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### Wooden Materials and Construction in Architecture

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#### Abstract

Wood's qualities probably make it the most outstanding material for construction. As a renewable building resource, wood is environmentally friendly and consumes the least amount of energy during manufacture. Although new materials have emerged over time, wood still remains one of those most used today.

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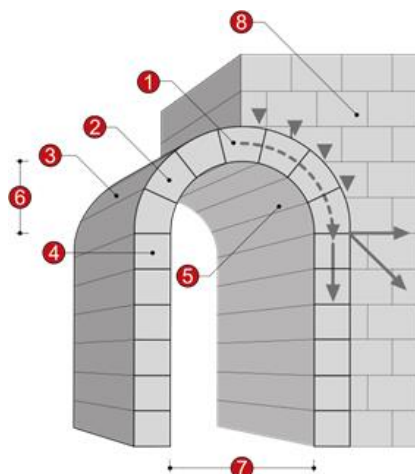
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Wood is one of the oldest building materials from which houses, bridges, towers and other fortifications were built. For the construction of arches, the ancient builders used circles - special wooden structures. The history of wooden architecture shows that with proper maintenance of wooden structures, the service life of wooden structures can be measured in centuries. For example, the longest wooden and oldest Chapel Bridge in Lucerne (Switzerland, Europe), erected in 1330, has survived to this day.



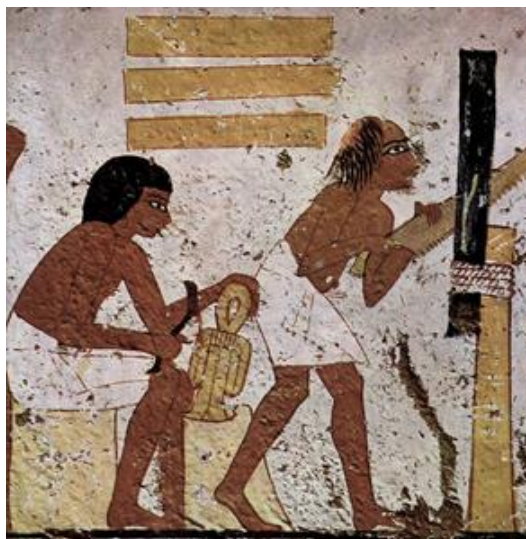
Masonry arch: 1.Keystone 2.Wedge stone (voussoir) 3.Outer surface of the vault (extrados) 4.Heel stone (impost) 5.Inner vault (intrados) 6.Climbing arrow 7.Span 8.Support wall.

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Wooden structures - building bearing and non-bearing structures made entirely or predominantly of wood, may have metal inclusions, as a rule, in the joints. Wood structures are reliable, durable and available in processing, and most importantly, they are environmentally friendly. Timber structures can be *beams*, purlins, decks, trusses, *arches*, *vaults*,. Joints of wooden structures can be glued, on cuts, on cylindrical and lamellar pins, etc. *Arches* (fr. Arc, Italian arco, from lat. Arcus - arc, bend, German Bogen) - a type of architectural structure, arcuate overlap of the opening - the space between two supports - columns, pylons. An arch extending into the depth forms a vault. Thus, the arch becomes the "guide" of the vaulted structure. In the history of architecture, semicircular, lancet, box-shaped, elevated, perspective, flattened, lanceolate, three-bladed and multi-bladed, horseshoe-shaped, keeled arches are known.

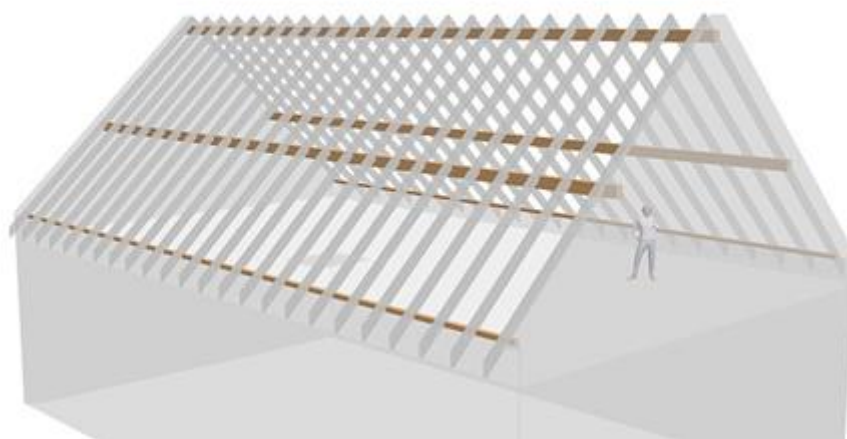
Wooden structures can be of solid homogeneous elements or composite (glued), can also be solid or prefabricated. Elements of timber structures in engineering calculations can be considered as centrally stretched, centrally compressed (see tension-compression), bending, compressed-bent and stretched-curved. Bearing structures - a set of structures of a building or structure, which, statically interacting, withstand loads, provide the strength and stability of the building. The rest of the building structures are called enclosing (self-supporting). The main structures that accept the loads arising in the building make up the load-bearing frame, that is, a set of horizontal (floors) and vertical (walls, pillars, posts, columns, etc.) (sometimes inclined) structural elements. In addition to the frame, foundations are considered to be load-bearing structures (loads of the load-bearing frame are taken and distributed to the base of the building, for example, to the load-bearing soil), stairs, and a roof (a flat roof is sometimes referred to as overlappings). Woodworking - technological processes used in the processing of wood and wood materials to give them a certain size, shape and quality, as well as to obtain finished products. Includes: cutting, bending, gluing, assembling and finishing. Woodworking is carried out using a variety of woodworking tools and machines. Woodworking products: materials and semi-finished products - boards, bars, plywood, wood-based panels; finished products - wood. structures and structures, carts and coopers, furniture, musical instruments, sports equipment, stationery, containers, pallets, etc. Woodworking has existed in the handicraft and craft form for a long time.



*Image of carpenters from the ancient Egyptian tomb of Nebamun and Ipuki, XVIII dynasty.*

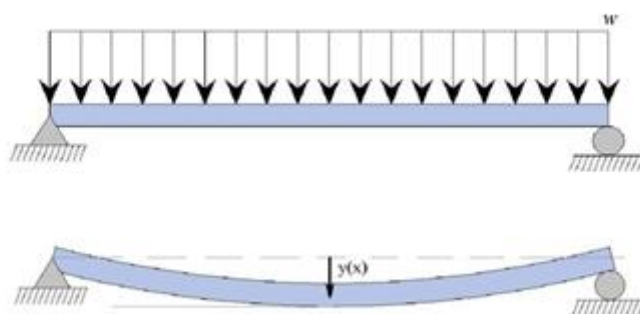
*Beam* is a linear (since the length significantly exceeds both the width and the height) element of load-bearing structures, with different support conditions and working mainly in bending. Various sections are produced (T-beam, I-beam, box-shaped, timber and others). In practice, as a rule, a horizontally

located beam perceives a vertical transverse weight load, but in some cases it is necessary to take into account the influence of probable horizontal shear forces (for example, a wind load or when taking into account a possible earthquake). A loaded beam, in turn, acts on supports, which can be columns, suspensions, walls, or other beams (crossbeams). Then the load is transferred further and, as a result, in most cases, is perceived by the structural elements working in compression - the supports. Separately, we can single out the case of a truss structure in which the rods are resting on a horizontal beam.



*A statically definable beam with hinge support at the ends under a uniformly distributed load*

A girder is a structural element of a building, a horizontal beam. The run rests on the supporting structures of the structure (walls, columns, pylons, trusses, beams, traverses), supports other beams and the roof of the building. It can be made of metal, reinforced concrete or wood. Metal purlins can be solid or lattice. Wooden purlins are solid, or they can have a closed or open cross-section. In roof construction, purlins are classified into three types: ridge purlins, side purlins, and Mauerlat. The upper part of the roof (ridge) rests on the ridge girder. The side girders are located between the ridge and the base of the roof to provide additional support for the rafters. The Mauerlat is located at the base of the rafters and is laid on top along the perimeter of the outer wall.



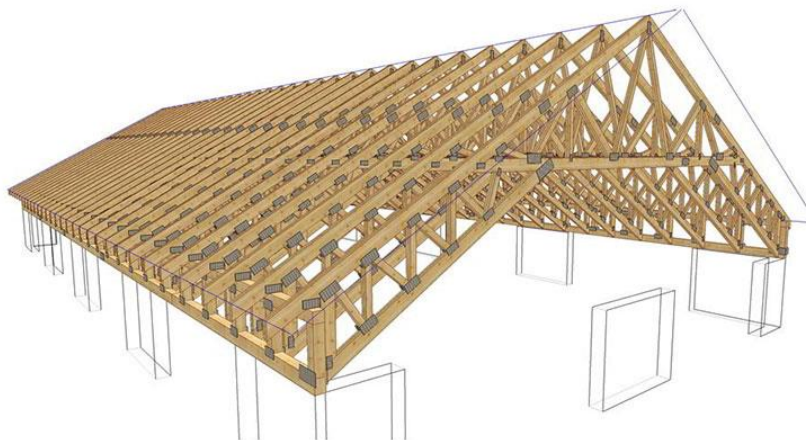
*Gable roof with ridge girder, side girders and Mauerlat*

*Vault* (from "bring" - to connect, close) - in architecture, the type of overlap or covering of a space (room) bounded by walls, beams or pillars - a structure that is formed by inclined surfaces (rectilinear or curved). Vaults allow covering large spaces without additional intermediate supports, they are used mainly in round, polygonal or elliptical rooms in terms of plan.



*Vault made of wood*

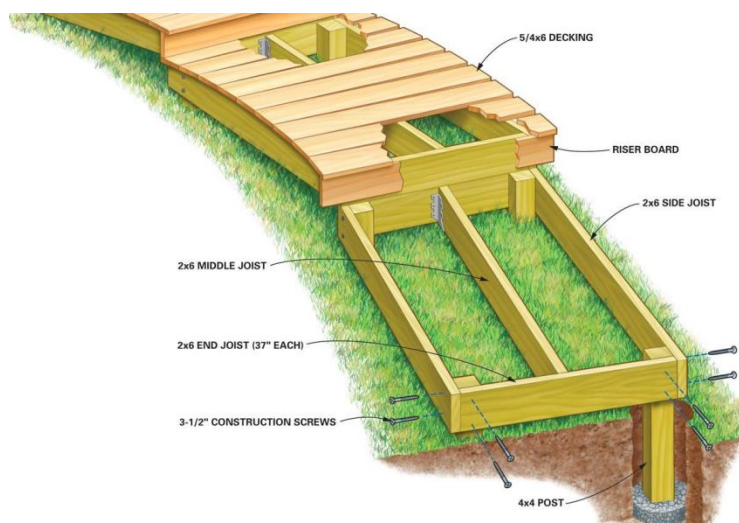
*Ferme* (fr. Ferme, from lat. Firmus - "strong") is a pivot system in structural mechanics that remains geometrically unchanged after replacing its rigid nodes with hinged ones. In the elements of the truss, in the absence of misalignment of the rods and off-node loads, only tensile-compression forces arise. Trusses are formed from rectilinear rods connected at the nodes into a geometrically unchangeable system, to which the load is applied only at the nodes. Truss beams, with a reservation, include truss beams, which are a combination of a two- or three-span continuous beam and a spring rod; they are typical for steel and timber structures, with an upper belt made of continuous rolled profiles (sawn timber or packages of glued boards). There can also be truss reinforced concrete trusses of small spans.



*Farm made of wood*

Wooden floorings in front of the house are multifunctional structures. They can serve as a terrace and be a continuation of the house - or they can be located away from home, in the garden (or on the shore of a reservoir). Wooden flooring for the street is also able to solve the problem of the complex relief of the site. Raised off the ground, it will help make the hilly area usable. It can be used to equip a recreation area, a playground for children or a patio. Wooden flooring is quite often used for functional furnishing and decoration of plots.





*Wooden flooring*

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