The Usage of Wood Materials in Architecture

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Abstract: This article is dedicated to contemplate the usage of wood materials in the modern architecture. The purpose of this article is to introduce readers to a modern architecture, and show the place of wood in it. The article highlights the feature of applying the timber to the interior décor and how it will be advantageous in modern life. The main aspect of the research that formed the basis of this article are how the development of civilization and development of wood processing influences why timber is an acceptable option in the construction of houses and in the interior. Based on the researches of modern architect from wide web we may say that in the current constructions frequently observed the applying wood and modern types of timber. And according to this researches, the author put forward a number of proposals and recommendations aimed at introducing the readers to a modern constructions build of wood.

Keywords: architecture, modern, building, wood, timber, construction, material, decorate.

I. Introduction

Wood is a universal and, at the same time, a unique material deeply rooted in the history, culture and life of people all over the world.

The color, texture, strength, flexibility and acoustic properties of different types of wood have interested architects, designers, builders and artisans for thousands of years.

Figure 1/ The "carbon negative" cultural center in Shellefteo in northern Sweden is built of local wood, including a 20-storey hotel building. The authors of the project are the White Bureau.

Even today, no other material can compare with wood in versatility and natural beauty. Modern designers and architects still choose wood and, subjecting it to various types of processing,
create new interpretations of the use of this material. Especially popular is the influence of Scandinavian and Japanese traditions, which are distinguished by functionality, beauty and lightness.

The Scandinavian construction and design traditions are based on the use of wood. The Finnish architect and designer, the "father of modernism" in Northern Europe, Alvar Aalto (Alvar Aalto) has opened a new look at wood to the world, which in his understanding is a "living material". The design of the Finnish Pavilion, presented by him at the World Exhibition in Paris in 1937, combined modern and traditional methods of wood processing and was rightfully recognized as one of the most innovative projects of the exhibition. Aalto's experiments with the use of bent wood led to the appearance of bent wood chairs (Paimio Chair, 1931) and brought the use of wood in industrial design to a new level. The influence of the Aalto Master on the formation of trends in the use of this material we see even today. They were partly adopted by other modernist masters, including Charles and Ray Eames and Eero Saarinen.

The use of wood in Japanese architecture is distinguished by a strict style, lightness of materials, as well as the close connection of interiors with open space. The minimum amount of furniture in Japanese homes is compensated by unique techniques of its creation - the connection of fragments without the use of nails, various surface treatments and the search for the right tone of wood. From a massive unyielding material in the hands of craftsmen, wood turns into flexible polished plates with countless unique "drawings". In the field of retail and hospitality, the tree also plays an important role. For example, the non-standard design of the store of the Australian cosmetics brand Aesop and the Hermes store in Paris.

Figure 2. Traditional Japanese house.

Recently, wood has also often been used to equip luxury resorts. Wooden frame structures, furniture and interiors radiating warmth and comfort, give the rest an additional flavor.

II. Research

The widespread use of wood is by no means a tribute to fashion; it is an ancient, noble, living material that we have the privilege to use. Wood in architecture - general trends Wood as a building material, durable, light in weight and in processing, hygienic and relatively cheap, has always found and is widely used. Dwellings, public and industrial buildings have long been built from it. For example, in Russia before the XVIII century. construction in cities and rural areas was carried out mainly of wood, and it is no coincidence that buildings made of it were so improved in artistic and aesthetic and constructive relations that they gave rise to a peculiar style of architecture known as Russian wooden architecture. In the following decades, a significant improvement in the properties of wood due to antiseptics, impregnation with flame retardants, pressing made it a non-rotting and difficult-to-burn material with increased strength and expanded the possibilities of wide use of wood in architecture. The appearance of a particularly
strong adhesive for connecting individual elements has made it possible to create such wooden structures that successfully compete with load-bearing structures made of high-strength materials. In this regard, we can safely say that the problem of the integrated use of wood is one of the urgent problems of modern architectural and construction practice. The construction of wood materials acquires a wider scope, and wood material successfully replaces materials such as reinforced concrete and brick. Modern construction wood undoubtedly has a number of advantages that help to create new architectural forms and determine the industriality and mass character of construction. The main volume of wood is used in construction and architecture, which remain its main consumers.

Catalogs of wooden construction products include hundreds of names, and with further improvement of the construction properties of wood, their list will be replenished with new types of products. Today, timber is mainly the products of automated enterprises used in prefabricated industrial construction. And if in the recent past, timber was used in construction only in its natural form (logs, beams, boards, slats, etc.), now products are supplied to the construction in the form of enlarged structural elements ready for use, details of facings and decor mounted on a conveyor. These products should be called products made of a new type of building material - "updated" modified wood, which, with the technical improvement of processing tools and technology, opens up wide opportunities for its effective use. Wood in architecture - general trends - Wood in architecture In our country, a powerful material and technical base for wood processing is being created, which will have large mechanized and automated enterprises for the production of a wide range of wood products. Thanks to the use of effective means of wood processing, our factories have started the production of glued wooden structures, prefabricated houses, individual structural elements and various wood products. But during the reorganization of our construction industry in the early 50s, wooden house construction remained aloof from the general development of the industrialization of the construction of buildings. There was an opinion that, unlike precast reinforced concrete and metal structures, wooden structures do not meet the requirements of complex mechanized in-line production. The development of science and technology has proved the opposite. In particular, the experience of manufacturing and using wooden glued structures of various shapes on a large scale has confirmed the economic efficiency of their use in industrial construction. Wood in the architecture of small-sized lumber in glued structures. Glued joints made it possible to obtain monolithic structural elements of considerable length and any configurations. Thanks to the introduction of a new technology based on complex mechanization and automation of in-line production, all conditions have been created to increase labor efficiency. Therefore, determining the prospects of wooden construction, it is safe to say that the transition to mass production of glued wooden structures in our country, which has rich forest resources, is extremely necessary, and modern industrial methods should be used as the basis for their manufacture. The field of application of glued wooden structures is mainly public and industrial buildings. Effective coating designs are not only medium-sized, but also significant in size spans (from 20 to 100 m), which, with high load-bearing capacity and low weight, as well as with good moisture resistance, are durable in operation. In large-span domed, arched and vaulted structures of buildings, glued wood successfully replaces such traditional materials as reinforced concrete and metal. Under certain conditions, the use of glued wooden structures is also advisable for the construction of other types of buildings and structures, as well as small architectural forms. The improvement of the architecture of wooden structures can be achieved only by identifying the aesthetic features of wood. For modern wooden architecture, its own forms, inherent only in scrap material, have been determined. Glued wooden structures and pressed wood make it possible to create not only geometrically correct, but also complex curved shapes of shells, vaults, domes and coatings such as hyperbolic paraboloids rich in their plasticity. The surfaces of the turf can be concise and at the same time expressive, neutral or, on the contrary, with a pronounced structure. Architects have been thinking about the problems of aesthetics of wooden buildings since ancient times, many beautiful works of architecture have been built from wood. However, in theoretical works, researchers of wooden architecture did not always pay enough attention to the artistic
expressiveness of these structures, their efforts were mainly aimed at studying the properties of wood, analytical analysis of structures or descriptions of individual buildings. Now there is enough material about the use of wood in modern architecture - in small-scale buildings, in large large-span structures and buildings of complex configurations. The aesthetic qualities of such structures are characterized by a clear composition of the whole, scale, proportionality, severity of decor, active use of the texture and color of elements of wooden structures and wood products. The development and introduction of new materials, products and structures made of wood becomes a clear example of the implementation of scientific and technological achievements in the creation of various architectural forms. Wood is the only material in nature, the reserves of which are constantly and fairly quickly replenished. If the forest resources are handled wisely, then humanity will be provided with this excellent building material not for decades, but for centuries.

The forest is one of the main types of the plant world of our planet, represented by numerous forms of plants, among which the main place belongs to trees. The ecological significance of the forest is great. Being the most important component of the natural complex, it performs stabilizing functions in regulating natural processes occurring in the biosphere of the planet and in the composition of its atmosphere, has a beneficial effect on the climate and hydrological regime. One of the main features of the tree is the variety of species, sizes, shapes and properties of timber. This allows you to satisfy almost any requirements imposed on the tree. Wood has a high specific strength, high durability and operational properties, which is important when using wood as a building material. The dry wood of the tree has good insulating properties with respect to heat, sound and electricity. Under appropriate conditions of use, wood tends to absorb and dissipate sound vibrations, being an indispensable material for many musical instruments. Due to its unique texture and color, wood is an aesthetically attractive material, and its appearance can be improved with various types of finishes. The wood of the tree is easy to give the desired shape by machining, it can be connected with adhesives, nails, screws, bolts and other fasteners. Damaged wood elements in structures can be easily replaced, and the structures themselves can be rebuilt. In addition, the tree is resistant to oxidation, the action of acids and aqueous solutions of salts. The tree has a good resistance to shock loads, perceives impregnation with antiseptics and flame retardants, which further increases its value. Wood is perfectly combined with almost any materials, both for functional purposes and for aesthetic effect.

Historically, some types of wood are used for many purposes, while other types of wood, less accessible and lacking the necessary qualities, were used only in one or two areas. Oak is out of competition in terms of breadth of application. Due to its viscosity, strength and durability, it was highly valued in various fields: shipbuilding and bridge construction, cooperage, house construction and the manufacture of tools, sleepers, and, of course, floors, stairs, furniture and paneling.

Currently, hundreds of wood species are used in the world, which are divided into two broad classes - deciduous (hardwoods), and coniferous (softwoods). It is easy to distinguish them - conifers are distinguished by needle-shaped or scaly leaves (needles) that remain on trees throughout the year (the exception is larch), and hardwoods, again with few exceptions, shed their leaves in autumn or winter. Both have their own characteristics and a wide range of applications. Sawn products of coniferous trees are used in construction for formwork, scaffolding, frames, floor covering, ceilings, profile products for exterior and interior decoration, paneling, simple built-in furniture, window covers, etc.

Hardwoods are in demand in construction for floors, architectural, decorative products, profile products for interior and exterior decoration, paneling. Most of the deciduous trees are used for furniture, floors and containers.

But, before being used, the tree undergoes a long and complex technological process consisting of competent drying, protective and decorative surface treatment, cutting, sorting by strength, appearance and finish quality, and even processing and grinding of wood. As a result,
construction and furniture production receive solid wood materials for their needs - the most valuable, cheaper glued wooden structures, or numerous types of chipboard and fiberboard, which are then primed, painted, varnished, or covered with veneer and plastic.

Currently, modern woodworking technologies combined with the uniqueness and uniqueness of the natural properties of wood allow you to create exceptionally durable wooden houses, furniture, tools and decorative structures from wood. Their perfection is achieved by using the results of technological development in the production of wood products. This allows you to maintain the characteristics and guarantees for a product made of wood are the same or even higher than from any other material.

In just a couple of years, one of the most unusual and innovative buildings in all of Europe will appear in Stockholm - a high-rise called Big Wood. The fact is that this 34-storey building will be the world's first wooden skyscraper.

![Figure 3. Big Wood - wooden skyscraper in Stockholm](image)

The above-mentioned 34-storey skyscraper Big Wood is only just planned for construction in Stockholm, but a completely ready multi-storey house made of wood has already appeared in the Swedish capital. It was built by Wingardhs Arkitekter architectural bureau commissioned by Folkhem.

![Figure 4. Residential wooden high-rise building in Stockholm](image)
The eight-storey residential building has a height of 26 m. It houses 31 apartments ranging from 55 to 130 square meters. And this is only the first construction in the future experimental micro district consisting of four wooden houses.

![Figure 5. Residential wooden high-rise building in Stockholm](image)

When this 540-meter bridge over the Inguri River in the Georgian town of Anaklia was put into operation, local residents decided that it was only a temporary structure, and the media oppositional to the authorities even rushed to report that it was demolished after the first heavy downpour. And all because the bridge structure was completely made of wood.

![Figure 6. Wooden bridge in Anaklia](image)

The most famous facility on the campus of the European Organization for Nuclear Research (CERN) is the Large Hadron Collider, a charged particle accelerator with a ring length of more than 26 kilometers. But there is another outstanding building on the territory of this institution – the Globe of Science and Innovation Museum.
Figure 7. Globe of Science and Innovation - Wooden Science Museum in CERN

This domed building was opened at CERN in 2004 as a museum of modern technologies, as well as a platform for demonstrating the latest achievements and research results of scientists working in this organization. The structures and exterior decoration of this structure are built of wood, which looks very unusual on the territory of one of the largest and most reputable scientific institutions in the world.

Figure 8. Globe of Science and Innovation - Wooden Science Museum in CERN

The small town of Jackson in Wyoming is known for being a transit center for guests of the famous Yellowstone National Park, visited annually by millions of US residents and people from other countries. And since December 2013, this locality boasts one of the most beautiful and cozy airports in the world.
In many large and small Spanish cities, there are special places in the central squares where you can relax in the shade. These can be balconies hanging over the first floors of houses, or individual structures – giant umbrellas right in the middle of the square. And the largest object of this kind appeared in 2011 in Seville.

Metropol Parasol is a giant canopy of unusual shape, which looks like a cloud hovering over one of the squares in the center of the capital of Andalusia. The roof of this wooden structure is 175 meters long and 50 meters wide, which makes it the largest wooden object in the world.
Figure 11. Metropol Parasol - giant wooden umbrellas in Seville

Figure 12. Metropol Parasol - giant wooden umbrellas in Seville

References.