

Selecting materials

Materials can be selected based upon their **working properties**. It is important to know and understand which materials can be used for a specific purpose:

- How do they look?
- What are they commonly used for?
- How can they be manufactured?
- How do they perform in use?

When selecting a timber, there are many different types to choose from. **Hardwood** and **softwood** are types of timber that come from many different trees.

Manufactured boards such as **plywood** are man-made from layers of wood.

MDF is made from small timber fibres that are mixed with wax and **resin**. They are heated and **compressed** so that a flat, usable sheet is produced.

Chipboard is a man-made sheet material, made from small **chips** of timber bonded together to produce a dense **sheet**.

Prototypes can be rough and look like models, and some function as intended and are well finished.

One-off production such as made-to-measure wardrobes or hand-crafted furniture are expensive because each piece of material has been designed and cut for that specific product, involving great skill and time. If just one product is made, quite often the cost is high because small orders are placed to supply the materials.

Batch production is where many items of the same product are produced. An example is where a set of chairs is required to match a dining room set. A carpenter could design the chair, and then cut all the timber at the same time to make the set. The carpenter would then have a kit to start making batches of chairs. If each part of the chair needed to be drilled in exactly the same place, the carpenter would make a drilling jig that would hold the timber while each part was drilled. If a part of the chair needed the same shape profile from a plank of timber, the carpenter would make a designing template so that each part would be shaped the same.

Each time a product is made, the materials that are used have had to be bought. When a product is built on a large scale, money is saved.

Mass-produced products are manufactured in large volumes, often on **assembly lines** where workers fit standard components such as screws and hinges to parts.

Sustainability

If a designer understands where **raw materials** come from, they can understand the environmental concerns associated with that material.

In the context of timber and man-made boards, the original source is a tree. Trees are grown all over the world - some are for timber produce, and others could be for paper. They can be categorised as **hardwood** and **softwood**.

Hardwood is harvested from deciduous trees. These types of tree lose their leaves in autumn and take a long time to grow, around 60 years (sometimes up to 100). Hardwoods include beech, oak, mahogany, balsa and jelutong.

Softwood is harvested from coniferous trees. These trees remain evergreen all year and take around half the time to grow, 25 to 30 years. Softwoods include Scots pine, Western red cedar and **paraná** pine. As trees are **felled**, it is important to plant new ones so that the timber source is **sustainable**. When a tree is chopped down for timber, there is a cost to the environment. Trees are vital for our survival as they absorb carbon dioxide (CO₂). Although more than one tree can be planted for each tree that is chopped down, older trees often absorb more carbon dioxide and provide more of a habitat for wildlife because of their size.

The availability of a material is an important consideration too. Some softwoods are

Plywood, medium-density fibreboard (MDF), chipboard and **blockboard** can all be made from **recycled** timber. These **recycled** materials are made by gluing pieces of timber or fibres of timber together - the gluing process makes it very difficult to recycle the timber a second time around. MDF cannot be recycled and often ends up in a landfill site when it has reached the end of its life.

In order to reduce environmental impact, an analysis is carried out to review different stages of the material or product's life cycle. There are two different cycles:

- linear - ending with disposal, adding waste to landfill
- circular - continuous and incorporate recycling to ensure materials and products are used over and over again

Life cycle analysis needs to be considered by the designer, the **manufacturer** and the **consumer** to reduce negative impact on the environment.

Responsibilities of designers and manufacturers

Along with cost and environment issues, there are also considerations when it comes to employees and their working conditions. Designers and manufacturers may choose to opt for more 'ethical' choices by finding suppliers that may pay higher labour costs or tackle poverty in other ways when selecting timber.

Joining methods Materials are joined permanently by using **adhesives**, a substance that bonds surfaces together. Adhesives can range in bonding strength and types depending on the materials that need joining.

- Polyvinyl acetate (PVA) - Used as a general purpose woodworking glue, and some PVA adhesives are water resistant. This is most commonly used to join wood but can also be used with papers and boards.

Finishing

Sanding with different grades of sandpaper achieves a nice clean smooth finish, ready for a treatment to improve durability.

Paint gives colour to the timber and can protect the timber if it is going to go outside.

Wood stain is applied so that the appearance of the timber is enhanced. Many wood stains are designed to look like a different wood type. Pine can be stained to look like a darker more expensive **hardwood**. Wood stain gives some protection to the timber.

Oil and wax soak into timber and can be used to enhance the natural appearance of the timber. Often kitchen worktops and chopping boards are oiled or waxed so that the surface repels water.

Varnish can be applied to timber so that a shiny appearance is achieved. Varnish is usually applied in many layers so that the thickness of the varnish is more **durable**. Varnish can be glossy or matt depending on the type used.

Wood joints

Wood joints are a traditional method of joining timber. There are a range of different joints that can be used for different situations that provide a variety of levels of strength and structure. Joints are often glued to make them secure and permanent. Wood joints are classified into two construction categories:

Frame joints

corner halving - a strong joint due to the surface area available for gluing, and the shoulder gives extra mechanical strength

mitre - cut at a 45-degree angle and glued together, used for picture frames

Box joints

butt - a simple joint where the edges of the timber are glued together, so it is easy to make but weak

comb - offers good contact for gluing and the pieces of the wood interlock providing strength, often used in wooden boxes

