ISSN NO: 2770-4491
Date of Publication:10-07-2022

Functional foundations of architectural design

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Abstract: This article talks about the natural and climatic conditions of habitat formation

Key words: Architecture, design, history, functional basis, architecture

Functional foundations of architectural design.

We live in a world with familiar features: day follows night, seasons change throughout the year, water can be in the form of snow, air movement drives water circulation in nature, wind carries storms and rain, gravity forces a porcelain bowl on the edge of the table that orders the existing houses to stand up and not be put down. But these properties are unique and the earth, the third planet of the Sun, provides a high total state of temperature changes on its surface, it is due to the fact that the atmosphere, the "normal" gravity, the seasonal change of the seasons, the preservation contribution register and the rotation speed of the water as a fluid-carrying life. The presence of a tide-generating moon once pre-dated the migration of life from the oceans to land, and widespread climate change forced animals and later humans to migrate and develop adaptive responses. If a person always lives in comfortable conditions and is only biologically adapted to climate change, he does not need a built house, then a bed sheet will be enough for him. History records the immutability of lifestyles and the unwillingness to change them in areas of the planet where food and climate conditions are constant, such as Central Africa. However, at latitudes far from the equator, there is a change in climate — from dry and cold to warm and humid in the Northern Hemisphere. Currently, a period of warming has begun, accompanied by climate disturbances and unusual natural phenomena [24]. During climate change, people had to leave their habitats, and whole peoples affected by cold or heat moved to new lands. Moving to different places in terms of living conditions, people learned to create living environments that were less dependent on the vagaries of nature. In addition, even if the climate and natural conditions are satisfactory, a person moves from simple shelters such as a cave or a tree to the construction of a residence, the type and appearance of which is determined by convenient needs, a convenient form of economic activity, available building materials. Thus, unique, local types of buildings were formed in each place, on the basis of which zonal architecture was formed.

The separation of the inner space from the outer solved two tasks: creating a living environment with an internal microclimate and providing security from external enemies, i.e. tasks that we define as physiological and psychological when working with the inner space.

Man was able to adapt to the harsh conditions of the North and the dry heat of the continental part of the continents - zonal architectural forms demonstrate the amazing ingenuity and worldly wisdom of people who have achieved a harmonious unity of all aspects of their existence.

The home of the nomadic reindeer herders of the Far North is an igloo, a dome made of snow blocks and a tent made of poles covered with hides. The main function of these structures is to provide shelter from multi-day snow storms. Protection against the cold is provided by special clothing, a parka, which is basically a spacesuit. Clothes in the north are the first house, igloo and chum are the second house. This distinction is also appropriate for the reason that it is impossible to heat the inside of the stove up to a temperature of + 15-20 degrees, because its coating does not protect against the cold, and keeping a large fire (open, at the same time) can lead to a fire. can come If you heat the ice house, the igloo, it just melts. This means that the survival of the North and the favorable requirements for this region must be addressed with other measures.

Taiga accommodation-log cabin-is warm due to the thickness of the logs. Stoves in huts are large, massive; after the oven, they emit heat for a long time and allow to maintain a comfortable temperature in

ISSN NO: 2770-4491
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the room. This, in turn, allows you to separate clothes for home and street. In order to support the well-being of residents, people and animals during the long winter, the North property, together with the communal rooms, is covered with a common roof.

Houses in the middle zone, where all seasons are manifested in full force, must be protected from all natural phenomena: rain, snow and wind, heat and floods. Here, the roofs have a wide overhang and reliable waterproofing. The north-facing wall is being built with blinds or small windows. The main rooms are spacious to the south it opens with its charms. Average rainfall allows to separate the outbuildings from the residential building. The floors of the buildings are raised to a height sufficient to prevent the influence of soil moisture. The house is often built on two or three floors for greater compactness and heat preservation.

Silhouette and Southern district residential interior functional division have similar characteristics: they are more open to nature, verandas, terraces, entrance galleries along its own, umbrella-shaped buildings, street kitchens fast - fast - the mildness of the climate attached to them, the lack of resistance to nature affects everything.

The traditional folk house of arid regions, as a rule, is characterized by a pitched roof, the houses look like simple mud boxes, the windows of which are replaced by holes in the ground for ventilation. The residence is often formed in the form of perimeter galleries covering the garden with a swimming pool. To ensure maximum coolness, such houses are placed by galleries and entrances to the north.

Two Rivers unusual hot spot dwellings are often built with parabolic plasterboard domes over a square structure, with maximum ventilation in mind. A hole in the top of the dome creates an air draft, which makes life a little easier in a heated interior. To weaken the influence of the sun on the ceiling, its surface is sprinkled with grass, which increases the heat exchange of the roof and lowers its temperature. This technique was later used in arranging the gardens of Semiramis.

The Prairie House - the home of American immigrants - is characterized by ease of construction and openness to nature. Where the outside temperature is kept at room temperature throughout the year, there is no need to install thermal protection structures - frame and light partition walls are enough. Such a house has a spread layout with passages and open spaces.

Nomads of Central Asia live in gathering lands, moved after herds, driven to new seasonal pastures. The frame of the house consists of cylindrical walls with bars and a pole cone of the roof. In hot summer, when the main thing for a residence is its ventilation, the country will have an elongated silhouette; in winter, when it is important to save heat and increase the size of the dwelling, the land is flattened.

In the course of seasonal movements, settlers stop for the winter on the southern side of the mountain gorge - under the cover of the northern winds, where wooden houses are erected. Tents are used for hiking.

Japanese peasant housing, takayuka, is a structural system designed to withstand strong winds and typhoons, in the form of temples and storehouses. The frame volume of the platform-raised structures is covered with a heavy massive roof of rice straw, not on the frame, as in the case of independent columns supporting the ridge beam of the roof. A Japanese house is planned according to a module of 180 x 90 cm, which is the size of a tatami mat laid on the floor. As in Prairie House, closed structures are made in the form of lightweight parts.

Similarly, a saddle roof residence is being built on the Indonesian island of Sulawesi. This roof also has additional columns-supports that end with a spring structure. In keeping with the hot and humid climate, the floor of this house is raised above the ground, a perch, easily ventilated.

In the architecture of the ancient Chinese semi-earthen dwellings, the lantern - superstructure is interesting to ventilate the interior during the hot season and remove smoke from the hearth.

Most famous in this area of the earth is the wide extension of the "winged" roof, a smoke-resistant construction of a wooden structure that provides shade, rainwater drainage, and aerodynamic qualities that protect the roof from being thrown during typhoons. This "spring" structure, called Dou-gong, formed the structural basis and the source of artistic imagery in the spread areas of traditional Chinese architecture.

The architecture of zones of extreme climate and harsh natural conditions is built on the basis of established traditional forms and modern technological achievements.

Thus, for the architecture of earthquake-prone zones, various systems have been developed to neutralize the effects of earthquakes, the main technique of which is to break the rigid connection of buildings with the foundation with the help of elastic gaskets, springs and other shock absorbers.

ISSN NO: 2770-4491
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In the permafrost zone, for buildings built in Northern conditions, their own methods are provided to cut off the flow of heat from the place of residence to the permafrost layer, the melting of which threatens the collapse and destruction of the structure. By far the most reliable technique is building on piles.

Information on zonal types of housing by comparing, we can come to some conclusions about the influence of natural conditions on the type and image of the habitat.

1. The residence located in areas with unfavorable natural conditions is isolated, compactly built; on the contrary, a comfortable, mild climate suits a dispersed building form close to and open to nature.

2. Areas with heavy rainfall encourage the grouping of residential and commercial buildings under a common "umbrella". In such places, the roofs of the houses have a sharp silhouette. And the roofs of the Southern arid regions are very flat, with minimal removal of corners; such a roof may not be installed at all, and a plastered roof will save the building from excessive heat reflecting the sun's rays.

3. In places with a very hot climate, houses are equipped with ventilation shafts or domes with exhaust holes are installed on them.

4. In the tropics and subtropics, as well as in places with regular flooding, houses are put on piles. Living in a swamp and under constant water

5. zones (for example, the Mekong Delta) explain the appearance of settlements on boats.

6. In extreme natural conditions, the architectural and structural solutions of the dwelling have been developed in accordance with the conditions (seismic, permafrost, typhoons, etc.).

7. In the architectural form of the zonal structure, its tectonics is revealed by the constructive and artistically expressive features of local building materials.

By creating a living environment for family life, work and recreation with different degrees of isolation from the outside world, a person strives to ensure the comprehensive comfort of space, the level of which is determined according to sensitive receptors, personal or generalized standards.

General impressions of microclimate comfort consist of comfortable sensations of heat, humidity, ventilation, lighting, sound insulation; it is better if they are not installed with feelings at all. It should be remembered that there are different combinations of environmental parameters that correspond to different living conditions. For example, in a room for work that does not require physical exertion, the optimal temperature level should be within 18-20. When the ambient temperature rises and falls, physical fatigue occurs and work does not continue. Even negative ambient temperatures are favorable for strenuous exercise.

At normal room temperature, 50-70% relative humidity is not noticeable - this means that it is within normal limits. An increase in humidity with a decrease in air temperature gives a feeling of humidity, a decrease in humidity and an increase in temperature - a feeling of dryness. The feeling of congestion, which occurs in high positive air temperature and humidity, is eliminated by ventilation at an air speed of about 50 m/min. A temperature ratio of + 22 often with relatively still air and 80% humidity seems comfortable.

The amount of efforts made to maintain the temperature and humidity conditions (TVR) of buildings at a comfortable level depends on the climatic parameters of the external environment and the thermal protection characteristics of the external surrounding structures.

First of all, the issues of the direction of the building are solved taking into account its planning structure. During the day, the sun, moving from east to west, illuminates with direct rays only the rooms oriented to the Southern sector of the horizon, and in accordance with hygiene requirements, the main day rooms should be illuminated by the sun for at least 2 hours; this period is called insolation time. In the climate of Central Europe, the North wall of the house is directly outside the zone of sunlight and in winter it is attacked by wet cold Northwest winds, so the need for insulation in the North part of the building excludes secondary rooms or planned to find rooms with buildings. strong heat generation (utility rooms, kitchens).

The spectral composition of solar radiation changes during the day. In the morning, ultraviolet rays prevail, in the evening - infrared. If ultraviolet radiation has bactericidal properties, infrared rays help to heat buildings. Windows are equipped with solar panels and curtains to protect against excessive sunlight, which is important in southern regions. In addition, horizontal blinds are placed to protect the southern facades from the midday sun, and vertical blinds are used to protect the western facades from the hot sun below the horizon. In the south, as additional protection from the sun, shady canopies, galleries, terraces are placed on

ISSN NO: 2770-4491
Date of Publication:10-07-2022

the southern facades, and porches are hung. In the north, glazed galleries along the southwest walls additionally heat the buildings, which is called the greenhouse effect.

Therefore, the level of natural lighting of buildings depends on the insolation conditions must be coordinated with ri, as well as with the thermal performance of window openings: in traditional wooden design, transparent structures do not retain heat well, so wide windows mean a significant decrease in internal temperature in winter. The obvious benefit of an interior filled with natural light can, in addition, become a problem related to the arrangement of furniture and the achievement of comfort in general. The sufficient level of natural light is determined by the ratio of the area of the window openings to the floor area in the form of the empirical formula s0kha = Snona / 6 (8). However, with the expansion of industrial production of double-glazed windows, single- or double-glazed (with triple-glazed windows), the issue of inequality in the level of thermal protection between the window and the wall is removed, so glass surfaces can be widely used in the modernization of facades in modern architecture. protection systems [25].

For areas with constant wind, the configuration of the building is very important and protects the area from snow, sand and dust drifts. But it is equally necessary to activate air movement to ventilate the habitat [140].

The wind protection building is planned in the form of a perimeter fence that covers the area inside the block or a comb arrangement of buildings that extinguishes wind vortices. In order to better ventilate the urban development, free corridors are placed in it, corresponding to the directions of air currents. It is known that winds bend around freely rounded structures (pipes, gas tanks) in terms of construction. This aerodynamic effect is often used in modern architecture - high-rise buildings are given a cylindrical, lanceolate, ovoid silhouette. In some cases, in order to neutralize the wind pressure and overturning of high-rise buildings (strong winds are constant at high altitudes), their body is divided into separate blocks with "explosions" between them.

Taking into account the direction and strength of the wind, it is necessary to adjust the direction and small development. For example, it is not necessary to find the entrance to the manor house from the north in the middle latitudes, where it is constantly covered with snow in winter.

In multi-apartment residential buildings, the location of the departments should take into account the possibility of accounting for the ventilation of the apartments, and for the Southern residential buildings, such a spatial structure of the location of the apartments is provided so that they are connected to a vertical ventilation shaft that activates the air extraction from the residential area .

In rural buildings in Southeast Asia, in order to prevent the roof from being damaged by strong winds, it was made in the form of a thick straw roll, which became heavier when wet during the rainy season and covered the entire structure, protecting it from destruction. This structure of the roof with log shorties (tigi) reinforcing the roller is preserved in the canonical architectural solution of traditional temple types in Japan. Even more cleverly, it was decided to protect the tall fragile pagodas from being overturned by the wind. In their center, separate from the layered structures, a tall cedar column decorated with sacred rings is placed on a reliquary covered with a stone slab. During the typhoon, the pagoda and the pillar vibrated with different amplitudes, mutually canceling the resulting vibrations. The heavy roll of the roof, covered with thick ceramic tiles and filled with two thick ridge logs, protected the light frame structures of China not only from wind, but also from earthquakes.

The ingenuity of builders who have learned to cope with the devastating effects of earthquakes is amazing. Constructive anti-seismic experience formed the basis of the artistic representation of the architecture of the countries located on the line of the seismic belt of the earth, which stretches from Malaysia to Japan, China, Tibet, Central Asia, Turkey, the Black and Mediterranean seas to Iceland. Did you remember that the main anti-seismic technique is to separate the structures of the structure from its base? Thus, the elimination of the shock-transmitting "bridge" characterizes all zonal antiseismic solutions, no matter how different they are.

In the Chinese wooden structure, not only the columns and the dou-gongs that complement the spring-softening underground shocks are original; the structure itself is curious, resembling a table, the legs of which are attached to the contour board under the table top and rest freely on stone slabs with recesses. the columns do not move. The roof beam is placed horizontally to eliminate the seam.

ISSN NO: 2770-4491
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In Tibetan houses, the walls on which the floors and floors rest, and the inner frame are built separately. During seismic tremors, the walls could collapse, but the frame remained.

Central Asian house - a characteristic feature of iwan architecture is a place of deep shade, in which an intermediate light is used as a support - a source of strength. ki there are two wooden posts. The columns ended with an elongated carved console laid across the beam, and the base rested with a spherical base in an appropriately sized recess in the top of the stone column.

In the event of an earthquake designed for the entire structure, the column could deviate on the hinged base, but the cantilever did not allow the beam to lose its support. The lack of rigidity of fastening gave some guarantees of maintaining the integrity of the structure.

During the construction of the mud walls of houses made of paxa (a raw base-shaped cast made of clay with a mixture of crushed grass) or dried bricks, the stones were made by inserting rows of bricks in the form of a locust or on the edge. From such walls comes the tradition of creating a decorative brick surface, which is then decorated with glazed coatings; This is how the unique style of Central Asian architecture developed.

The strange wavy shape of the walls of feudal Asian castles in the form of keches-corrugations was designed to control possible wall cracks during an earthquake, as well as to give a clearer visual perception of the structure in the monotonous blue haze of dry steppes.

To reduce the harmful effects of water on the building, it is collected in special trays on the roof that lead to vertical drainage pipes of external or internal location.

Let's turn our attention to the effect of climate on the indoor environment of buildings.

In order to ensure thermal comfort in winter conditions for moderate regions, the type of material and the thickness of the outer wrapped walls should be selected judiciously.

To understand the physical structure of the heat transfer phenomenon, let's refer to Figure 1.1.13, which shows the part of the wall that separates the internal and external environments. For simplicity, assume that tB and tH are constant. Then a stable heat flow is formed in the wall array, represented by the change of internal temperature from the TV to cn (the fact is that the temperature of the wall surfaces slightly softens the difference between tB and tB due to the influence of the ambient temperature of the opposite sides with indicators tH).

The thicker the wall and the lower its thermal conductivity, the slower the heat transfer and the less heat is used to maintain a comfortable internal temperature. It is clear that the minimum wall thickness of the material with the minimum thermal conductivity is the most suitable for the design of external closed structures. As a thermophysical characteristic of materials, their thermal conductivity coefficient X is calculated taking into account the amount of heat that passes through the massif of walls made of this material with a cross-sectional area of 1 m2 and the temperature difference on the surfaces of 1 m thick in 1 hour from 1 S. dense, og Heavy materials have the maximum value of the heat transfer coefficient, and light and porous materials have the minimum value. For example, X of copper is 330 kcal / m.h.deg., aluminum - 190, steel - 50, granite - 3, brick - 0.6 - 0.8, foam - 0.04. The coefficient of thermal conductivity increases with the increase in temperature and humidity of the material.

But the indicator necessary for thermal engineering calculations is the resistance of the material to heat transfer, expressed by the ratio of the I-layer thickness 5 to the coefficient of thermal conductivity, that is, R = 8 / X. if the wrapped structure is a layered structure has, then the total thermal resistance of the wall will be be equal to the sum of the thermal resistances of each layer.

In order to determine the adequacy of the thermal resistance of the wall from the selected components under certain climatic conditions and a certain temperature regime of the internal environment, it is necessary to perform calculations that also take into account the length of the heating period. Calculations are made using special techniques using climatological data and thermophysical properties of materials. As for the temperature and humidity regime of heated rooms in the cold season, the following should be added. The increase in humidity has a negative impact on the well-being of the population and the condition of structures and their surfaces.

In a warm room, air water vapor is invisible, but it is enough to pass cold air through the window, because the cooled moisture condenses in the form of a gray vapor wave. Indoors, such a balance between temperature and humidity can be formed, in which the amount of water vapor in the air reaches absolute

ISSN NO: 2770-4491
Date of Publication:10-07-2022

saturation, even with a slight decrease in temperature, before their condensation. This reduction provides a difference of about 6 between tB and TV at a room temperature of 18-20 s.x. k. What will be the result? The wall "weeps", the paint gets wet, and flakes, wallpaper, and black mold appear. The situation is worse with the outer corners, their zone is under the influence of external low temperatures. Overcooling corners and even to eliminate the effect of freezing, they should be insulated by thickening the wall, pilasters, or adding layers of insulating materials to their construction.

In winter, with the insulation of the rooms inside the buildings, their humidity increases, which can be reduced with well-regulated ventilation.

Due to the increase in water vapor pressure in heated rooms, moisture enters the closed structures of the building together with the heat flow: walls and ceilings. During the movement in the enclosure array, the steam reaches the dew point and condenses. The structure loses its thermal stability, and the accumulation of moisture inside it eventually leads to its destruction. A vapor barrier diaphragm is inserted into the layer closest to the internal environment to prevent moisture from entering the structures separating the external and internal environments. When developing the design of a manor house, this should be taken into account when designing the basement and roof floors, in the attic.

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