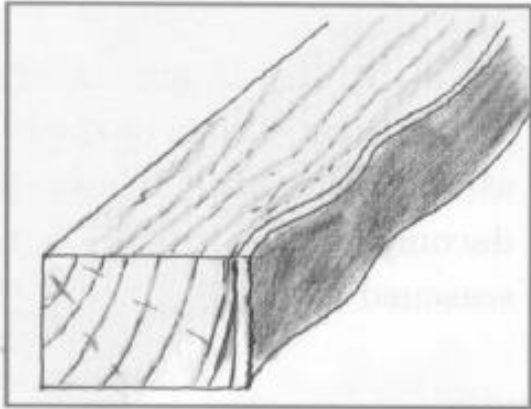


*Ring shake*



# Waney Edge

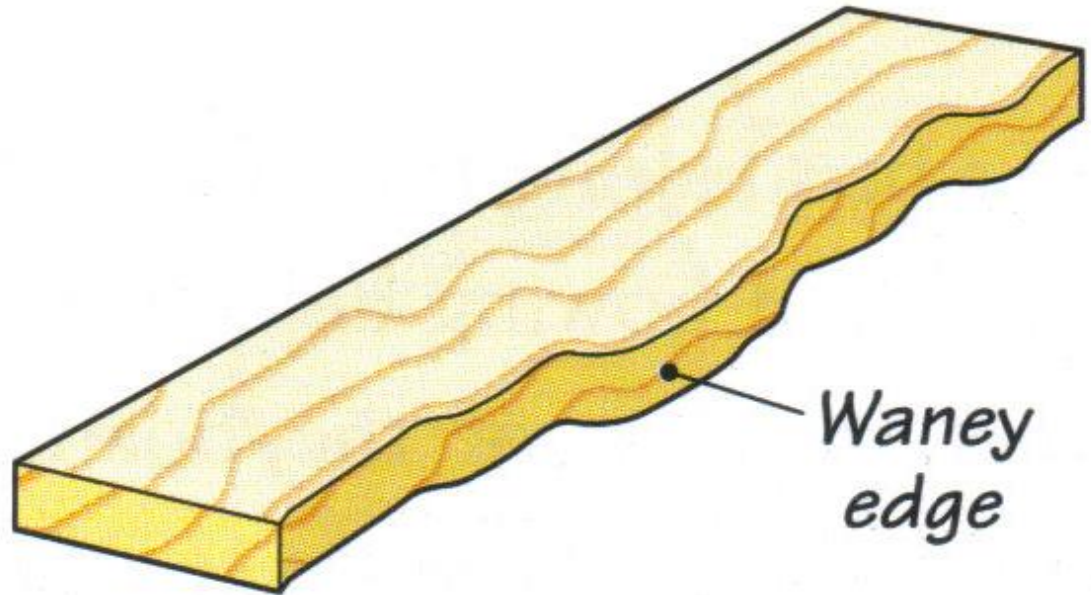
- ▶ Occurs during the conversion process
- ▶ Occurs when the bark is left on the edge of the



*Conversion defect*



A BOARD SHOWING WANNEY EDGES



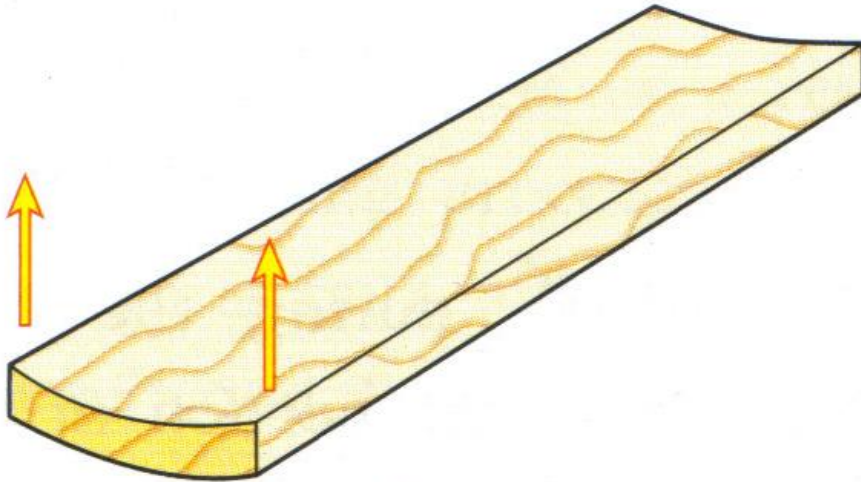
*Waney  
edge*

# Artificial Defects

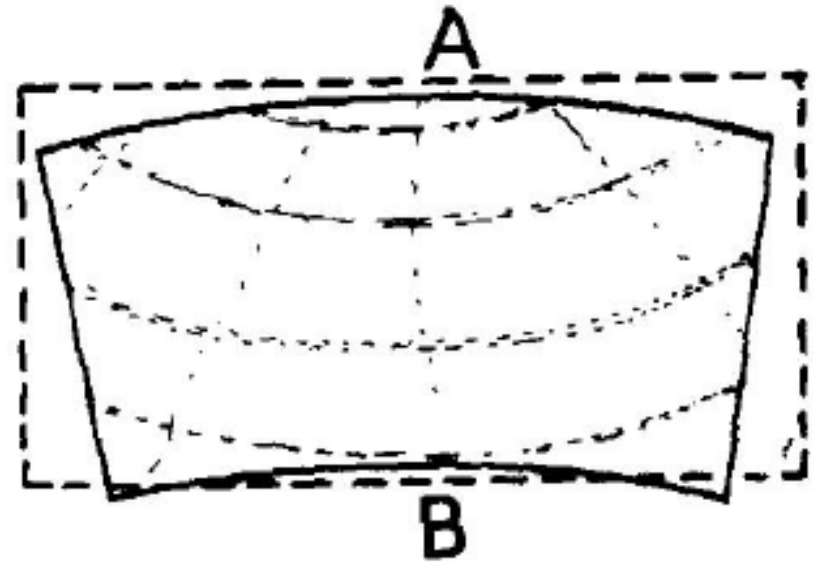
- ▶ Occur as a result of incorrect stacking or inappropriate drying schedule, stresses will be created in the wood that will cause
  - Cupping
  - Bowing
  - Twisting / Warping
  - End Splitting
  - Case Hardening
  - Honeycomb Checks

# Cupping

- ▶ Caused by differential shrinkage
- ▶ Planks will cup away from the pith
- ▶ Annual rings appear to try to straighten



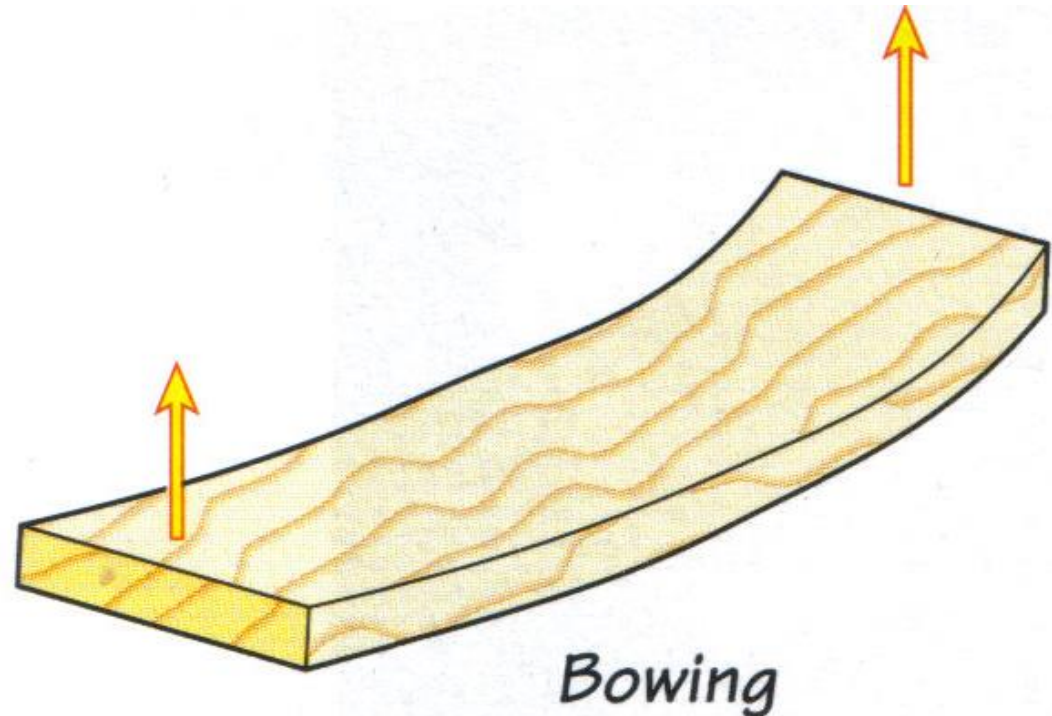
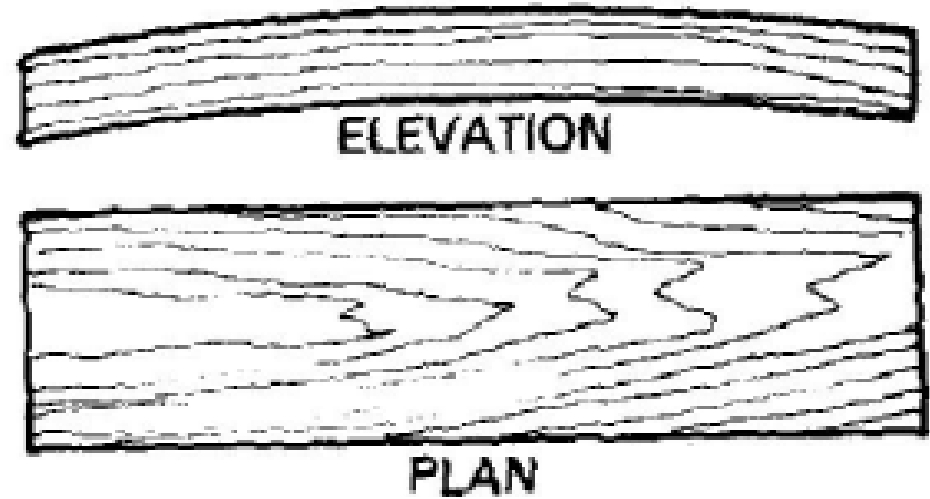
*Cupping*



IN THIS BOARD 'A' IS THE SIDE NEAREST THE PITH. MORE SHRINKAGE TAKES PLACE AT SIDE 'B', HENCE THE WARP OR CUPPING.

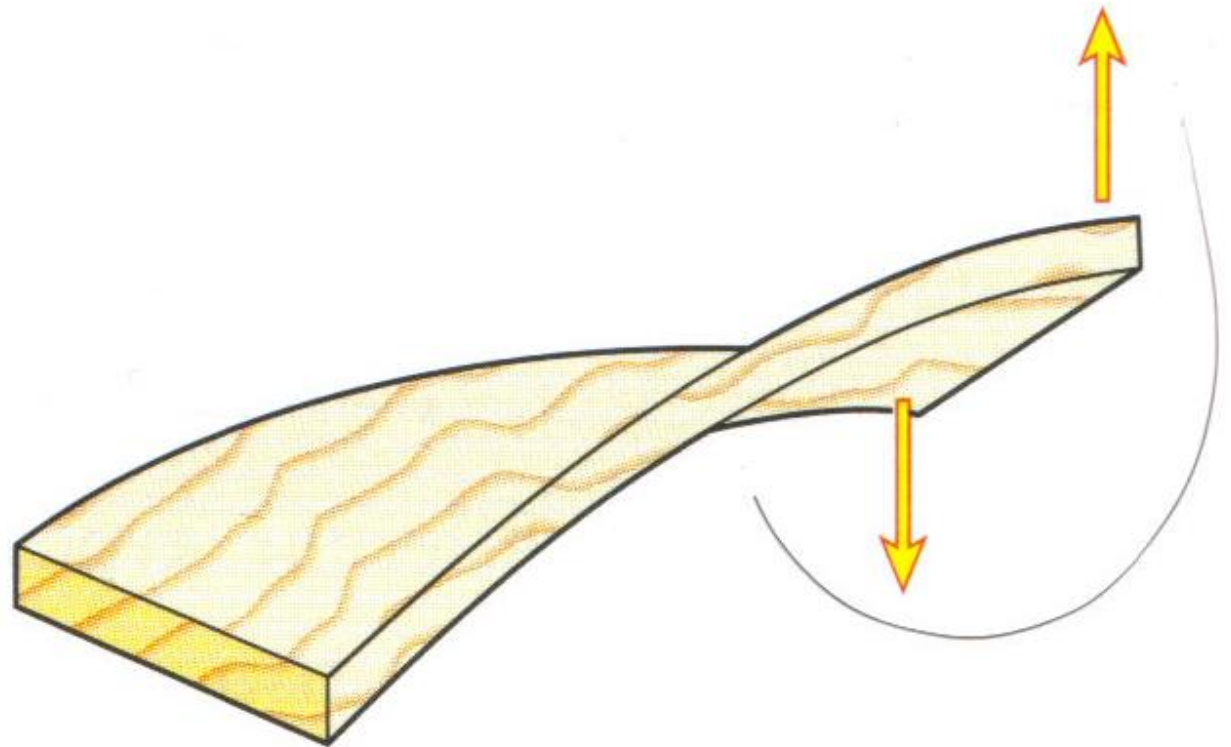
# Bowing

- ▶ Takes the form of a bend along the length of the piece
- ▶ Can be as a result of improper stacking – stickers too far apart



# Twisting

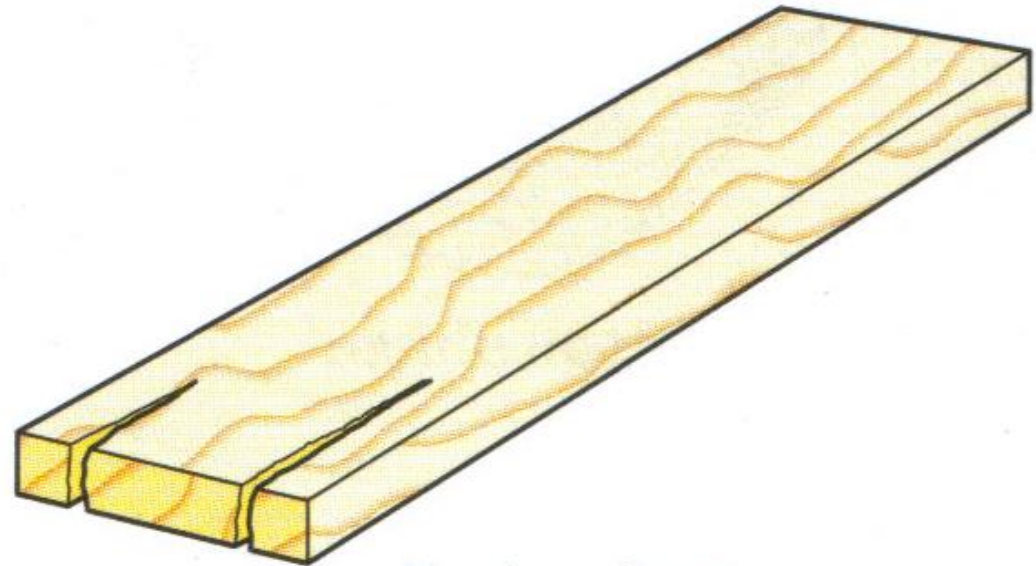
- ▶ Occurs when opposite corners move in a similar direction and the plank loses its flatness as a result



*Twisting or warping*

# End Splitting

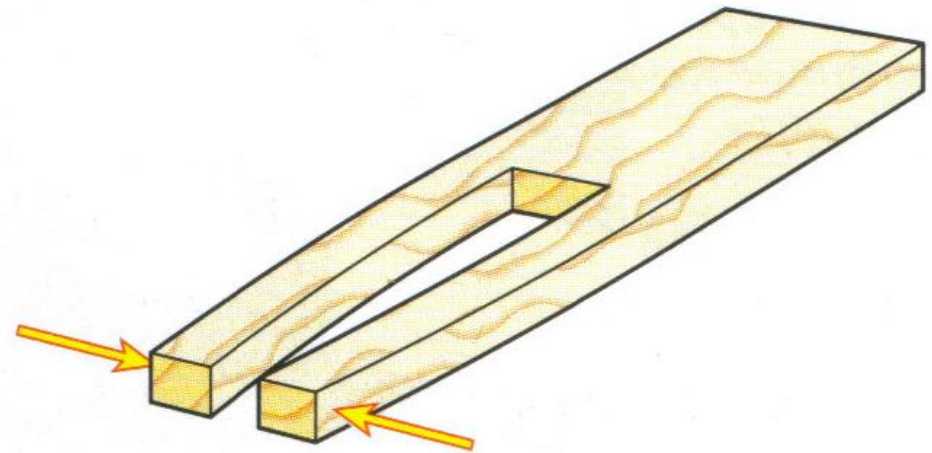
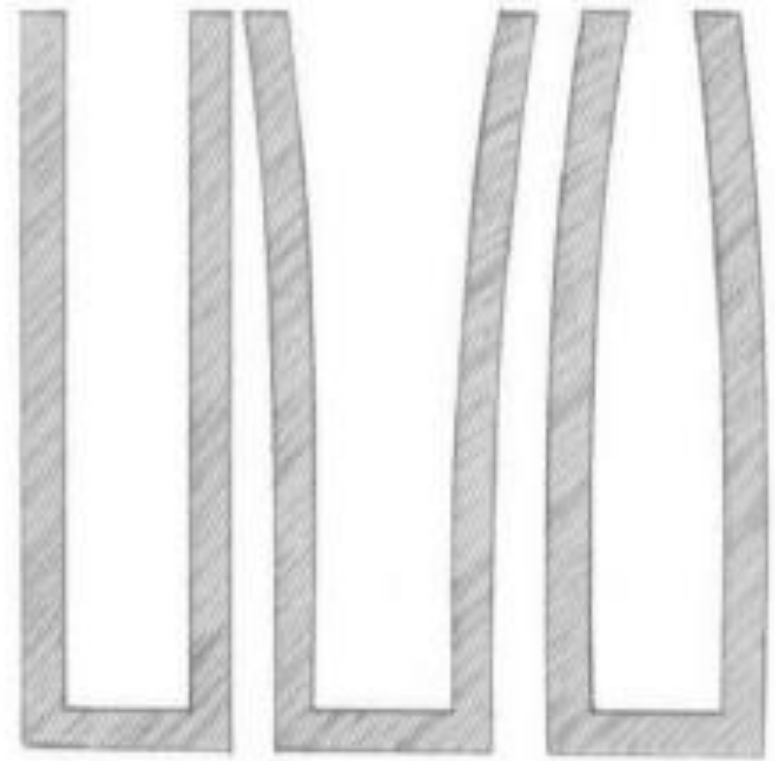
- ▶ Caused if the ends of the boards dry out too quickly due to exposure to the sun or heat
- ▶ Occurs during Air Seasoning
- ▶ Can be prevented by sealing or covering the end grain of the planks of wood



*End splitting*

# Case Hardening

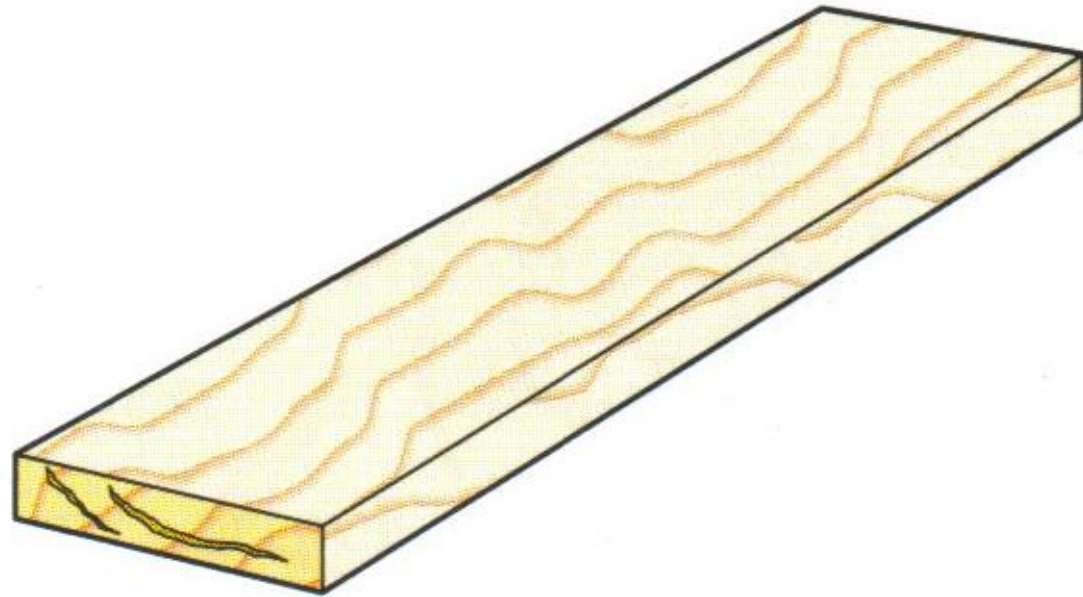
- ▶ Happens when boards are seasoned too quickly
- ▶ Surface and the centre do not dry out at the same rate
- ▶ Leaves the timber dry on the outside and wet on the inside
- ▶ As a result tensions are created



*Case hardening*

# Honeycomb Checks

- ▶ Occurs on the inside of the timber
- ▶ Rapid drying causes the wood to shrink and internal fibres to split
- ▶ This greatly reduces the strength properties of the wood



*Honeycomb checks*