

Features of Carpentry: Basic Building Constraction Material

Ms. Appaji Gowda Shwetha

Assistant Professor, Department of Civil Engineering, Presidency University, Bangalore, India,
Email Id-shwetha.a@presidencyuniversity.in

ABSTRACT:

Working with wood to build, install, and repair different buildings and items is a skill in the profession known as carpentry. Building furniture, cabinets, homes, and other residential and commercial structures are just a few of the many duties that fall under this category. With a focus on its essential facets, methods, and applications, this chapter offers a succinct introduction to carpentry. Craftsmanship is at the heart of carpentry, which calls for a blend of technical expertise, real-world proficiency, and originality. Wooden materials are measured, cut, shaped, joined, and finished by carpenters using a range of hand and power equipment. To build and strengthen buildings, they use a variety of wood species, including hardwoods, softwoods, and engineered wood products. They also frequently use hardware, adhesives, nails, screws, and other fasteners. Rough, finish, and cabinetry carpentry are only a few of the fields that fall under the umbrella term of carpentry. Buildings' skeleton structures, such as their walls, floors, and roofs, are framed and constructed during rough carpentry. Trim work, molding, doors, windows, and interior fittings are some of the finer features that are the emphasis of finish carpentry. Construction and setup of unique cabinets, shelves, and storage units are included in cabinetry.

KEYWORDS:

Cabinets, Carpentry, Furniture, Glue, Plywood, Wood.

I. INTRODUCTION

The main output of the forest is wood made from trees. It has received widespread acceptance as a raw material for producing appliances or other wooden goods. Wood has been used as a significant source of heat generation since ancient times. It has been put to use as a major building material for creating shelter, which is a basic human need. It became an extremely important particular material for building boats and for piling to support ports and railway tracks as civilization developed. But in more recent times, thanks to improvements in wood chemistry, wood has come to be appreciated for its value in producing inexpensive useful items like chapter, furniture, textiles, plastics, and a vast array of chemicals and extractives [1], [2].

In some goods, plywood and other hardwood products have surpassed metallic and ceramic materials. Some metals used in gears and die casts have also been replaced by compressed wood. In Europe, wood has been used as a source of wood gas to power vehicles during times of conflict. Similar to cotton, wool has also been used to make garments. The most popular shop, known as a carpentry shop, is where the beneficial work on wood is typically done. Cutting, shaping, and connecting wood and other materials to create wood goods make up the work done in carpentry shops. Consequently, a carpentry shop works with wood, a variety of tools, and the craft of joinery. In wood, there are two different sorts of cells: those that run along the length of the wood and those that radiate outward from its center. According to how they grow, trees are typically divided into exogenous and endogenous forms [3], [4].

Exogenous kinds are also referred to as outward-growing trees that generate commercial-grade wood. While the innermost timber continues to mature, they grow outward, with the additional growth that takes place each year taking place on the outside of the trunk just beneath its bark. The tree adds a new growth ring or yearly ring each time the growth cycle is finished. Since each of these rings reflects a year of growth, it is possible to calculate the age of a tree by counting them. Inward-growing trees are another name for endogenous trees. Every new layer of sapwood is added from the inside rather than the outside as they grow inward. Examples of such endogenous trees are cane, bamboo, and coconut trees. Wood that is suited for engineering, construction, and building uses is referred to as timber in common parlance. After the tree has reached full growth, the main body of the tree is cut into the appropriate sizes to produce timber. Annual rings, heartwood, sapwood, pith, cambium layer, bast, medullary rays, and bark make up the timber structure. Hardwoods and softwoods are two popular categories for

commercial timbers. Oak and beech are examples of hardwoods, both of which have broad leaves. Softwoods, on the other hand, have slender, needle-like leaves like pine and spruce.

The numerous types of materials, tools, and equipment used in the carpentry shop are discussed in this chapter along with their characteristics and applications. Working with wood to build, construct, and repair various structures, furniture, and other wooden objects is the task of a competent tradesperson who practices carpentry. It has been practiced for thousands of years and is one of the oldest and most fundamental crafts. The construction, woodworking, and interior design industries all heavily rely on carpentry, which includes a broad range of skills, techniques, and tools. The craft of carpentry entails shaping unfinished wood into structures and products that are both useful and aesthetically beautiful. Carpenters use specialized hand tools and power tools to shape, cut, join, and finish a variety of wood types, including hardwoods, softwoods, and engineered woods. Carpenters work on many different parts of building and woodworking projects. They can construct and erect structural frameworks for homes, buildings, and other structures, such as walls, floors, roofs, and stairs. Because of their proficiency, they can measure and cut wood properly, guaranteeing accurate fits and alignments. Carpenters are skilled at putting together and installing cabinets, furniture, windows, doors, and other interior fixtures [5], [6].

Carpenters frequently work on repair and restoration initiatives for wooden objects and structures in addition to construction tasks. To maintain the historical and architectural significance of old wooden structures, they might rehabilitate them, repair or replace deteriorating or broken wood components or restore antique furniture. Technical expertise, manual dexterity, inventiveness, and problem-solving abilities are all necessary for carpentry. Carpenters need to be able to read architectural blueprints and drawings, make accurate measurements, and comprehend the traits and attributes of various wood types. To make solid and long-lasting connections between pieces of wood, they need a solid grasp of joinery techniques including mortise and tenon, dovetail, and tongue and groove. Modern carpentry has adopted computer-aided design CAD software and computer numerical control CNC machinery due to technological improvements, enabling more accurate and effective woodworking procedures. The carpenter's toolset still includes conventional hand tools and workmanship, though, as they add a personal touch and focus on detail [7], [8].

Craftsmanship and creativity are encouraged in the flexible and rewarding vocation of carpentry. Effective and aesthetically pleasing buildings, furniture, and other items that improve our living and working spaces are made by skilled carpenters. With their carpentry skills and knowledge, carpenters play a crucial part in influencing the physical environment around us, whether they are building a new home, creating custom cabinetry, or repairing a piece of history.

II. DISCUSSION

Common Wood Species, Their Characteristics, And Uses

Due to its distinctive qualities and aesthetic appeal, wood is a flexible and often utilized material in a variety of industries and applications. There are many different types of wood, and each one has unique qualities that make it appropriate for a particular function. I'll describe a few popular wood species, along with their traits and typical applications, in my response. Please note that this is not a comprehensive list; rather, it offers an overview of the most common wood species.

Oak: Oak is a hard wood with a reputation for being resilient and strong. It comes in red and white variations, each having a distinct ray pattern and a noticeable grain pattern.

Uses: Oak is frequently utilized for architectural elements, flooring, interior trim, and cabinets. Due to its longevity, it is also appropriate for use in outdoor applications like decks and fences.

Maple

Characteristics: The texture of maple, a thick hardwood, is uniformly fine. It is light in color, ranging from creamy white to light brown, and may have faint grain patterns.

Uses: For furniture, flooring, cabinets, and interior millwork, maple is preferred. Cutting boards, butcher blocks, and musical instruments are some items that frequently employ it.

Walnut: Walnut is hardwood with a straight grain and a dark, rich hue that is deep brown. Its texture ranges from mild to coarse, and it can display lovely figure patterns.

Uses: High-end furniture, cabinets, paneling, and flooring frequently include walnut, which is highly prized for its aesthetic appeal. Gunstocks and ornamental things can also be made using it.

Cherry

Characteristics: Medium-density hardwood cherry matures to a cozy reddish-brown hue when exposed to light. It is smooth and has a fine, straight grain.

Uses: Cherry is frequently used for furniture, cabinets, interior trim, and millwork in buildings because of its rich hue. Making musical instruments using it is also very common.

Mahogany

Characteristics: Mahogany is a reddish-brown tropical hardwood with a straight grain and a medium-to-coarse feel. It is extremely durable and stable.

Uses: For fine furniture, cabinets, doors, and musical instruments, mahogany is the material of choice. Additionally, ornamental veneers, external millwork, and boat construction all employ it.

Pine

Characteristics: Pine has a light tint that runs from pale yellow to light brown. It is a softwood. It has a very uniform texture and a straight grain.

Uses: Pine is frequently used in construction for sheathing, flooring, framing, and interior trim. It is also widely used in furniture, cabinets, and handicrafts.

Cedar

Characteristics: Softwood recognized for its inherent resistance to dampness, insects, and rot is cedar. It is reddish-brown in color, fragrant, and has an unusual grain pattern.

Uses: Considering its endurance, cedar is frequently utilized for external projects including siding, decking, and fence. Additionally, closets, chests, and interior furniture are made of it.

Teak

Characteristics: Teak is a solid hardwood with a straight grain, a high natural oil content, and a golden brown hue. It has a high level of resistance to decay, insects, and wetness. Utilized extensively in outdoor furniture, boat decks, and maritime uses is teak. Decorative veneers, flooring, and cabinets are further used for it.

Birch

Characteristics: Birch is a hardwood with a light hue, delicate, smooth texture, and straight grain. Its hues might range from milky white to reddish-brown. Birch is frequently used for furniture, flooring, cabinets, and interior millwork. For creating plywood, veneers, and turned products, it is also widely used.

Felling, Conversion, And Seasoning of Wood

Felling a tree refers to the act of chopping down a living or standing tree for its wood. The right time is chosen to take down trees. To get the most wood with the greatest quality, it is important to cut the tree as soon as it reaches its full development or maturity age can be acquired. A young tree will have a lot of sapwood, which may not be very useful for carpentry work if it is chopped down. In contrast, if the tree is left standing for a long time after reaching maturity, the most valuable component of the timber will be prone to degradation. As a result, sufficient care must be taken to ensure that felling only occurs at the proper moment. When a tree should be trimmed depends primarily on its age and the time of year.

Because the sap of the tree is at rest at these times, cutting trees for use is typically done in midsummer or midwinter when the likelihood of any decay of the wood is at its lowest. Whether a tree is softwood or hardwood will affect how long it takes to reach maturity. The maturity of a softwood tree takes between 80 and 100 years, but that of a hardwood tree takes between 130 and 200 years. The branches are removed from the tree once it has been cut from the bottom up, creating a log. Conversion is the process of sawing timber logs into sizes and forms that are usable for markets or other commercial needs boards, planks, squares, and various plane sections and sizes, etc. Two processes plain, though, through sawn process and quarter and rift sawn process are used to carry over conversion before seasoning. Plain wood pieces may warp and cannot be used for work of a high caliber. Warping is usually never an issue while using a quartersaw. For cabinet building, ornamentation, and framework, quarter-sawn parts make excellent wood. It is also important to plant new trees, and this should be done periodically.

Timber logs are sawed into various industrial sizes during conversion. The provision of an adequate tolerance for shrinkage that occurs while sawn or converted wood is curing is a prominent component of conversion. According to the type of wood and the time of cutting, the shrinkage of wood typically ranges from 3.2 mm to 6.4 mm. The following discussion covers the three most used conversion techniques. The first approach, also known as flat or conventional cutting, is the simplest sawing process, although the cut parts are prone to warping. As a result, the wood that was cut using this method cannot be considered to be of high quality. By making several parallel saw cuts into the appropriate shapes, the timber log is divided into several boards using this technique.

The second technique is called tangential cutting, and it entails cutting the wood so that the widths of the boards are parallel to the annual rings. However, it may distort like flat-sawn wood. The timber cut using this process is quickly dried and cutting waste is very little. The third method is called quarter or radial sawing, and it entails sawing the logs of wood so that the breadth of the cut boards falls along the medullary rays, or that they intersect the section of the log. By using this sawing technique, the typical warping flaw is almost completely eradicated, making the wood excellent for all types of woodworking, including cabinet manufacturing, decorating, and framework. Trees are transformed into useful, marketable forms like posts square pieces of timber 175-300 mm wide or round pieces of 175-300 mm in diameter, deals 225 mm wide and roughly 100 mm thick parallel side pieces, planks 50 to 100 mm thick, 275-300 mm wide, and 3 to 7 meters long, and boards or battens 25 to 50 mm thick and 125 to 175 mm wide. Available sizes of timber Kail, Deodar, etc. for building construction include 10' 10 x 5, 12' 10 x 5, 10' 8 x 5, 10' 8 x 4, etc.

Seasoning is the process of lowering the moisture, or sap content, of wood to the point where, under typical use conditions, no additional drying out will occur. Seasoning has as its primary goal the removal of excess moisture from the wood. The shrinking of the wood that results from the evaporation of the moisture in the cell walls is greatest along the growth rings. Seasoning may cause some additional flaws, such as shaking and warping, to appear. Therefore, save for rough work, green or unseasoned lumber should not be used for any projects. As long as the wood has been properly seasoned before usage, it won't twist, shrink, or swell while it is used. Seasoning wood before use is vital to attain the desired moisture content, reduce fungus decay, minimize insect assault, boost wood strength, and reduce wood warpage. Natural and artificial seasoning are the two categories into which seasoning is divided. In general, natural seasoning takes place in the air, water, or smoke. The most traditional way to dry wood is through air seasoning, which completely relies on the free movement of air around the wood to evaporatively remove moisture. Fig. 1 depicts a timber stack in a shaded area for air seasoning.

Defects due to Fungi and Insects

Fungi, dry rot, and wet rot are three examples of defects brought on by fungi and insects in wood, and they are addressed here. Fungi in wood consume the wood as food and obliterate it. It impacts wood tissues and cells can deteriorate. Wet rot and dry rot are two different forms of faults in wood caused by fungi and insects. A form of fungus called dry rot grows on dry wood and feeds on and decomposes damp wood. Infected wood soon loses weight and develops the look of being severely scorched by fire, except that it is brown rather than black and collapses when applied light pressure, giving rise to the name dry rot. Since this fungus cannot grow on wood with a sap content of less than 20%, using seasoned wood and maintaining it in a dry environment should be enough to prevent it.

Wood that has experienced wet rot is damaged by moisture. Due to fungi's attack on living trees, the wood seems to be moist. The affected areas of wood are reduced to a powdery, gray-brown substance. Wet rot can be prevented by using well-seasoned wood that has been painted or otherwise treated. The wood is attacked by insects like beetles, borers, and white ants, which render it useless. In temperate, tropical, and subtropical environments, beetles are frequently encountered. Beetles eat wood as a food source. Borers drill holes in the wood to find a place to live. In places with warm climates, white ants or termites are quite prevalent. They damage the wood and hollow it out from the inside. Insecticides can be used to control the insect invasion. Another technique involves placing the timbers in a kiln, where the pests are suffocated by heat and steam.

Timber Preservation

The need to preserve wood from fungus and insect damage cannot be overstated. If a product made of wood, such as doors, windows, poles, etc., is exposed to the elements, it needs to be protected. Preserving the wood is a considerably more affordable option for extending its life. The purpose of treating wood with a preservative is to make it resistant to deterioration even when it gets quite damp and to stave off attacks by insects that devour wood. The majority of wood preservatives fall into one of three categories: organic solvent compounds, water-soluble types, and tar-oil derivatives like creosote.

Characteristics of a Good Timber

1. Timber is free from knots, insects attack, excessive moisture, discoloration, twisted fibers,
2. Cup and ring shake, sound, bright, and free from any discoloration. It is solid with annual rings
3. But not hollow in the center. Timber should be well seasoned for easily workable specific use.
4. It should possess straight fibers and high fire resistance. It should not split when nails are
5. Driven into it. It should not clog with the saw teeth during the sawing operation. Timber should
6. Be highly suitable for polishing and painting.

Factors Influencing Timber Selection

The characteristics of the timber, including its durability, workability, weight, hardness, cohesiveness, elasticity, type of texture, type of grains, resistance to fire, resistance to various pressures, capacity to maintain shape, and suitability for a particular use, are the variables determining the choice of lumber.

Plywood and Applications

Plywood and other manufactured boards have gradually replaced solid wood in the production of furniture, fixtures, paneling, and many other types of building work over the past number of years. Plywood typically consists of three or more layers. Veneer sheets adhered together, the grain of the subsequent plies being put across. Given that wood is strongest down its grain, when veneer plies are bonded against one another, strength is spread along the length and width of the piece. As opposed to plain wood, plywood may be purchased in much bigger sizes without shrinking or warping. Plywood can be used to create molded plywood boats, television, and radio cabinets. The plywood can easily resist humid conditions. Even the hardest hardwoods cannot compare to the strength and lightness of plywood. Plywood can be fastened with screws and nails very close to the edge without the risk of splitting. On plywood, premium surface quality is simple to obtain.

The creation of heat- and moisture-resistant adhesives has facilitated the use of laminated members in heavy truss construction, the joining of short lengths to create longer pieces, and the gluing together of narrow boards to create broader ones. Sheathing, interior finishing, subflooring, under-roofing, paneling, flooring, cabinets, furniture, shelving, partitions, ceilings, containers such as baskets, boxes, crates, trunks into boats, toys, tables, woodenware, and repair work in garages and basements are just a few uses for plywood in construction.

Miscellaneous Material Used in Carpentry Shop

In addition to lumber, a variety of other materials are employed in carpentry shops. Dowels, nails, screws, adhesives, paints, and varnishes are the main components. Below is a basic description of this kind of information.

Dowels

Dowels are small wooden objects with specific nails that are often crafted by the carpenter from bamboo or other similar wood. They are employed to fasten various wood structural elements. The two components or parts that will be connected must first have a hole drilled through them. The dowel is then driven through the pieces once they have been assembled and placed in the right position for joining.

Nails

Drawn wire made of brass, copper, low-carbon steel, or malleable iron rods is used to make nails for woodworking. Wire nails are those created from drawn wires, and clasp nails are those manufactured from rods. The clasp nails are more capable of holding than wire nails. The clasp nails are typically used for heavy work, whilst the wire nails are utilized for light and medium work. Nails are primarily used to hold various wood components together and reinforce bonded seams. Their length and diameter serve to describe their size. In the market, these are sold by weight.

Screws

Screws are fasteners that are primarily used to secure metallic fittings like hinges and hasps in timber structures. They are made from bright drawn wires or thin rods.

Adhesives

Adhesives are substances that cling to surfaces, such as glue, paste, cement, and mucilage, and can be used to permanently join wooden parts to one another. It is frequently used to link the boards together face-to-face to

enhance thickness or edge-to-edge to create a larger surface. It is used to adhere together relatively small surface areas, such as woodworking joints, as well as huge surface areas of material, such as when installing veneers. A good connection between the wooden components is maintained by an effective adhesive, sticking paste, or glue under the service conditions that the joint must resist. In joinery work and many other typical types of woodworking, it is commonly necessary to join together hardwood boards edge to edge to create a bigger surface or face-to-face to enhance thickness. It can be applied in a hot or cold environment. The former, also referred to as liquid or cold glue, is employed when a slower and weaker setting is preferred. It is known as cooked glue when it is hot applied, allowing a particularly strong and long-lasting sort of bond between the neighboring layers of wood pieces. Casein glue, animal glue, vegetable glue, albumen glue, synthetic resins, polyvinyl acetate PVA, paint and varnish, rubber cement, and plastic cement are a few of the commercially available adhesives that can be categorized. A few significant examples of these adhesives are briefly mentioned below.

Creature Glue

Hoofs, bones, hides, and other animal wastes are used to make this glue. These substances are produced and processed into sheets, flakes, or powder. The adhesive should be heated after spending the night in cold water before use. Typically, it is applied hot and quickly sets. Commercially, it is also offered in liquid form, which can be applied directly without being heated first. It's crucial to remember that this glue needs to be used right away after heating. Repeated heating should be avoided since it weakens the glue's binding and causes water to evaporate, losing fluidity and making the glue thicker.

Plant-Based Glue

It is made from starch that is extracted from tree roots, grains, and corn by soaking them in acid and grinding them into a powdered form. It is mostly utilized in plywood production and is not well-suited for other types of work.

Albumen cement

It is made by combining an alkali with cattle blood and is sold in a flake form. They are dissolved in water for approximately an hour before using to create a liquid. The solution and it creates a connection that is both strong and waterproof.

Artificial Resin Glue

Formaldehyde, uric acid, and other chemicals are used to make this glue. It is typically offered in powder form. It is carefully blended with water to the right consistency before usage. Resorcinol resin, liquid polyvinyl resin glue, and powdered plastic resin glue are the commercially available types of resin glue. Polyvinyl glue is widely used in furniture and decorative work because it sets up quickly, is sturdy, and is simple to use. In plywood production, plastic resin glue is primarily employed. The resorcinol glue can be used to attach timber components exposed to humid environments and continually changing weather conditions.

Varnishes and Paint

They are frequently used on wooden or metal objects to shield their surfaces from the effects of moisture and climate change. They are used to decorate surfaces by adding decorative elements to them.

III. CONCLUSION

The last phases of a carpentry project, where all the major building work is finished and the finishing touches are added, are often referred to as the end of a carpentry project. Here are some crucial elements of the end of carpentry. Carpentry is a trade that involves using wood to construct, install, and repair various structures and objects. Just a few of the numerous tasks that come under this category include building furniture, cabinets, houses, and other residential and commercial constructions. This chapter provides a brief overview of carpentry with an emphasis on its fundamental characteristics, approaches, and applications. The core of carpentry is craftsmanship, which requires a combination of technical knowledge, practical skill, and uniqueness. Carpenters use a variety of hand and power tools to measure, cut, shape, connect, and polish wooden materials. They employ a range of wood species, including hardwoods, softwoods, and engineered wood products, to construct and reinforce buildings.

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