

# S A M P L E

## Effects of Shrinkage

Shrinkage occurs when timber is dried or seasoned because wood naturally holds water, and this water is lost during these processes. As water is lost, the timber shrinks in both thickness (depth) and width. Timber only shrinks nominally across its length and so this is not an issue.

**Tangential shrinkage** - refers to shrinkage around the circumference of a log and accounts for most shrinkage. This is more of a problem in flat sawn (back cut) timber which is cut tangentially and can tend to warp or bend along the length.

**Radial shrinkage** - refers to shrinkage along the radius. Boards which have been quarter cut are more likely to have radial shrinkage but ultimately the board retains its shape, it just becomes slightly smaller on the cross-section.

Tangential shrinkage can be twice as much as radial shrinking (approximately 12% v 6%). Posts which have been cut square can tend to twist with shrinkage forming a diamond-shaped cross-section.

The way the tree has been grown, harvested, and handled can have implications for the timber end-product. Some are better grown slowly (giving denser tissue), some can be damaged if not seasoned correctly.

## Seasoning

This is the drying of timber. Timber is seasoned so that shrinkage takes place before the timber is used in carpentry and joinery. Splits, shakes, warps and twists can be removed or cut out before the timber is used during machine cutting.

**Natural seasoning** - this is where the timber is allowed to dry naturally through contact with the air. Timber seasoned in this way is usually stacked in warehouses where it is exposed to the air but protected from rain. It could remain like this for several months up to a year.

**Artificial seasoning** - the most common method of doing this is kiln drying. Here, the timber is stacked in kilns. Moist, heated air is applied. The temperature is slowly increased and the humidity level is slowly decreased to avoid splitting.

Nowadays, most timbers are dried artificially, but sometimes a combination of both methods may be used.

## Stacking Timber Boards for Seasoning

Boards must be stacked properly to reduce the impact of shrinkage:

- Use only a flat surface.
- Ensure the ground is dry.
- Place load-bearing wooden lengths of timber (2 x 1 inch) onto the ground spaced out evenly in parallel at around 1.2m apart (these should be slightly longer than the boards are wide and run perpendicular to them).
- Place a board horizontally on top of these load-bearing supports.
- Add wooden spacers which are a smaller gauge timber than the ground supports (these should line up over the supports and be as long as the boards are wide).
- Continue to stack layers of boards horizontally on top of layers of spacers ensuring that each board and each spacer are exactly on top of one another. This helps to prevent boards from twisting as they dry and allows air to move freely around them.
- The ends of the boards should then be painted or sealed with thin strips of timber nailed to them. This is done to stop the ends from drying out before the rest of the boards and thereby resulting in end-splitting. If the very end load-bearing support and spacing battens are all flush with the ends of the boards this will also help to keep drying at the ends under control.

## Moisture Content

When a log is converted to timber it is known as 'green wood' to begin with. As it seasons, the timber loses moisture until it eventually reaches a state of equilibrium with the moisture in the air. This is known as

equilibrium moisture content (EMC). This value is higher in humid areas and lower in dryer regions. If timber is used in building construction, for example, it will swell less (due to moisture uptake) or shrink less (due to moisture loss) if it has a similar EMC to the local climate.

The moisture content of a given timber is denoted as a percentage. For most joinery work, timber will have a moisture content of between 10 and 20%. Timber with low moisture content (nearer 10%) is preferred for internal work and furniture since it will be in a relatively dry environment and will be less likely to shrink due to moisture loss. Timber with high moisture content (nearer 20%) is better suited to outdoor projects since it will be less likely to swell.

Moisture content for a timber can be read using a moisture meter which provides an instant reading. Otherwise, a sample of the timber can be weighed, then dried in an oven, and reweighed until the weight remains stable. The following calculation can then be used to determine moisture content:

$$\text{Moisture percentage} = \frac{\text{Moisture weight (g)}}{\text{Dry timber weight (g)}} \times 100$$

### Stress Grading of Timber

The stress grade or strength of timber is generally classified according to either visual inspection or machine testing. Visual inspection is used to ascertain things like knots, the position or size of shakes or splits, the closeness of growth rings, the slope of the grain, insect (e.g. borer) damage, any fissures or distortions in the timber, and so on.

Machine testing is used to determine the strength and stiffness of a piece of timber. Bending machines are most commonly used where a load is applied to the timber to bend or deflect it.

Species may be grouped according to grades so that different species can be interchanged which have the same strength. Different countries employ different grading systems. Many systems involve grading hardwoods, softwoods and joints - and these may each be graded as unseasoned and seasoned. Timber may be marked with its denoted grade. In some countries these marks are in different colours to make it easier to identify the grade.

Grading systems allow the user to select a timber which will withstand the load it is intended to bear, or to choose a suitable alternative if the preferred timber is unavailable.

## DIFFERENT TYPES OF WOOD AND ITS USES

The most useful way of distinguishing timber is by classifying it as hardwood or softwood. Although hardwoods are mostly harder than softwoods they are not always. Instead, hardwoods and softwoods are so named after their botanical classifications. Hardwoods are derived from broad-leaved trees, whereas softwoods come from conifers which have needle-like leaves.

### Hardwood

The term 'hardwood' is a little misleading since not all hardwoods are actually hard, although most are. Balsa is an example of a hardwood which is softer than the vast majority of softwoods. The timber is often of a darker colour than softwoods and may produce aromatic sap. Hardwoods are more difficult to cut, drill and nail, but their timber is usually denser and they are more likely to resist pests or rotting.

Hardwoods include: mahogany, teak, oak, walnut, jarrah, eucalyptus species, and elm.

| Hardwood   | Origin | Weight (kg/m <sup>3</sup> ) | Properties   | Uses  |
|------------|--------|-----------------------------|--|---|
| Greenheart | Guyana | 990-1090                    | Very dense and hard, difficult to work with, resists fungi and borers. | Harbours, docks, flooring, heavy construction purposes. |

|                   |                        |         |   |   |
|-------------------|------------------------|---------|---|---|
| Jarrah            | Western Australia      | 900-960 | Very dense and hard, deep red colour, often has straight grain, hard wearing.     | Flooring, stairways, heavy construction purposes.                                       |
| European Oak      | Europe                 | 740-770 | Attractive silver grain if quarter sawn, light to dark coloured, strong, durable. | Gates, posts, doors, sills, interior joinery, furniture.                                |
| European Walnut   | Europe                 | 610-770 | Easy to work with, attractive, strong, easy to polish.                            | Panelling, veneers, cabinet making.   |
| Beech             | Europe, Asia           | 720     | Strong, easy to work with and polish, straight grain, fine texture.               | Flooring blocks, veneers, tool handles, kitchen units, cabinet making.                  |
| Birch             | Britain, Europe        | 670     | Hard, tough, pale brown to yellow with dark lines, even texture.                  | Flooring, bench tops, stairs, cabinet making.   |
| Iroko             | West Africa            | 660     | Very durable, golden brown colour,  | Interior and exterior joinery, garden furniture.  |
| Teak              | India, Thailand, Burma | 640-720 | Extremely strong, durable, dark colour, fire and rot-resistant.                   | Panelling, window frames and sills, doors and door frames, outdoor furniture, flooring. |
| Red Meranti       | Malaysia               | 630-670 | Reasonably durable, pinkish red colour.   | Framing, interior joinery, furniture, boat building.                                    |
| Sycamore          | Europe                 | 610     | Attractive, whitish colour, straight grain and fine texture, not so durable.      | Cabinet making, joinery work, ladders.  |
| Elm               | Europe                 | 560     | Withstands wet conditions, twisted grain, warps if not properly seasoned.         | Panelling, furniture, coffins, weatherboards.   |
| African Mahogany  | Western Africa         | 560     | Strong, durable, difficult to work with.  | Decorative interior features, veneers, joinery.   |
| Honduran Mahogany | Honduras               | 540     | Strong, easy to work with, deep red colour.                                       | Panelling, veneers, high class joinery.   |

## Softwood





Softwoods are mostly soft though a few are hard e.g. pitch pine. The timber is usually easier to work with than hardwoods and often has a sweet smelling sap. Although some softwoods are more susceptible to rotting and termites, new treatment methods mean that softwoods are now extensively used for structural timbers. Most softwoods are grown in plantations, so using these timbers reduces the damage to our native forests.

Softwoods include: Douglas fir, yellow pine, redwood, whitewood, and spruce.

| Softwood | Origin | Weight (kg/m <sup>3</sup> ) | Properties | Uses |
|----------|--------|-----------------------------|------------|------|
|----------|--------|-----------------------------|------------|------|

|                              |                |         |  |   |
|------------------------------|----------------|---------|--|---|
| Pitch Pine                   | USA            | 660     | Strong, hard, similar to hardwood, resinous, easy to work with.  | Flooring, heavy construction purposes.  |
| Scot's Pine (Redwood)        | Europe, Asia   | 530     | Strong, resinous, straight grain, sometimes many knots, yellowish colour with dark lines, easy to work with. | Flooring, joinery, timbers for carpentry - flooring, skirting, doors, stairs. |
| Douglas Fir (Oregon Pine)    | USA and Canada | 530     | Straight grain, easy to work with, stains well.  | Panelling, flooring, doors, timbers for carpentry.                            |
| European Whitewood (Spruce)  | Europe         | 430-510 | Not strong, not durable, may be many knots, easy to work with and finish, yellowish to whitish colour.       | Flooring, interior joinery.   |
| Sitka Spruce (Silver Spruce) | Europe         | 450     | Resilient, springy, whitish with dark lines, straight grain.   | Interior painted joinery.   |
| Western Red Cedar            | USA            | 360     | Soft, straight grain, attractive red colour.   | Weatherboards, doors, cupboard doors, kitchen units, ceiling work.            |

## WHERE THE WOODS COME FROM

|   |  |  |  |
|---|--|--|--|
|  |  |  |  |
| Quercus palustris (Pin Oak)   |  | Quercus robur (English Oak)  |  |
|  |  |  |  |
| Acer pseudoplatanus (Sycamore)  |  | Acer pseudoplatanus (Sycamore)   |  |

|   |   |
|---|---|
|  <p>Ulmus spp. (Elm)</p>                       |  <p>Meranti (Shorea spp)</p>              |
|  <p>Eucalyptus marginata (Jarrah)</p>          |  <p>Eucalyptus sideroxylon (Ironbark)</p> |
|  <p>Thuja plicata<br/>(Western Red Cedar)</p> |  <p>Pinus sylvestris (Scots Pine)</p>    |

## COMPOSITES

These are man-made timbers which mostly come in sheets. Their use represents an alternative to logging native trees. Composites are made by gluing particles of wood together, traditionally by using formaldehyde based glues and epoxy resins which may be dangerous to the environment by releasing toxic vapours if they are not sealed. In recent times alternative glues have been trialled to create more environmentally friendly boards. Some of the more common composites are as follows:

### Hardboard (High Density Fibreboard)

This is made by compressing wood fibres under high pressure. The resultant board is very strong and hard (as the name suggests). It may have one smooth side and one rough side (if made using a wet process), or two smooth sides (if made using a dry process). It will not split or crack. Masonite is a type of hardboard. Pegboards for hanging tools are made from perforated hardboard.

### Chipboard (Particle Board)

This is similar to hardboard but is made using tiny chips of wood. It is often used in furniture making. It may split or crack.

### Plywood

This is made by gluing together several layers of veneer. It is used in furniture manufacturing because of its strength, for panelling, skins on doors, and in formwork. Marine ply is a type of plywood which has water-resistant properties making it suitable for outdoor use, as well as in boat building.

## MDF (Medium Density Fibreboard)

This comes in sheets or mouldings. It is made from plantation chippings usually sandwiched between two layers of veneer, which gives it the appearance of wood. It has a wide range of applications e.g. doors, rails, mouldings, skirtings, and cornices.

### Laminates

Laminating refers to the process of making smaller pieces of timber larger by gluing other timber to it.

Laminated veneer lumber (LVL) is similar in appearance to plywood, and is made by gluing together a number of layers of veneer. It is strong and straight and less likely to warp than conventional timber. It is used for beams and edges.



Glulam is a type of laminate in which small pieces of wood are glued together in layers. It is used for wide-spanning beams, upright posts, and is also able to be shaped into curves. It is extremely strong and versatile.

### Veneers

Veneers are thin layers of timber - usually attractive hardwoods. They may be used to enhance the appearance of many composites if used for cupboard doors and in furniture. We shall look at veneers in greater detail in Chapter 9 on finishes.

## BUYING TIMBER

When buying timber, you need to select the right timber for the job. You should consider things like the cost, availability, purpose (e.g. interior, exterior, structural or not), and what type of finish it will have.

If you are ordering timber for large carpentry jobs you will need to choose the right sizes and lengths so that they can be properly framed and joined together. Many boards and sheets come in standard sizes and you'll need to work out which sizes best suit your needs. You don't want to order too much or too little. Too much timber may result in wastage which if you are working for profit could eradicate any financial gain. Too little could result in hold-ups to work which again could impact on profitability.

If you need to have the timber delivered then you will probably save money by having it all delivered at the same time for a small job. It may pay to draw up your project so you can more easily work out what is required.

The cost of timber may also be cheaper if you order it all at the same time for a larger job (even if you have deliveries staggered) since many timber merchants will offer discounts for bulk orders.

## SET READING

Refer to, and read any reference material you have access to that relates to the aim of this lesson.

This may include any of the following:

- Books in your own possession, or which you find in a library
- Periodicals you have access to (i.e. magazines, journals or newspapers)
- Websites

Spend no more than 2 hours doing this.

## SET TASK

### Activity 1

Visit a timber seller, this could be a building merchant or DIY store, and study six different timber samples (or look at six different timbers you have access to). These should include at least two samples of hardwood.

Evaluate the six different timber samples in terms of appearance, density, and hardness.

Photograph them.

Write down comments about each.

### Activity 2

Examine three different types of composite board at the same timber supplier. Find out what standard sizes they come in and what type of job they are suited to.

### Activity 3

Find out as much as you can about the system for stress grading of timber in your region or country. You may need to contact government departments, timber merchants or undertake online research.

Are hardwoods classified separately to softwoods?

Are seasoned and unseasoned wood given different grades?

Is the wood stamped with its grade before being sold?

Make notes.

# Assignment 1

## Question 1

Report on your set task. Write a brief description of each timber sample in terms of:

- Appearance
- Density
- Hardness

Write a paragraph for each. You may tabulate your answer if you prefer.

## Question 2

Briefly discuss your findings from your second set task. Write a paragraph for each or tabulate your answer.

## Question 3

Define the following terms in your own words using a sentence or two for each:

- Quarter-sawn
- Bending strength
- Dry rot
- Ribbing
- Boxed heart
- Heart shake
- Slabbed
- Compressive strength
- Thunder shake
- Bark pocket

## Question 4

Report on your findings from your third set task. Write up to a one page or 500 words. You may tabulate the timber grades if you prefer.

## Question 5

Explain some of the problems which can occur in timber if it is not seasoned properly. Write about half a page or 250 words.