TIMBER AND MODERN MATERIALS

Timber - Market forms - Industrial timber - Doors and Windows – specification - Plywood - Veneer – False ceiling materials - Panels of laminates - Steel - Aluminum and Other Metallic Materials - Composition – Aluminium composite panel - Uses - Market forms - Mechanical treatment. Glass - Ceramics - Sealants for joints - Fibre glass reinforced plastic - Clay products - Refractory's - Composite materials - Types - Applications of laminar composites Fibre textiles - Geo-membranes and Geo-textiles for earth reinforcement.

TIMBER

TIMBER

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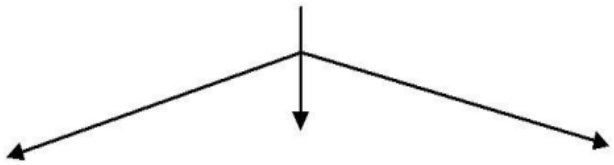
(Denotes wood which is suitable for building or carpentry or various other engineering purposes and it is applied to the trees measuring not less than 600mm in girth or circumference of the trunk)



Converted timber	rough timber	standing timber
(Timber which is sawn and cut into Suitable commercial sizes)	(timber which is obtained after felling a tree)	(timber contained in a living tree)

The conversion of timber is a phrase usually used in reference to turning a log into a pile of boards/planks. This is done using a saw mill of some kind. There are several things that need to be taken into account when sawing up a log.

Fig. Converted timber

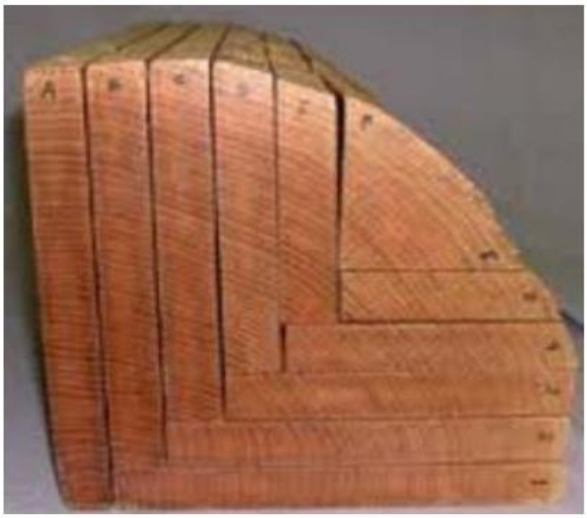


Fig. Converted timber

Fig. Rough timber

Standing timber means the current value of trees that have been planted which will yield saleable timber when felled at maturity, usually forestry trees. The Inland Revenue accepts that fruit trees do not generate saleable timber

Fig. Standing timber

Processing of timber

- Felling of trees
  - Age of trees for felling
  - Method of felling
  - Season for felling
- Seasoning of timber
  - Meaning of seasoning

    (The water is to be removed before the timber can be used for any engineering purpose.)
  - Free moisture and bound moisture

    (Moisture in the timber can be either in the cell cavities or in the cell walls. The former is known as the free moisture or free water and major part of moisture in timber is present as free water. The latter is known as the bound moisture and it is closely associated with the body of timber.)

- Determination of moisture content

  $P = ((W_1 - W_2) / W_2)) \times 100$ where P – percentage of moisture, W_1 – original weight of timber, W_2 oven – dry weight of timber.(drived in an oven at a temperature of 103 °C ± 2 °C)

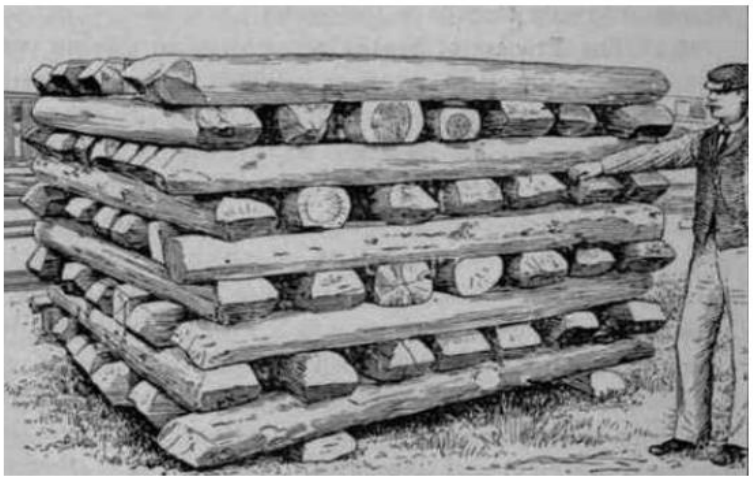


Fig. Seasoning of timber

Fig. Seasoning of timber

❖ Objects of seasoning

- To allow timber to burn readily, if used as fuel
- To impart hardness, stiffness, strength and better electrical resistance to timber.
- To increase resisting power of the timber

- To maintain shape and size of the components of timber To make timber easily workable
- To make fit for receiving treatment of paints, preservatives, varnishes, etc. To make timber safe form of fungi and insects.

❖ Method of seasoning

- Natural seasoning and artificial seasoning(various methods- boiling , chemical seasoning, kiln seasoning, electrical seasoning, and water seasoning.
- Comparison between natural seasoning and artificial seasoning

❖ Conversion of timber

Process by which timber is cut and sawn into suitable sections is known as the conversion. (power machines may be employed at different stages of process.)

Fig. Conversion of timber

❖ Preservation of timber

- Object of preservation of timber
- To increase the life of timber structures
- To make the timber structures durable
- To protect the timber structures form the attack of destroying agencies such as fungi, insects , etc.

- Requirements of a good preservative
  - Should be capable of covering a large area with small quantity
  - Should be cheap and easily available
  - Should be durable
  - Should be non-inflammable
  - Should be quite efficient in killing fungi, insects, etc.
  - Should be safe and harmless for persons and animals
  - Should offer high resistance to the moisture and dampness.

- Types of preservatives

  Ascu treatment
  - Chemical salts
  - Coal tar
  - Creosote oil
  - Oil paints
  - Solignum paints

- Methods of preservation of timber
  - Brushing
  - Charring
  - Dipping and steeping
  - Hot and cold open tank treatment
  - Injecting under pressure
  - Spraying

Fig. Oil paints, Brushing

Qualities of good timber

In general, the quality of timber depends on the following factors:

- Environmental conditions of the locality
- Maturity of the tree
- Method of seasoning
- Nature of the soil
- Process of preservation
- Time of felling.

Following are the characteristics or quality of a good timber

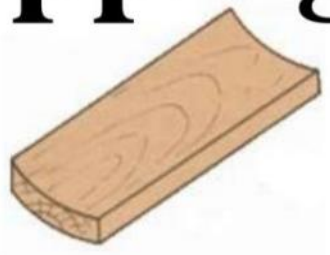
- Appearance:
- Colour
- Defects
- Durability
- Elasticity
- Fibres
- Fire- resistance
- Hardness

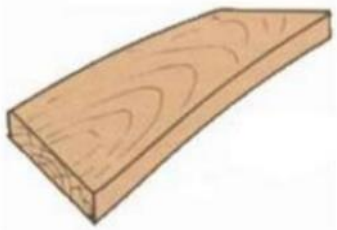
- Mechanical wear
- Shape
- Smell
- Sound
- Strength
- Structure
- Toughness
- Water permeability
- Weathering effects
- Weights
- Working conditions

Factors affecting the strength of timber

1. Abnormalities of growth
2. Faults in seasoning
3. Invasion of insects
4. Irregularities of grain
5. Moisture content
6. Presence of knots, shakes, etc.
7. Way in which a timber piece is cut from the log, etc.

Cupping **Twisting**





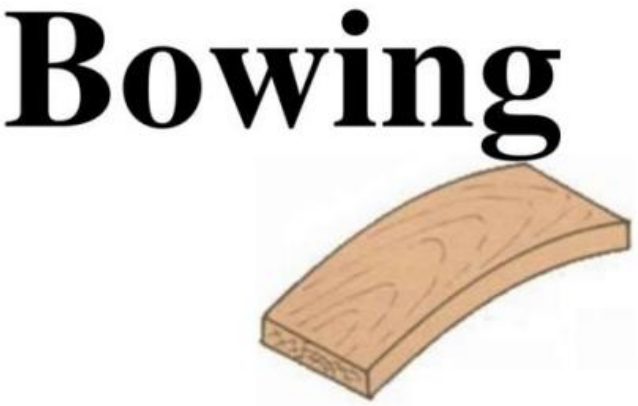


Fig. Faults in seasoning

Fig. Invasion of insects

Fig. Irregularities of grain

Fig. Presence of knots

MARKET FORMS

Various types of market forms of timber

Batten - timber piece whose breadth and thickness do not exceed 50mm

Baulk - roughly squared timber piece and it is obtained by removing bark and sap wood. Cross-sectional dimension exceeds 50mm.

Board - timber piece with parallel sides and thickness is 50mm to 100mm and its width does not exceed 230mm

Deal - piece of soft wood with parallel sides and thickness varies from

50mm to 100mm and its width does not exceed 230mm.

End - short piece of batten, deal, scantling etc.,

Log - trunk of tree obtained after removal of branches

Plank - timber piece with parallel sides and thickness is less than 50mm and its width exceeds

Pole - it is a sound long log of wood and its diameter does not exceed 200mm and it is also known as a spar

Quartering - square piece of timber and the length of side being 50 mm to 150mm.

Scantling - timber piece whose breadth and thickness exceed 50mm but are less than 200mm in length (pieces of miscellaneous sizes of timber sawn out of a log.

DOORS AND WINDOWS

General:

- Wood has a proven durability as an appropriate material for windows and doors, particularly in harsh climates
- Wood is 100% renewable
- offers long term value
- Timber has an elegant appearance and feel, with unquestionable thermal performance, required for today‘s tough construction regulations.
- Timber is the only naturally renewable material for windows
- The total amount of energy used to make a timber windows and doors is 20% of the energy required to make a (PVC) plastic window.
- The timber used in our products is responsible sourced from well managed forests. For every tree felled, two others are planted. This environmentally responsible approach to forestry ensures that timber resources are sustainable.
- Our Timber windows & doors use less energy to manufacture than those made from any other material, therefore reducing carbon emissions to the atmosphere.

- Our double and triple glazed windows and doors provide good energy efficiency, so will continue to save carbon emissions throughout their long life.
- Very few window materials compare to timber in terms of character, style and versatility.
- As a natural product, it brings warmth, good looks and added value to any property. Couple his with high quality glazing and factory applied modern decorating techniques, and your timber windows will provide you with long lasting high performance for years to come.

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Timber door and window frames shall be installed either by built-in method ‘ or prepared opening method ‘

The thickness selected for door shutters shall be not less than 40 mm for permanent installations.

The thickness may be reduced for temporary installations. These, however, would require additional care in maintenance.

For aesthetic and decorative purposes in high class buildings, decorative type of door shutters may be used.

The most commonly used decorative surface timber is teak. These require polishing and waxing as against painting required for commercial door shutters.

Types of doors:

- Timber/wood doors
- Battened and ledged doors
- Framed and paneled doors
- Flush doors

- Glass doors
- Steel doors
- PVC doors
- Fiberglass doors
- Fiber reinforced plastics doors
- Aluminum doors
- Bamboo-jute composite doors

INDUSTRIAL TIMBER

The timber which is prepared scientifically in a factory is termed as the industrial timber and such timber possesses desired shspe, appearance, stength, etc.

Following are the few varieties of industrial timber:

- Veneers
- Plywoods
- Fibreboards
- Impreg timbers
- Compreg timbers
- Block board and lamin board
- Glulam
- Flushdoor shutters
- Particle board (or) chip board
- hardboard

PLYWOOD

- Plywood - sheet material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another.
- It is an engineered wood from the family of manufactured boards which includes medium-density fiberboard (MDF) and particle board (chipboard).

- All plywood‘s bind resin and wood fiber sheets (cellulose cells are long, strong and thin) to form a composite material. This alternation of the grain is called cross-graining several important benefits:

  - it reduces the tendency of wood to split when nailed at the edges; o it reduces expansion and shrinkage, providing improved dimensional stability;

  - it makes the strength of the panel consistent across all directions. There are usually an odd number of plies, so that the sheet is balanced—this reduces warping.

Different varieties of plywood exist for different applications:

- Softwood plywood Hardwood plywood
- Tropical plywood
- Aircraft plywood
- Decorative plywood (overlaid plywood)
- Flexible plywood
- Marine plywood
- Other plywood‘s

Grades

Grading rules differ according to the country of origin. Most popular standard is the British Standard (BS) and American Standard (ASTM). Joyce (1970), however, lists some general indication of grading rules:

Grade Description

A - Face and back veneers practically free from all defects.

A/B - Face veneers practically free from all defects. Reverse veneers with only a few small knots or discolorations.

A/BB - Face as A but reverse side permitting jointed veneers, large knots, plugs, etc.

B - Both side veneers with only a few small knots or discolorations.

B/BB - Face veneers with only a few small knots or discolorations. Reverse side permitting jointed veneers, large knots, plugs, etc

BB - Both sides permitting jointed veneers, large knots, plugs, etc.

WG - Guaranteed well glued only. All broken knots plugged.

X - Knots, knotholes, cracks, and all other defects permitted.

JPIC Standards

Grade Description

BB/CC -Face as BB, back as CC. BB as very little knots of less than 1/4 inches, slight discoloration, no decay, split and wormholes mended skillfully, matched colors, no blister, no wrinkle. Most popular choice for most applications.

Applications

Plywood is used in many applications that need high-quality, high-strength sheet material. Quality in this context means resistance to cracking, breaking, and shrinkage, twisting and warping.

Exterior glued plywood is suitable for outdoor use, but because moisture affects the strength of wood, optimal performance is achieved in end uses where the wood's moisture content remains relatively low. On the other hand, subzero conditions don't affect plywood's dimensional or strength properties, which makes some special applications possible.

Plywood - used as an engineering material for stressed-skin applications.

- used for marine and aviation applications
- used for the hulls in the hard-chine Motor Torpedo Boats (MTB) and Motor Gun Boats (MGB) built by the British Power Boat Company and Vosper's.
- currently successfully used in stressed-skin applications
- often used to create curved surfaces because it can easily bend with the grain. Skateboard ramps often utilize plywood as the top smooth surface over bent curves to create transition that can simulate the shapes of ocean waves.

Softwood plywood applications

Typical end uses of spruce plywood are:

- Floors, walls and roofs in home constructions
- Wind bracing panels
- Vehicle internal body work
- Packages and boxes
- Fencing

There are coating solutions available that mask the prominent grain structure of spruce plywood. For this coated plywood there are some end uses where reasonable strength is needed but the lightness of spruce is a benefit e.g.:

- Concrete shuttering panels
- Ready-to-paint surfaces for constructions

Hardwood plywood applications

Phenolic resin film coated (Film Faced) plywood is typically used as a ready-to-install component e.g.:

- Panels in concrete form work systems
- Floors, walls and roofs in transport vehicles
- Container floors
- Floors subjected to heavy wear in various buildings and factories
- Scaffolding materials

Birch plywood is used as a structural material in special applications e.g.:

- Wind turbine blades
- Insulation boxes for liquefied natural gas (LNG) carriers

Smooth surface and accurate thickness combined with the durability of the material makes birch plywood a favorable material for many special end uses e.g.:

- High-end loud speakers
- Die-cutting boards
- supporting structure for parquet
- Playground equipment
- Furniture
- Signs and fences for demanding outdoor advertising
- Musical instruments
- Sports equipment

Fig. Marine plywood

Fig. Aircraft plywood

Fig. Flush doors

Fig. Glass doors

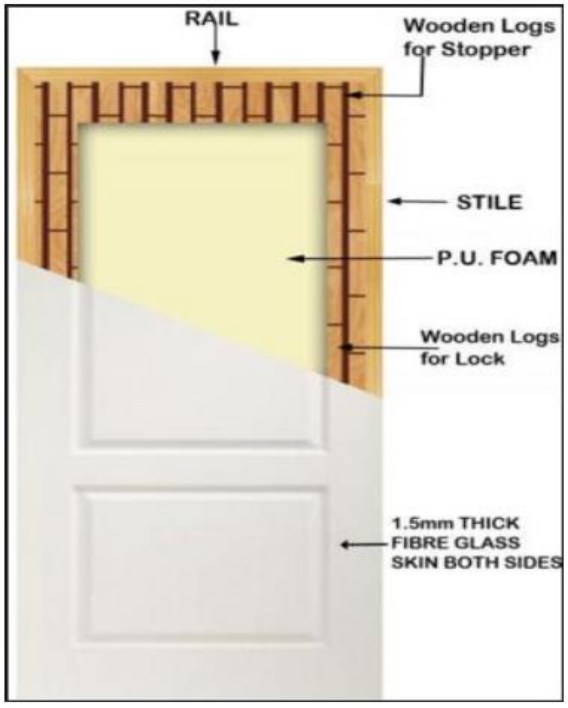

Fig. Fiber reinforced plastics doors

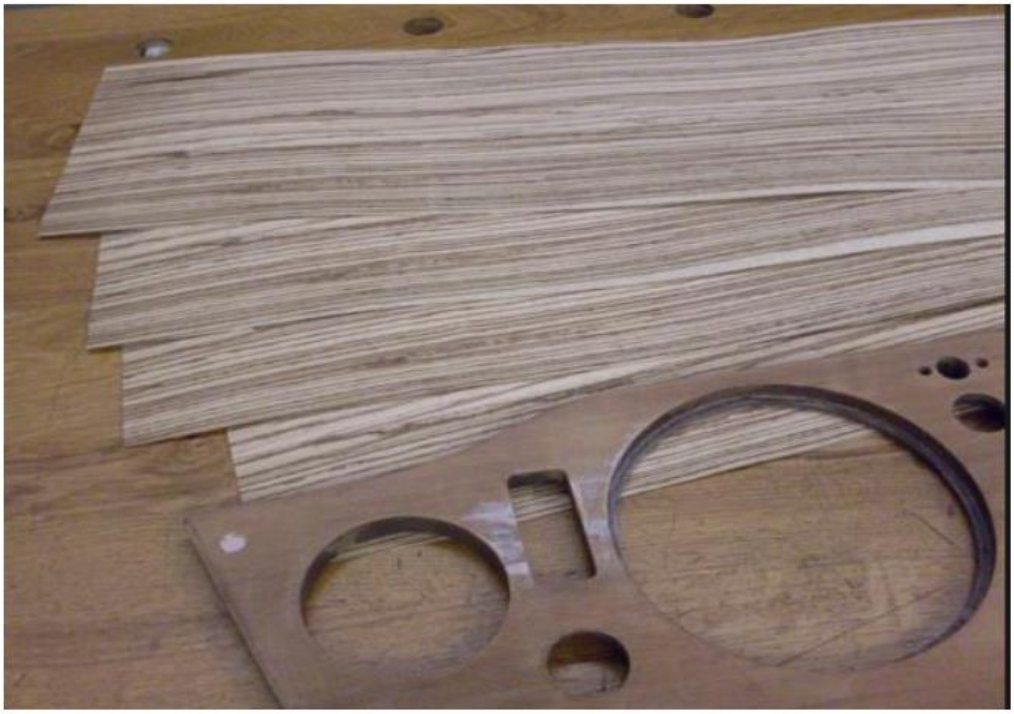

Fig. Veneers

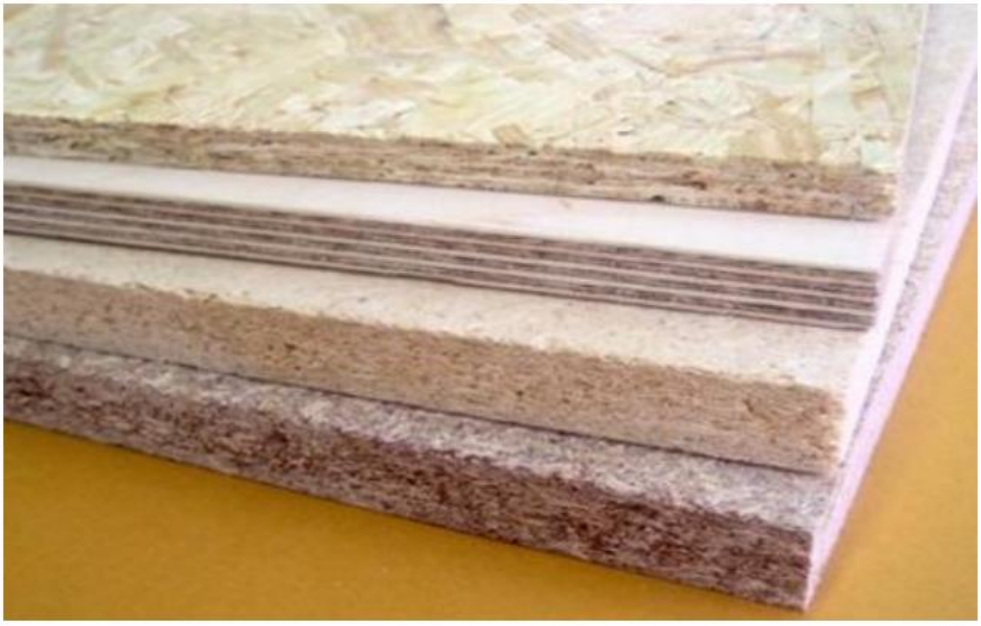

Fig. Fibreboards

Fig. Glulam Beams

Tropical plywood applications

Tropical plywood is widely available from the South-East Asia region, mainly from Malaysia and Indonesia. Tropical plywood boasts premium quality, and strength. Depending on machinery, tropical plywood can be made with high accuracy in thickness, and is a highly preferable choice in America, Japan, Middle East, Korea, and other regions around the world.

- Common plywood
- Concrete panel
- Floor base
- Structure panel
- Container flooring
- Lamin board
- Laminated veneer lumber (LVL)

VENEER

- In woodworking, veneer refers to thin slices of wood, usually thinner than 3 mm (1/8 inch), that typically are glued onto core panels (typically, wood, particle board or medium-density fiberboard) to produce flat panels such as doors, tops and panels for

cabinets, parquet floors and parts of furniture.

- They are also used in marquetry. Plywood consists of three or more layers of veneer, each glued with its grain at right angles to adjacent layers for strength.
- Veneer beading is a thin layer of decorative edging placed around objects, such as jewelry boxes.
- Veneer is also used to replace decorative papers in Wood Veneer HPL. Veneer is also a type of manufactured board.
- Veneer is obtained either by "peeling" the trunk of a tree or by slicing large rectangular blocks of wood known as flitches.
- The appearance of the grain and figure in wood comes from slicing through the growth rings of a tree and depends upon the angle at which the wood is sliced.

Three main types of veneer-making equipment used commercially:

- A rotary lathe in which the wood is turned against a very sharp blade and peeled off in one continuous or semi-continuous roll. Rotary-cut veneer is mainly used for plywood, as the appearance is not desirable because the veneer is cut concentric to the growth rings.
- A slicing machine in which the flitch or piece of log is raised and lowered against the blade and slices of the log are made. This yields veneer that looks like sawn pieces of wood, cut across the growth rings; such veneer is referred to as "crown cut".
- A half-round lathe in which the log or piece of log can be turned and moved in such a way as to expose the most interesting parts of the grain.

Types of veneers

Few types of veneers available, each serving a particular purpose.

Raw veneer has no backing on it and can be used with either side facing up. It is important to note that the two sides will appear different when a finish has been applied, due to the cell structure of the wood.

Paper backed veneer is as the name suggests veneers that are backed with paper. The advantage to this is it is available in large sizes, or sheets, as smaller pieces are joined together prior to adding the backing. This is helpful for users that do not wish to join smaller pieces of raw veneers together. This is also helpful when veneering curves and columns as the veneer is less likely to crack.

Phenolic backed veneer is less common and is used for composite, or manmade wood veneers. Due to concern for the natural resource, this is becoming more popular. It too has the advantage of being available in sheets, and is also less likely to crack when being used on curves.

Laid up veneer is raw veneer that has been joined together to make larger pieces. The process is time-consuming and requires great care, but is not difficult and requires no expensive tools or machinery. Veneers can be ordered through some companies already laid up to any size, shape or design.

Reconstituted veneer is made from fast-growing tropical species. Raw veneer is cut from a log, and dyed if necessary. Once dyed, the sheets are laminated together to form a block. The block is then sliced so that the edges of the laminated veneer become the ―grain‖ of the reconstituted veneer.

Wood on Wood Also called 2-ply is a decorative wood veneer face with a utility grade wood backer applied at an opposing direction to the face veneer.

Advantages of using veneers

Furniture made with wood veneer uses less wood than the same piece of furniture made with solid wood.

Some projects built using wood veneer would not be possible to construct using solid lumber, owing to expansion and contraction caused by fluctuation of temperature and humidity.

Thermocol

Thermocol is a light and cellular plastic material used for sound and heat insulation of ceiling, walls, and refrigerators and for air conditioning of the buildings. It is soft, light, strong and durable having compressive strength in the range of 11.7 N/mm2 to 14.4 N/mm2. It has excellent heat, sound and electric insulating properties.