History of Methods and Materials Used in the Construction of Traditional Houses in Romania

Abstract: Constructions of a house to live in, is a complex process and it involves a lot of decisions to make. Along the history of the humankind, builders were people respected by the society and in each region of the globe there are a series of customs and habits related to the construction of the house. The purpose of this paper is to identify the main construction materials used to build the homes in rural areas from Romania. We also identify the main traditions for organizing the construction works as well as the tools that they use. The focus of the article is to record and popularize the history of old simple construction technics used in building houses.

Keywords: construction materials, history of construction materials, construction work organization

INTRODUCTION

Most of the time the decision of building you own home is an important decision and if we take into consideration the cost involved, we can say that for most people is the biggest investment that they will make in their lifetime. The household belongs to the village economic order, in its way, the villager fulfilling his material purposes. The house goes beyond this limit, in the area of realities that exceed the means of subsistence. Precisely for this reason, the construction of the house is related to the seven that do not have a material and utilitarian character, but a spiritual and aesthetic one.

The structure of these papers follows the structure of scientific paper. In the first part of the paper we presented a briefly history of the houses constructed in the north east area of Romania, Europe. We focus on the models of houses in the rural architecture and on the popular architecture in the area. The next section of the paper we identified the main construction materials used throughout the history in building houses in the area and present how the materials were obtained by the owners. Further on we identify how the construction works were organized and what are the main characteristics that the builders had in mind in choosing the construction solutions. In the last part of the paper we present the tools used for building the houses. The paper is closed by the main conclusions and the bibliography used in this paper.

Brief History Of House Building In The, N-E Area Of Cluj County In Romania

The rural architecture of Transylvania is very diverse and complex. The variety of functional forms of buildings, households and local structures, the planimetric (Gheorghe, 2018; Maier, 2018a), volumetric, structural and ornamental diversity of rural buildings is a clear consequence of the geographical complexity and socio-economic and ethnocultural characteristics of the region.

The territory that is in the focus of research is the Transylvania region, the territory surrounded by the Eastern, Southern and Western Carpathians, so the center of the country, without the territory of Banat, Crișana and Maramureș - the N-E area of Cluj County (Maier, 2018c; Puiu, 2019).

Levels of rural architecture zoning

The four planimetric models used in the 18th century are the basis for delimiting the macro-regions of Transylvanian rural architecture:

- The pantry house used by the Romanian population in Apuseni and the Pădurenilor Region, with connections to the rural architecture of Gorj and Vâlcea.
- The eaves house with a room heated by a tile fireplace, characteristic of the eastern strip of Szeklerland which is the result of an internal evolution influenced by the architecture of the mansions.
- The house with an oven in the porch, characteristic of the central regions of Transylvania, influenced by the evolution of mansions and city buildings.
- The house with oven in the room and free porch, characteristic of the northern Transylvanian region, is a form present on a vast territory, which also includes the northern territories of Hungary.
In the 19th century, the area of houses with a kiln in the porch widened to the east and west to the detriment of the areas corresponding to houses with pantries and eaves (Baca, 2014; Maier, 2018d; Project, 2020). To the north, we find the existence of a transition zone of significant size, where both functional types are present. From the end of the nineteenth century and the beginning of the twentieth century, the functional type represented by the house with clean room - kitchen room becomes predominant in all four areas determined above.

The Someș area, ie the territories east of the Someș Valley, north of Cluj-Napoca and east of the Borșeș Valley which extends to the peaks of Meses, is a transition area where there are specific forms of the house area with oven in the porch, respectively the house area with oven in the room. In the twentieth century, it also received impulses from the direction of the Călata Zone (Furu, 2015; Maier, 2018e; Vadastreanu, Maier, & Maier, 2015). The characteristics of the area are close to those of the Lăpuș Area, the type of material used on the walls generally differs.

The outbuildings in the household are determined by the agricultural production characteristic of the area, respectively by the social status and welfare of the owner.

**Popular architecture from Transylvania**

- building materials: wood and stone, clay and lime;
- household components: dwelling, barn and stable, outbuildings (huts, carpentry, basket, tool shed and firewood, etc.);
- arrangement of the components: the house on the street front and the secluded annexes on the opposite side;
- the plan of the houses is quadrilateral, with three rooms (a central porch and two rooms) or more (rooms, pantry, cellar, etc.);
- the walls of the constructions are made of veneered beams;
- the facade of the house is provided with a porch, bordered by pillars and a railing;
- the roofs are raised in two or four waters and their roof is made of shingles, straw or reeds;

Given that we have chosen a traditional area as a study area, it is also affected by migration in the modern era. Of course, we looked for long-lived populations as a percentage of the total population of the studied community, but in modern times, starting with the 20th century, the composition of the population was affected by migration depending on the personal interest of the person who made this decision, more developed and accessible, as well as more and more accessible material means as the standard of living and personal demands increase (Maier, 2018b; Radoi & Postelnicu, 2016). Thus, in selecting the target population I will also take into account the absolute number of longevity, in addition to their share.

1. **Construction materials used for building rural houses**

   **According to the destination, the construction materials are divided into:**

   - masonry materials;
   - binder;
   - aggregates;
   - waterproofing materials;
   - thermal insulation materials;
   - soundproofing material;
   - Finishing materials.

   The construction materials used were determined by the natural conditions, but also by the social relations and the material well-being of the inhabitants. The technical characteristics of the constructions reflect the influences of the geographical factors in the respective area:

   - The buildings are located on accessible surfaces, with a reduced slope, with exposure to the sun, near roads and aquatic units (lakes, rivers), etc.;
   - the materials used are stone (cheap, durable), wood, reeds, straw, sand, lime and clay (cheap and handy);
   - the thickness of the walls, the appearance of the roof, the number and size of the premises and the size of the windows depend on the climate of the respective area, and the color of the exterior and the decorations reflect the cultural side of the population;
   - The volume and compartmentalization depend on the social status of the owners and the tradition.

   Most often they were obtained from nature, a few years before the start of the works to be good to put in place.

   **The wood** was cut, shaped and kept dry in stacks arranged to dry. This is a natural material found in nature in the form of trees and shrubs. The main properties of wood are resilience, compressive and tensile strength, durability and thermal and acoustic properties (Maier & Marusciac, 2011). This building material is still used today in its natural form, but it has received a series of processing from which derived products emerge, the most used in the modern era being chipboard (wood chipboard, MDF (medium density fibreboard) and oriented strand board (OSB) which are derived from wood falls, the technologies for obtaining these materials leading to the use of wood on a larger scale, practically reducing the losses obtained from its raw processing.
Stone is a natural building material composed of natural aggregate of mineral substances and are of three categories: sedimentary, eruptive and metamorphic according to their mineral composition. It was brought and sorted into piles, according to size and type of use. The same was done with the sand extracted from the nearby riverbed (Maier, 2019). Thus, the watercourses along which human settlements were built in general, we notice that they also have an important role in building the house, in addition to the fact that water was essential in daily life and in agriculture, in addition to being a resource important industrial development.

With a special specificity we find a special stone called zeolite, also known as hot stone due to the fact that it releases water if heated, which is a sedimentary rock of volcanic origin, composed of hydrated hydrated calcium, sodium, potassium, magnesium silicates, manganese etc.

The adobe (vaiog) is a construction material widely used in the analyzed period and was made / prepared in parallelepiped shape, brick type but not burned. It is made from a mixture of clay / clay, straw and horse manure, shaped and dried naturally in the sun. It was generally considered to be a building material used by the poorest people who built houses but was found to have good earthquake resistance and low thermal conductivity (it heats up hard and gives off heat slowly) this being a very insulating property, appreciated in the construction of houses. The adobe houses are considered ecological (green), cool in summer and warm in winter due to the thermal insulating properties of adobe and are considered houses that “breathe”, ie ventilated, providing a healthy living environment. The big drawback is that they are sensitive to moisture and when soaked in water they lose their load-bearing capacity. However, according to the rules in force, they are guaranteed for 20 years and with adequate maintenance can exceed a lifespan of 70 years, found in practice.

The lime pit provides the main binder when building a house. Extinguished lime and water were used. Construction lime is used as a basic binder for plaster mortars or as a plasticizer additive to cement mortars.

The reeds were harvested in the fall and then "woven" into carpets that were applied to the ceiling to support the plaster, acting as a reinforcement.

Brick is a material of artificial construction, prismatic in shape, obtained from a mixture of clay, sand and water or other materials (concrete, blast furnace slag, etc.), dried in the sun or burned in the oven.

Towards the end of the analyzed period, following the appearance of factories that produced bricks, cement and other construction materials on a large scale, they began to be used more and more, being used to this day on a large scale for the construction of most houses. The obvious advantage is the durability and speed with which you could work to build houses.

Tile is a piece made of a wear-resistant material, such as clay (most often), stone, metal, cement, or even glass, used to cover roofs, floors, walls, and more.

In fact, nowadays we can go to DIY stores and we can buy absolutely any construction material, tools and other necessary things, being able to build our own house if we have the necessary and sufficient energy. We even have, in the digital age in which we are, on the internet, the possibility to find free information starting from the architecture project, the necessary construction materials for the house, explanations and video examples about any technologies and construction materials as well as training. Free construction of a house of modern composite materials and examples of their efficiency. But what is more interesting is that as the cost of building materials decreases and the speed of construction of the house increases by using semi-finished products or modern technology, people are increasingly looking for the old qualities of houses that were much healthier and more environmentally friendly, . in parallel with the reduction of consumption for the operation and comfort of the house, with tendencies to reach the passive house, which does not consume natural resources in operation and does not pollute the environment. I consider these to be very important elements in defining the upgraded / evolved house that together with social and medical factors can lead to a long and healthy life in the home we call our home.

2. Carrying out the work and the organizational scheme of the work team

From the discussions with several traditional craftsmen with a very old age, who worked in the field of constructions in the sampled area, it resulted that the organizational scheme consisted of a chief who led the works (foreman), polical and a small number of specialized craftsmen, various types of work such as: stonemason / mason, carpenter / carpenter, painter / painter and very few unskilled, practically apprentices who learned the trade to become journeymen. The rest of the unskilled work was often provided by the beneficiary of the work, usually the newlyweds and their families, who were occasionally joined by neighbors who acted as clackers.

Ever since that period, the importance of orienting houses according to the cardinal points has been known. Construction in this way ensuring a heat input on the southern facade (+5 degrees C) compared to the northern facade a heat deficit (-5 degrees C) according to design data in construction.
The houses at that time were not made on the basis of a project in the sense in which we understand it today, but on the basis of at most some hand sketches, made by the craftsman and agreed with the beneficiary according to his material and financial possibilities.

Another way to choose the type of house you wanted was to replicate constructions made by craftsmen before. In the construction technique, certain patterns were often used, such as the proportions known to the builders’ guild, namely the gold number.

The string of Fibonacci numbers represents numbers in which each new number that follows is equal to the sum of the two previous numbers. There is a strange connection between this string and some things in nature. The shell of the shell respects this principle, sunflower seeds, and pineapple fruit.

The gold number is 1,618. If we divide two successive numbers, from the Fibonacci sequence, we get the golden number. Nature is created according to an order that remains a mystery. We will never find a daisy that will have 14, 22, or 56 petals.

Pine needles also follow the Fibonacci principle. There are no scientific explanations. It is a golden rule that nature follows. The golden rule is also respected by human DNA. In architecture, the temple of Solomon, the pyramids, the Pantheon, the churches, all follow the golden rule of proportions.

In architecture the most used geometric shape is the rectangle, which respects the golden rule. If we divide the length by the width we will get pi, the golden number. The golden or isosceles triangle has angles of 36 and 72 degrees, the principle of the golden rule is respected.

In 2013, two researchers, with the help of a high-performance computer, managed to calculate the number pi. It has 10,000 billion decimals. The number goes to infinity, in a precise and at the same time mysterious order of decimals.

Researchers claim that decimals are not placed randomly, there is no chance. The decimal hundredth of the number pi is 9, the thousandth is 9, the position of the decimal one million is also 9. The proportion of plants, the proportion of the human body, respects the principle of the golden number.

Fibonacci created this string of numbers, starting from a simple problem. If we have a couple, a female and a male, of rabbits and it produces a new pair of rabbits, in a month, just as each new couple will produce another couple, in a month, how many couples will form?

The result is incredible, 1, 1, 2, 3, 5, 8, 13, 21, 34…

The sum of the two preceding numbers is equal to the next number. If we divide the next number by the previous one, we get, 1,618, which is the golden number.

In 1509, Fra Luca Paciolo published De Divina Proportione, which was illustrated by Leonardo da Vinci. The book develops the golden principle of architecture, geometry, mathematics. It is the first treatise on the number of gold. The author believes that the golden number has not only mathematical properties. It has characteristics related to aesthetics, mysticism and divinity - gold number -

Leonardo da Vinci was the first to analyze the proportions of the human body. He showed that every component of the human body respects the proportion of the golden number. Most painters respected the proportion of gold in their paintings. The golden number, pi or phi, comes from Phitias, a Greek architect, who introduced the proportion of gold into architecture.

The organization of the site necessary to carry out the work consisted in creating a shed with a protective role in case of weathering of materials that risk being damaged, but also being used as a locker room and dining area.

I mention that the water was extracted from a well that was previously dug by well craftsmen.

The toilet was arranged in the back of the property, in the farthest place from the house, by digging a pit and arranging a wooden construction, with the role of private.

The fencing of the land on which the construction is carried out was not necessarily done from the beginning. Given that the works were carried out in the spring-summer-autumn period, the working day was used at maximum capacity, approximately 10-12 hours a day, which meant that the lighting was not very important.

The lunch break was set for lunch, on which occasion the beneficiary provided a hot meal, followed by a short nap period of about 30 minutes. The builders did not work during the cold season, practically in the period before Christmas and until after Easter.

Claca meant voluntary work performed for a third party for his benefit. In fact, it was voluntary help or mutual collaboration provided in the family or between neighbors from a certain community or area. The payment was in kind through the end-of-work party and the moral obligation to participate in another work for the benefit of the one who helps you. In rural areas, it was the most common method of doing occasional
teamwork when someone was building a house and needed a large amount of work / labor at a time. It was usually used for digging the foundation, transporting and unloading construction materials and finally for cleaning and fencing the construction site.

The work equipment specific to our days did not exist then, using work clothes that everyone brought from home.

Protective measures were strictly reduced to the care they took of each other to avoid accidents at work. Over time, relationships of friendship and kinship were established within the work teams. Payment was made in cash and / or in kind (barter system).

3. Machinery, work tools from that period and the transport of construction materials

The wood material - beams and planks - was purchased from sawmills that finished them for this purpose or the processing was done manually at the working point.

In order to obtain the stone, various equipment was used to extract the stone from the quarries, but stones were also brought from the river as well as sand from the riverbed that was sifted and prepared according to needs and work operations.

Tools and work tools used:
- Carpenter: hammer, pliers, axes, saw, saw mill, ropes, pulleys, straight, level, meter, square
- Mason: shovel, trowel, towel, wooden box for preparing mortar, wheelbarrow, screed, bucket, level hose, lead wire, square, compass, straightener, leveling, chisel, hammer
- Painter: paint brushes, bucket, rulers, and templates for various models to paint.

The transport of these construction materials was done by means of locomotion such as the cart pulled by animals and motorized means towards the end of the analyzed period.

CONCLUSIONS

The construction of a home for a family is an important process. In this paper we highlighted the main categories of houses constructed in Transylvania area of Romania. We also presented the main construction materials and organization of the works as a sense of appreciation for the builders we can highlight the certification of the quality of construction works. After the construction works were completed, including the roof, a bouquet of flowers was placed on top of it, the head of the work received from the owner a towel that had the role of “quality diploma” of the work, and together, the owners with the work team, I drink a bottle of wine with joy that the new house was ready. In turn, the master builder hung the towels in his own house, as a proof of professionalism and personal experience, which were proudly presented in subsequent discussions with potential customers.

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