Lumber

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Lumber (American English;[1] used only in North America), or **timber** (used in the rest of the English speaking world[2]) is wood that has been processed into beams and planks, a stage in the process of wood production. Lumber may also refer to currently un-needed furniture, as in Lumber room, or an awkward gait, ultimately derived from the look of unfashionable and unwanted furniture.


Timber in storage for later processing at a sawmill

Lumber may be supplied either rough-sawn, or surfaced on one or more of its faces. Besides pulpwood, *rough lumber* is the raw material for furniture-making and other items requiring additional cutting and shaping. It is available in many species, usually hardwoods; but it is also readily available in softwoods, such as white pine and red pine, because of their low cost.[3] *Finished lumber* is supplied in standard sizes, mostly for the construction industry—primarily softwood, from coniferous species, including pine, fir and spruce (collectively spruce-pine-fir), cedar, and hemlock, but also some hardwood, for high-grade flooring.


Wood cut from Victorian Eucalyptus regnans

Lumber is mainly used for structural purposes but has many other uses as well. It is classified more commonly as a softwood than as a hardwood, because 80% of lumber comes from softwood.[4]


Timber warehouse

Contents

The harbor of Bellingham, Washington, filled with logs, 1972

Terminology

In Australia, Ireland, New Zealand and Britain, the term *timber* describes sawn wood products, such as floor boards. In the United States and Canada, generally *timber* describes standing or felled trees, before they are milled into boards, which are called *lumber*.

Timber there also describes sawn lumber not less than 5 inches (127 mm) in its smallest dimension.[5] The latter includes the often partly finished lumber used in timber-frame construction.

In the United Kingdom, the word *lumber* is rarely used in relation to wood, and *timber* is almost universally used in its place; but *lumber* has several other meanings in Britain, including unused or unwanted items.

Remanufactured lumber

Remanufactured lumber is the result of secondary or tertiary processing/cutting of previously milled lumber. Specifically, it is lumber cut for industrial or wood-packaging use. Lumber is cut by ripsaw or resaw to create dimensions that are not usually processed by a primary sawmill.

Resawing is the splitting of 1-inch through 12-inch hardwood or softwood lumber into two or more thinner pieces of full-length boards. For example, splitting a ten-foot 2x4 into two ten-foot 1x4s is considered resawing.

Plastic lumber

Structural lumber may also be produced from recycled plastic and new plastic stock. Its introduction has been strongly opposed by the forestry industry.[6] Blending fiberglass in plastic lumber enhances its strength, durability, and fire resistance.[7] Plastic fiberglass structural lumber can have a "class 1 flame spread rating of 25 or less, when tested in accordance with ASTM standard E 84," which means it burns slower than almost all treated wood lumber.[8]

Conversion of wood logs

Logs are *converted* into timber by being sawn, hewn, or split. Sawing with a rip saw is the most common method, because sawing allows logs of lower quality, with irregular grain and large knots, to be used and is more economical. There are various types of sawing:

- Plain sawn (flat sawn, through and through, bastard sawn)—A log sawn through without adjusting the position of the log and the grain runs across the width of the boards.
- Quarter sawn and rift sawn—These terms have been confused in history but generally mean lumber sawn so the annual rings are reasonably perpendicular to the sides (not edges) of the lumber.
- Boxed heart—The pith remains within the piece with some allowance for exposure.
- Heart center—the center core of a log.
- Free of heart center (FOHC)—A side-cut timber without any pith.
- Free of knots (FOK)—No knots are present.

Dimensional lumber


A 2×4.

Dimensional lumber is lumber that is cut to standardized width and depth, specified in inches. Carpenters extensively use dimensional lumber in framing wooden buildings. Common sizes include *2×4* (pictured) (also *two-by-four* and other variants, such as *four-by-two* in the Australia, New Zealand, and the UK), *2×6*, and *4×4*. The length of a board is usually specified separately from the width and depth. It is thus possible to find 2×4s that are four, eight, and twelve feet in length. In Canada and the United States, the standard lengths of lumber are 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24 feet (1.83, 2.44, 3.05, 3.66, 4.27, 4.88, 5.49, 6.10, 6.71 and 7.32 meters). For wall framing, "stud" or "precut" sizes are available, and are commonly used. For an eight-, nine-, or ten-foot ceiling height, studs are available in $92\frac{5}{8}$ inches (235 cm), $104\frac{5}{8}$ inches (266 cm), and $116\frac{5}{8}$ inches (296 cm). The term "stud" is used inconsistently to specify length; where the exact length matters, one must specify the length explicitly.

North American softwoods

Solid dimensional lumber typically is only available up to lengths of 24 ft (7.32 m). Engineered wood products, manufactured by binding the strands, particles, fibers, or veneers of wood, together with adhesives, to form composite materials, offer more flexibility and greater structural strength than typical wood building materials.[9]

Pre-cut studs save a framer much time, because they are pre-cut by the manufacturer for use in 8-, 9-, and 10-ft (2.44, 2.74 and 3.05 m) ceiling applications, which means the manufacturer has removed a few inches or centimetres of the piece to allow for the sill plate and the double top plate with no additional sizing necessary.

In the Americas, *two-bys* (2×4s, 2×6s, 2×8s, 2×10s, and 2×12s), named for traditional board thickness in inches, along with the 4×4 (89 mm × 89 mm), are common lumber sizes used in modern construction. They are the basic building blocks for such common structures as balloon-frame or platform-frame housing. Dimensional lumber made from softwood is typically used for construction, while hardwood boards are more commonly used for making cabinets or furniture.

Lumber's *nominal* dimensions are larger than the actual standard dimensions of finished lumber. Historically, the nominal dimensions were the size of the green (not dried), rough (unfinished) boards that eventually became smaller finished lumber through drying and planing (to smooth the wood). Today, the standards specify the final finished dimensions and the mill cuts the logs to whatever size it needs to achieve those final dimensions. Typically, that rough cut is smaller than the nominal dimensions because modern technology makes it possible and it uses the logs more efficiently. For example, a "2x4" board historically started out as a green, rough board actually 2 by 4 inches (51 mm × 102 mm). After drying and planing, it would be smaller, by a nonstandard amount. Today, a "2x4" board starts out as something smaller than 2 inches by 4 inches and not specified by standards, and after drying and planing is reliably $1\frac{1}{2}$ by $3\frac{1}{2}$ inches (38 mm × 89 mm).

North American softwood dimensional lumber sizes

Nominal	Actual		Nominal	Actual		Nominal	Actual	
in × in		mm × mm	in × in		mm × mm	in × in		mm × mm
1 × 2	$\frac{3}{4} \times 1\frac{1}{2}$	19 × 38	2 × 2	$1\frac{1}{2} \times 1\frac{1}{2}$	38 × 38	4 × 4	$3\frac{1}{2} \times 3\frac{1}{2}$	89 × 89
1 × 3	$\frac{3}{4} \times 2\frac{1}{2}$	19 × 64	2 × 3	$1\frac{1}{2} \times 2\frac{1}{2}$	38 × 64	4 × 6	$3\frac{1}{2} \times 5\frac{1}{2}$	89 × 140
1 × 4	$\frac{3}{4} \times 3\frac{1}{2}$	19 × 89	2 × 4	$1\frac{1}{2} \times 3\frac{1}{2}$	38 × 89	4 × 8	$3\frac{1}{2} \times 7\frac{1}{4}$	89 × 184
1 × 6	$\frac{3}{4} \times 5\frac{1}{2}$	19 × 140	2 × 6	$1\frac{1}{2} \times 5\frac{1}{2}$	38 × 140	6 × 6	$5\frac{1}{2} \times 5\frac{1}{2}$	140 × 140
1 × 8	$\frac{3}{4} \times 7\frac{1}{4}$	19 × 184	2 × 8	$1\frac{1}{2} \times 7\frac{1}{4}$	38 × 184	8 × 8	$7\frac{1}{4} \times 7\frac{1}{4}$	184 × 184
1 × 10	$\frac{3}{4} \times 9\frac{1}{4}$	19 × 235	2 × 10	$1\frac{1}{2} \times 9\frac{1}{4}$	38 × 235			
1 × 12	$\frac{3}{4} \times 11\frac{1}{4}$	19 × 286	2 × 12	$1\frac{1}{2} \times 11\frac{1}{4}$	38 × 286			

Early standards called for green rough lumber to be of full nominal dimension when dry. However, the dimensions have diminished over time. In 1910, a typical finished 1-inch (25 mm) board was $\frac{13}{16}$ in (21 mm). In 1928, that was reduced by 4%, and yet again by 4% in 1956. In 1961, at a meeting in

Scottsdale, Arizona, the Committee on Grade Simplification and Standardization agreed to what is now the current US standard: in part, the dressed size of a 1 inch (nominal) board was fixed at $^3\!/_4$ inch; while the dressed size of 2 inch (nominal) lumber was *reduced* from $1^5\!/_8$ inch to the current $1^1\!/_2$ inch.[10]

Dimensional lumber is available in green, unfinished state, and for that kind of lumber, the nominal dimensions are the actual dimensions.

Grades and standards

Individual pieces of lumber exhibit a wide range in quality and appearance with respect to knots, slope of grain, shakes and other natural characteristics. Therefore, they vary considerably in strength, utility and value.

The longest board in the world (2002) is in Poland and measures 36.83 metres (about 120 ft 10 in) long.

The move to set national standards for lumber in the United States began with publication of the American Lumber Standard in 1924, which set specifications for lumber dimensions, grade, and moisture content; it also developed inspection and accreditation programs. These standards have changed over the years to meet the changing needs of manufacturers and distributors, with the goal of keeping lumber competitive with other construction products. Current standards are set by the American Lumber Standard Committee, appointed by the U.S. Secretary of Commerce.[11]

Design values for most species and grades of visually graded structural products are determined in accordance with ASTM standards, which consider the effect of strength reducing characteristics, load duration, safety and other influencing factors. The applicable standards are based on results of tests conducted in cooperation with the USDA Forest Products Laboratory. Design Values for Wood Construction, which is a supplement to the ANSI/AF&PA National Design Specification® for Wood Construction, provides these lumber design values, which are recognized by the model building codes. A summary of the six published design values—including bending (Fb), shear parallel to grain (Fv), compression perpendicular to grain (Fc-perp), compression parallel to grain (Fc), tension parallel to grain (Ft), and modulus of elasticity (E and Emin) can be found in Structural Properties and Performance[12] published by WoodWorks.

Canada has grading rules that maintain a standard among mills manufacturing similar woods to assure customers of uniform quality. Grades standardize the quality of lumber at different levels and are based on moisture content, size and manufacture at the time of grading, shipping and unloading by the buyer. The National Lumber Grades Authority (NLGA)[13] is responsible for writing, interpreting and maintaining Canadian lumber grading rules and standards. The Canadian Lumber Standards Accreditation Board (CLSAB)[14] monitors the quality of Canada's lumber grading and identification system.

Attempts to maintain lumber quality over time have been challenged by historical changes in the timber resources of the United States—from the slow-growing virgin forests common over a century ago to the fast-growing plantations now common in today's commercial forests. Resulting declines in lumber quality have been of concern to both the lumber industry and consumers and have caused increased use of alternative construction products[15][16]

Machine stress-rated and machine-evaluated lumber is readily available for end-uses where high strength is critical, such as trusses rafters, laminating stock, I-beams and web joints. Machine grading measures a characteristic such as stiffness or density that correlates with the structural properties of interest, such as bending strength. The result is a more precise understanding of the strength of each piece of lumber than is possible with visually graded lumber, which allows designers to use full-design strength and avoid overbuilding.[17]

In Europe, strength grading of sawn softwood is done according to EN-14081-1/2/3/4 and sorted into nine classes; in increasing strength these are: C14, C16, C18, C22, C24, C27, C30, C35 and C40[18]

- C14 used for scaffolding and formwork
- C24 general construction
- C30 prefab roof trusses and where design requires somewhat stronger joists than C24 can offer
- C40 usually seen in glulam

Grading rules for African and South American sawn timber have been developed by ATIBT (http://www.atibt.com/) according to the rules of the Sciages Avivés Tropicaux Africains (SATA) and is based on clear cuttings - established by the percentage of the clear surface.[19]

North American hardwoods

In North America, market practices for dimensional lumber made from hardwoods[a] varies significantly from the regularized *standardized 'dimension lumber' sizes* used for sales and specification of softwoods — hardwood boards are often sold totally rough cut,[b] or machine planed only on the two (broader) face sides. When Hardwood Boards are also supplied with planed faces, it is usually both by random widths of a specified thickness (normally matching milling of softwood dimensional lumbers) and somewhat random lengths. But besides those older (traditional and normal) situations, in recent years some product lines have been widened to also market boards in standard stock sizes; these usually retail in big box stores and using only a relatively small set of specified lengths[c]; in all cases hardwoods are sold to the consumer by the board-foot (144 cubic inches or 2,360 cubic centimetres), whereas that measure is not used for softwoods at the retailer (to the cognizance of the buyer).[d]

North American hardwood dimensional lumber sizes

Nominal (rough-sawn size)	S1S (surfaced on one side)	S2S (surfaced on two sides)
$\frac{1}{2}$ in	$\frac{3}{8}$ in (9.5 mm)	$\frac{5}{16}$ in (7.9 mm)
$\frac{5}{8}$ in	$\frac{1}{2}$ in (13 mm)	$\frac{7}{16}$ in (11 mm)
$\frac{3}{4}$ in	$\frac{5}{8}$ in (16 mm)	$\frac{9}{16}$ in (14 mm)
1 in or $\frac{4}{4}$ in	$\frac{7}{8}$ in (22 mm)	$\frac{13}{16}$ in (21 mm)
$1\frac{1}{4}$ in or $\frac{5}{4}$ in	$1\frac{1}{8}$ in (29 mm)	$1\frac{1}{16}$ in (27 mm)
$1\frac{1}{2}$ in or $\frac{6}{4}$ in	$1\frac{3}{8}$ in (35 mm)	$1\frac{5}{16}$ in (33 mm)
2 in or $\frac{8}{4}$ in	$1\frac{13}{16}$ in (46 mm)	$1\frac{3}{4}$ inches (44 mm)
3 in or $\frac{12}{4}$ in	$2\frac{13}{16}$ in (71 mm)	$2\frac{3}{4}$ in (70 mm)
4 in or $\frac{16}{4}$ in	$3\frac{13}{16}$ in (97 mm)	$3\frac{3}{4}$ in (95 mm)

Also in North America, hardwood lumber is commonly sold in a "quarter" system when referring to thickness; 4/4 (four quarter) refers to a 1-inch-thick (25 mm) board, 8/4 (eight quarter) is a 2-inch-thick (51 mm) board, etc. This "quarter" system is rarely used for softwood lumber; although softwood decking is sometimes sold as 5/4, even though it is actually one-inch thick (from milling 1/8th inch off each side in a motorized planing step of production). The "quarter" system of reference is a traditional (cultural) North American lumber industry nomenclature used specifically to indicate the thickness of rough sawn hardwood lumber.

The following paragraph is exactly backwards from North American cultural practices where finished retail and rough lumber share the same terminology, as is discussed in the paragraph after about 'architects, designers, and builders': In rough sawn lumber it immediately clarifies that the lumber is not yet milled, avoiding confusion with milled dimension lumber which is s measured as actual thickness after machining. Examples- 3/4", 19mm, or 1x. In recent years architects, designers, and builders have begun to use the "quarter" system in specifications as a vogue of insider knowledge, though the materials being specified are finished lumber, thus conflating the separate systems and causing confusion.

Hardwoods cut for furniture are cut in the fall and winter, after the sap has stopped running in the trees. If hardwoods are cut in the spring or summer the sap ruins the natural color of the timber and decreases the value of the timber for furniture.

Engineered lumber

Engineered lumber is lumber created by a manufacturer and designed for a certain structural purpose. The main categories of engineered lumber are:[20]

- Laminated veneer lumber (LVL) – LVL comes in $1\frac{3}{4}$ inch thicknesses with depths such as $9\frac{1}{2}$, $11\frac{7}{8}$, 14, 16, 18, and 24 inches, and are often doubled or tripled up. They function as beams to provide support over large spans, such as removed support walls and garage door openings, places where dimensional lumber is insufficient, and also in areas where a heavy load is bearing from a floor, wall or roof above on a somewhat short span where dimensional lumber is impractical. This type of lumber is compromised if it is altered by holes or notches anywhere within the span or at the ends, but nails can be driven into it wherever necessary to anchor the beam or to add hangers for I-joists or dimensional lumber joists that terminate at an LVL beam.

- Wooden I-joists – sometimes called "TJI", "Trus Joists" or "BCI", all of which are brands of wooden I-joists, they are used for floor joists on upper floors and also in first floor conventional foundation construction on piers as opposed to slab floor construction. They are engineered for long spans and are doubled up in places where a wall will be aligned over them, and sometimes tripled where heavy roof-loaded support walls are placed above them. They consist of a top and bottom chord or flange made from dimensional lumber with a webbing in-between made from oriented strand board (OSB). The webbing can be removed up to certain sizes or shapes according to the manufacturer's or engineer's specifications, but for small holes, wooden I-joists come with "knockouts", which are perforated, pre-cut areas where holes can be made easily, typically without engineering approval. When large holes are needed, they can typically be made in the webbing only and only in the center third of the span; the top and bottom chords lose their integrity if cut. Sizes and shapes of the hole, and typically the placing of a hole itself, must be approved by an engineer prior to the cutting of the hole and in many areas, a sheet showing the calculations made by the engineer must be provided to the building inspection authorities before the hole will be approved. Some I-joists are made with W-style webbing like a truss to eliminate cutting and to allow ductwork to pass through.
- Finger-jointed lumber – solid dimensional lumber lengths typically are limited to lengths of 22 to 24 feet, but can be made longer by the technique of "finger-jointing" by using small solid pieces, usually 18 to 24 inches long, and joining them together using finger joints and glue to produce lengths that can be up to 36 feet long in 2×6 size. Finger-jointing also is predominant in precut wall studs. It is also an affordable alternative for non-structural hardwood that will be painted (staining would leave the finger-joints visible). Care is taken during construction to avoid nailing directly into a glued joint as stud breakage can occur.

Freshly cut logs showing sap running from beneath bark

- Glulam beams – created from 2×4 or 2×6 stock by gluing the faces together to create beams such as 4×12 or 6×16. As such, a beam acts as one larger piece of lumber - thus eliminating the need to harvest larger, older trees for the same size beam.
- Manufactured trusses – trusses are used in home construction as a pre-fabricated replacement for roof rafters and ceiling joists (stick-framing). It is seen as an easier installation and a better solution for supporting roofs than the use of dimensional lumber's struts and purlins as bracing. In the southern US and elsewhere, stick-framing with dimensional lumber roof support is still predominant. The main drawbacks of trusses are reduced attic space, time required for engineering and ordering, and a cost higher than the dimensional lumber needed if the same project were conventionally framed. The advantages are significantly reduced labor costs (installation is faster than conventional framing), consistency, and overall schedule savings.

Various pieces and cuts

- Square and rectangular forms: Plank, slat, batten, board, lath, *strapping* (typically $\frac{3}{4}$ in × $1\frac{1}{2}$ in), *cant* (A partially sawn log such as sawn on two sides or squared to a large size and later resawn into lumber. A *flitch* is a type of cant with wane on one or both sides). Various pieces are also known by their uses such as post, beam, (girt), stud, rafter, joist, sill plate, wall plate.
- Rod forms: pole, (dowel), stick (staff, baton)

Timber piles

In the United States, pilings are mainly cut from southern yellow pines and Douglas firs. Treated pilings are available in Chromated copper arsenate retentions of 0.60, 0.80 and 2.50 pounds per cubic foot (9.6, 12.8 and 40.0 kg/m^3) if treatment is required.

Defects in lumber

Defects occurring in lumber are grouped into the following four divisions:

Conversion

During the process of converting timber to commercial form the following defects may occur:

- Chip mark: this defect is indicated by the marks or signs placed by chips on the finished surface of timber
- Diagonal grain: improper sawing of timber
- Torn grain: when a small depression is made on the finished surface due to falling of some tool
- Wane: presence of original rounded surface in the finished product

Defects due to fungi

Fungi attack timber when these conditions are all present:

- The timber moisture content is above 25% on a dry-weight basis
- The environment is sufficiently warm
- Oxygen (O_2) is present

Wood with less than 25% moisture (dry weight basis) can remain free of decay for centuries. Similarly, wood submerged in water may not be attacked by fungi if the amount of oxygen is inadequate.

Fungi timber defects:

- Blue stain
- Brown rot
- Dry rot
- Heart rot
- Sap stain
- Wet rot
- White rot

Following are the insects which are usually responsible for the decay of timber:

- Woodboring beetles
- Marine borers (Barnea similis)
- Termites
- Carpenter ants
- Carpenter bees

Natural forces

There are two main natural forces responsible for causing defects in timber: abnormal growth and rupture of tissues. Rupture of tissue includes cracks or splits in the wood called "shakes". "Ring shake", "wind shake", or "ring failure" is when the wood grain separates around the growth rings either while standing or during felling. Shakes may reduce the strength of a timber and the appearance thus reduce lumber grade and may capture moisture, promoting decay. Eastern hemlock is known for having ring shake.[21] A "check" is a crack on the surface of the wood caused by the outside of a timber shrinking as it seasons. Checks may extend to the pith and follow the grain. Like shakes, checks can hold water promoting rot. A "split" goes all the way through a timber. Checks and splits occur more frequently at the ends of lumber because of the more rapid drying in these locations.[21]

Seasoning

The seasoning of lumber is typically either kiln- or air-dried. Defects due to seasoning are the main cause of splinters and slivers.

Durability and service life

Under proper conditions, wood provides excellent, lasting performance. However, it also faces several potential threats to service life, including fungal activity and insect damage—which can be avoided in numerous ways. Section 2304.11 of the International Building Code addresses protection against decay and termites. This section provides requirements for non-residential construction applications, such as wood used above ground (e.g., for framing, decks, stairs, etc.), as well as other applications.

There are four recommended methods to protect wood-frame structures against durability hazards and thus provide maximum service life for the building. All require proper design and construction:

- Controlling moisture using design techniques to avoid decay
- Providing effective control of termites and other insects
- Using durable materials such as pressure treated or naturally durable species of wood where appropriate
- Providing quality assurance during design and construction and throughout the building’s service life using appropriate maintenance practices

Moisture control

Wood is a hygroscopic material, which means it naturally absorbs and releases water to balance its internal moisture content with the surrounding environment. The moisture content of wood is measured by the weight of water as a percentage of the oven-dry weight of the wood fiber. The key to controlling decay is controlling moisture. Once decay fungi are established, the minimum moisture content for decay to propagate is 22 to 24 percent, so building experts recommend 19 percent as the maximum safe moisture content for untreated wood in service. Water by itself does not harm the wood, but rather, wood with consistently high moisture content enables fungal organisms to grow.

The primary objective when addressing moisture loads is to keep water from entering the building envelope in the first place, and to balance the moisture content within the building itself. Moisture control by means of accepted design and construction details is a simple and practical method of protecting a wood-frame building against decay. For applications with a high risk of staying wet, designers specify durable materials such as naturally decay-resistant species or wood that has been treated with preservatives. Cladding, shingles, sill plates and exposed timbers or glulam beams are examples of potential applications for treated wood.

Controlling termites and other insects

For buildings in termite zones, basic protection practices addressed in current building codes include (but are not limited to) the following:

• Grading the building site away from the foundation to provide proper drainage

• Covering exposed ground in any crawl spaces with 6-mil polyethylene film and maintaining at least 12 to 18 inches (300 to 460 mm) of clearance between the ground and the bottom of framing members above (12 inches to beams or girders, 18 inches to joists or plank flooring members)

• Supporting post columns by concrete piers so that there is at least 6 inches (150 mm) of clear space between the wood and exposed earth

• Installing wood framing and sheathing in exterior walls at least eight inches above exposed earth; locating siding at least six inches from the finished grade

• Where appropriate, ventilating crawl spaces according to local building codes

• Removing building material scraps from the job site before backfilling.

• If allowed by local regulation, treating the soil around the foundation with an approved termiticide to provide protection against subterranean termites

Preservatives

To avoid decay and termite infestation, untreated wood is separated from the ground and other sources of moisture. These separations are required by many building codes and are considered necessary to maintain wood elements in permanent structures at a safe moisture content for decay protection. When it is not possible to separate wood from the sources of moisture, designers often rely on preservative-treated wood.[22]

Special fasteners are used with treated lumber because of the corrosive chemicals used in its preservation process

Wood can be treated with a preservative that improves service life under severe conditions without altering its basic characteristics. It can also be pressure-impregnated with fire-retardant chemicals that improve its performance in a fire.[23] One of the early treatments to "fireproof lumber", which retard fires, was developed in 1936 by the Protexol Corporation, in which lumber is heavily treated with salt.[24] Wood does not deteriorate simply because it gets wet. When wood breaks down, it is because an organism is eating it. Preservatives work by making the food source inedible to these organisms. Properly preservative-treated wood can have 5 to 10 times the service life of untreated wood. Preserved wood is used most often for railroad ties, utility poles, marine piles, decks, fences and other outdoor applications. Various treatment methods and types of chemicals are available, depending on the attributes required in the particular application and the level of protection needed.[25]

There are two basic methods of treating: with and without pressure. Non-pressure methods are the application of preservative by brushing, spraying or dipping the piece to be treated. Deeper, more thorough penetration is achieved by driving the preservative into the wood cells with pressure. Various combinations of pressure and vacuum are used to force adequate levels of chemical into the wood. Pressure-treating preservatives consist of chemicals carried in a solvent. Chromated copper arsenate, once the most commonly used wood preservative in North America began being phased out of most residential applications in 2004. Replacing it are amine copper quat and copper azole.

All wood preservatives used in the United States and Canada are registered and regularly re-examined for safety by the US Environmental Protection Agency and Health Canada's Pest Management and Regulatory Agency, respectively.[26]

Ancient Construction Works

Timber was used as a dominant building material in most of the ancient temples of Kerala and coastal Karnataka of India.[27]

Timber framing

Timber framing is a style of construction which uses heavier framing elements than modern stick framing, which uses dimensional lumber. The timbers originally were tree boles squared with a broadaxe or adze and joined together with joinery without nails. Modern timber framing has been growing in popularity in the United States since the 1970s.[28]

Environmental effects of lumber

Green building minimizes the impact or "environmental footprint" of a building. Wood is a major building material that is renewable and uses the sun's energy to renew itself in a continuous sustainable cycle.[29] Studies show manufacturing wood uses less energy and results in less air and water pollution than steel and concrete.[30] However, demand for lumber is blamed for deforestation.[31]

Residual wood

The conversion from coal to biomass power is a growing trend in the United States.[32]

The United Kingdom, Uzbekistan, Kazakhstan, Australia, Fiji, Madagascar, Mongolia, Russia, Denmark, Switzerland and Swaziland governments all support an increased role for energy derived from biomass, which are organic materials available on a renewable basis and include residues and/or byproducts of the logging, sawmilling and papermaking processes. In particular, they view it as a way to lower greenhouse gas emissions by reducing consumption of oil and gas while supporting the growth of forestry, agriculture and rural economies. Studies by the US government have found the country's combined forest and agriculture land resources have the power to sustainably supply more than one-third of its current petroleum consumption.[33]

Biomass is already an important source of energy for the North American forest products industry. It is common for companies to have cogeneration facilities, also known as combined heat and power, which convert some of the biomass that results from wood and paper manufacturing to electrical and thermal energy in the form of steam. The electricity is used to, among other things, dry lumber and supply heat to the dryers used in paper-making.

Notes

a. Because working expensive hardwoods is far more difficult and costly, and because an odd width might well be conserved and be of use in making such surfaces as a cabinet side or table top joined from many smaller widths, the industry generally only does minimal processing, preserving as much board width as is practicable. This leaves culling and width decisions totally in the hands of the craftsman building cabinets or furniture with the boards.
b. In quarter sawn thicknesses, meaning the thickness and width dimensions as they come out of the sawmills table. Because lengths vary most with temperature, hardwoods boards in the USA often have a bit of extra length.
c. small set of specified lengths: Fixed length hardwood boards in the United States are most common in 4-6' lengths, with a good representation of 8' lengths in a variety of widths, and a few widths with occasional dimensional sizes to 12' lengths. Often the longer sizes would need be special ordered.
d. Fixed board lengths not apply in all countries; for example, in Australia and the United States, many hardwood boards are sold to timber yards in packs with a common width profile (dimensions) but not necessarily consisting of boards of identical lengths.

See also

- Board foot
- Lumberjack

- Yellawood
- Cubic ton
- Deck (building)
- Engineered wood
- Forestry
- Hardwood timber production
- List of woods
- Logging
- Non-timber forest product
- Pulpwood
- Recycling timber
- Timber treatment
- Wood
- Wood economy
- Woodworking

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Further reading

- Sathre, R; O'Conner, J (2010). *A Synthesis of Research on Wood Products and Greenhouse Gas Impacts* (PDF) (2 ed.). FPInnovations. ISBN 978-0-86488-546-3.

External links

- National Hardwood Lumber Association (http://www.nhla.com/) (Rules for Grading Hardwood Lumber - Inspector Training School)
- Timber Development Association of NSW (http://timber.net.au/) - Australia
- TDA: Timber Decking Association (http://www.tda.org.uk/)- UK
- TRADA: Timber Research And Development Association (http://www.trada.co.uk/)
- The Forest Products Laboratory. US main wood products research lab. Madison, WI (E) (http://www.fpl.fs.fed.us/)
- WCTE, World Conference on Timber Engineering (http://www.wcte2010.org/) June 20–24, 2010, Riva del Garda, Trentino, Italy
- Canadian Wood Council (http://www.cwc.ca/)
- Forest Products data in Canada since 1990 (http://nfdp.ccfm.org/products/national_e.php)

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