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TULOOU

Abstract. The article describes buildings made of sand and clay without calcination, using the example of a unique large residential area in the world - Hakku Tula, known as a treasure of Chinese dwellings. Traditional and modern houses of this area can be divided into three main systems: a curved circle, a rectangular system, a curve system of circles merging. The construction of buildings made of clay and sand is environmentally friendly, as they use natural, clean materials and are modern at the present time, as they are energy-saving. Erected buildings of this material are air-tight, effectively maintaining warmth and comfort in the room. Old technologies are relevant in modern construction.

Keywords: earthworks, Hakka construction, traditional dwelling.

Introduction: The creation of terrestrial buildings is closely related to the relocation of the inhabitants of the Central Plains. The location of Hakka Tulou is quite specific and unusual. When building earthen structures, using the following 3 methods of construction: a curved circle - taking a curve as the main means of the composition and using it as the main element in the plan add an arc, a plexus of circles and an ellipse for diversity. The straight rectangular plan system - taking a straight line as the main means of composition, the square is the main form and the main elements, including two forms, namely the square and the rectangle. The straight curve of the circle fusion system — the basic configuration means that the straight line and the curve are combined, the shape is square and round, and the square and circle are organically combined. The source of the image is more complex, including the horseshoe shape and the Wufeng floor shape. (pic 1)

The following criteria are used in the construction of Tulou:

First, considering life, production and travel, we must pay attention to the choice of a sunny place, protected from the winds, and where there is water.

Secondly, in the valleys of the southwestern part of Fujian province there are various Hakka earthworks. On one side, they are closed from the penetration of the wind by mountains and hills, which is a very reasonable solution for this place. On the other hand, there are constructions of various geometric shapes with internal courtyards. reasonable. This area can not only avoid the hazy northern wind, but also get the best light, fresh air, suitable temperature and a thousand miles of vision.

Third, pay attention to the “four scarecrows,” that is, avoid opposites, avoid buildings from south to north, avoid heights in front of the bottom, avoid the right to mountains, look for protection from the wind.

Fourth, understand the situation from mountain. It depends on the height of the mountain and the choice of location on the hillside. The building echoes the mountain in the ratio and must be harmonious. The natural nature of the choice of land building is

sufficient to show that the Hakka earth building is a combination of geography, ecology, landscape architecture, architecture, ethics and aesthetics

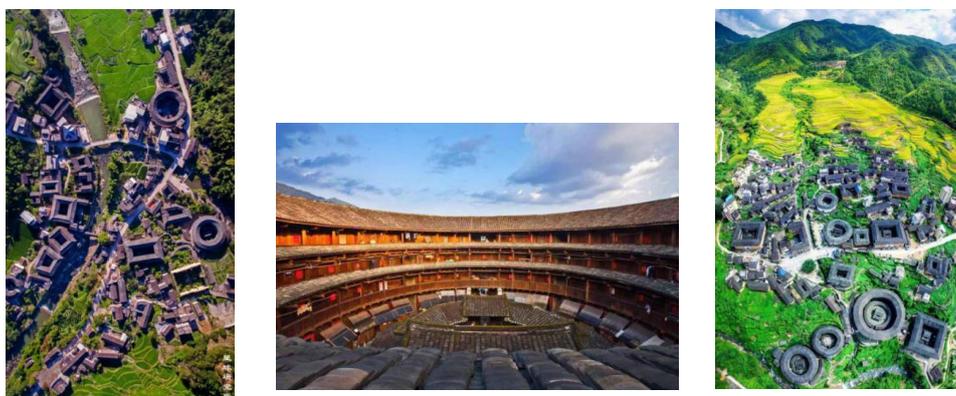


Fig. 1. Plans of Tulou

The sustainability of Tulou

The main materials required for the Tulou are soil (red loam, field sludge, crushed stone), wood (fir, small amount of pine, old bamboo), sand (river sand, river pebbles), linden and greens. As a rule, the earth wall is very durable. And at the same time can be reused as land after a few years. Land resources are constantly circulating and not consumed. Fir, pine, sand and other plants, if they are properly sized, can be used to build new homes. If it is not used in construction, they can also be decomposed as a fertilizer by microorganisms for circulation in nature. These are natural environmentally friendly building materials, which not only perform the function of “breathable”, but also effectively support the thermal comfort of the interior during their stay. The ecological architecture paradigm reflects the survival of Hakka, architectural wisdom and human settlements.

The construction process usually includes seven processes: site selection, foundation, stone pillar, wall, floor, water, interior and exterior. In addition, the drainage system in a land building typically consists of four parts: a water well that takes water, a patio that collects rainwater and household waste water, and directs waste water to a ditch outside a building or to a waste water basin and their cleaning.

The wells and the atrium form the natural, mild climate of the inner courtyards, which regulates the humidity. The courtyard after the rain becomes a place where rainwater is collected. Part of the water penetrates into the well clearing through the drainage layers and is used for the needs of the house, excess water is discharged into the ditch. Rainwater is oxidized and dissolved through the layers, and metabolic processes of microorganisms pass through it. Water is used for domestic purposes, for livestock and agriculture. In the hot summer months, outside air brings moisture into the courtyard of a building during cyclones, lowering the temperature of the air inside the courtyard. The cost of such buildings is noticeably lower than the cost of buildings using modern technologies. This kind of economical and energy efficient construction and planning model is easier to promote for developing China, and it has the enchanting charm and inspiration for modern architecture in China.

The material and structure of Tulou

The soil is one of the main materials for the construction of earthworks, it is easy to mine and transport. It is more durable than wood. Therefore, it has become an ideal material for building a Hakka house.

Large-scale use of earthen walls will inevitably lead to problems with floods, especially in Fujian province, where the climate is hot and humid, and from time to time heavy rain and flooding occur. However, the outer wall of the earthen building Hakka rarely gets off with a stone foundation. To improve the strength of the earthen wall, Hakka people add bamboo branches and other plant material to give strength to the wall. When building build a circle in a clockwise and counterclockwise. The lower part of the wall is more than 1 meter in width. It is solid and durable, waterproof, windproof, fireproof and shockproof. Almost all earthly buildings experienced earthquakes of varying degrees, and they still stand still and this is amazing. The total construction period is two to three years. It takes decades to build a large building. The building of untreated soil has good thermal insulation properties and has a certain effect of air conditioning, so the temperature in the room is warm in winter and cool in summer, harvested harvests are easier to store in a gas-permeable building than in a cement one. In addition, a thick earthen wall can effectively absorb noise, as well as absorb and release water depending on the humidity of the air. Even if the earth building is abandoned and destroyed, these materials can return to nature without causing pollution.

Wood is also used for frame construction and the floor, the size of the wood used is also different. Large spruce is mainly used as a lower support and internal supports, forming a holistic connection between the external and internal walls. The use of wood of smaller diameter as a bearing part is convenient for the construction and economy of material. The cross-section of the beam is smooth and neatly laid, and the fixed floor slab above will be stable.

The interior design and layout concept of Tulou

The earthen building uses a symmetrical shape in the form of a plane. As a large-scale group building for the whole family, the earthen building has the form of an internal enclosed courtyard with a clear axis. The symmetry of the earthly building begins with the main hall and consists of a gallery column, patio, monastery, and so on. Most of these spaces exist in the form of public space. Foyer, common room, lobby, patio and other rooms. - all of this belongs to public space. Public space is a collection of people and things. In this region, it not only satisfies human needs, but also satisfies various environmental requirements resulting from human interaction. Let's first look at the space in the lobby. The foyer is a road and a place where people relax and socialize. Therefore, the lobby is designed to be more regular and open. In the lobby are equipped with benches for people.

Upon entering Zhongtang, you can often feel the spacious and solemn atmosphere. This is the center of the whole building. Zhongtang is used for meetings such as family discussions, weddings and funerals, reception of friends and family banquets, and more. Its orientation and size, as a rule, are carefully thought out: when designing the hall of a land building, some use the installation method, that is, they use a colonnade to expand the space from the hall to the external courtyard, others use composite space. The form is an integral space consisting of a central courtyard, a main hall and a corridor.

Each room has the same size, while the study, the family room, the living room and the courtyard are used publicly; this is the tradition of equality and unity of Hakka. In the spatial arrangement, the central axis is the center, the span is relatively large, and in the middle there is an open space, which is favorable for summer ventilation. Public spaces, such as gates and halls, are located on the axis. Living areas, such as corridors and rooms, are built around a courtyard. Internal and external circles are inhabited in

them there is communication and work, at the same time, the confidentiality of residents is guaranteed. The staircase will depend on the size of the building. Two or more sets are provided to facilitate the transportation of daily life, and it also contributes to the concentration and evacuation of people in an emergency. In the vertical direction, the overall layout of the earthen building is the kitchen on the first floor and the barn on the second floor (the entire barn can store food for six months for residents of the house). The third floor is a living room with windows for ventilation. The space is relatively open because people spend a lot of time in the living room. To prevent outsiders from entering, there is no window on the outer wall on the first floor. The ground floor is relatively wet, as is the kitchen. It is saturated with the smell of smoke, which forms on the board a layer of protection against white ants. In the courtyard there is a hereditary hall, kitchen, bathroom, patio, gallery or just a patio, and the bathrooms are built on both sides of the building. Almost all the space available outside of the building is fully used for the construction of residential buildings, but it is very coordinated and can be called Humanized design. The second floor is also relatively wet, and in the interior layout takes into account the moisture-proof factor, which ensures that things inside do not deteriorate.

An open space is formed between the outer ring and the second ring. The gallery and patio consists of concave and convex spaces. The corridor is dry and convenient because it is separated from the patio. The corridor is a transitional space in the building. It not only provides the communication function of the premises, but also provides a place for people to communicate.

The window is located mainly on the third residential floor (Figure 2). This arrangement not only solves the problem of lower layer dampness in the hot and humid zone, but also provides internal sealing of the earthen building (for safety reasons, it is not recommended to open the window at the lower level). The window improves ventilation and lighting of the room located on the upper level, additionally illuminated from the atrium.

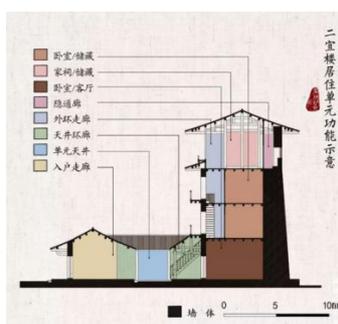


Fig. 2. Section of Land Building

It is worth noting that in the Hakka land building there is only one door. The form of a suite from one room to another is almost invisible in the earth building. The value of this plan is that each couple has its own private space. This layout is now taken for granted, but in ancient times this situation was very unusual. When Hakka's earth building draws attention to the unity of the masses, it also gives maximum freedom and independence of individual life through the space of a small bedroom. The same applies to employer's room. On the contrary, traditional dwellings in the southern part of the country, although there is no courtyard, no space for people gathering together. This is a

single home, but it manifests itself in the maximum publicity of a person's life in a family, a person does not have his own space, independence and freedom.

The influence of Tulou on modern architecture

Hakka Tulou demonstrates the charm of Chinese architectural culture and has a profound impact on modern architecture and is a source of inspiration for Hyundai designers. The student residence of the University of Copenhagen in Denmark was designed with reference to the traditional Chinese Hakka.

The construction of the student residential building of the University of Copenhagen was completed in 2006 with a total area of 26,800 square meters. This is the project of Lundgaard & Tranberg Arkitekter, symbolizing equality and community. The design concept and form are based on the idea of an earthly building, and its ring shape symbolizes equality and harmony. Communicative circular corridor connects each room on the same floor. The building was awarded the annual award of the Royal Institute of British Architects of Europe for its outstanding architecture for its unique creativity and form (Figure 3). The project pays great attention to student communication. Floor to ceiling windows in the apartment provide a lot of light, and windows and balconies are uneven, wavy and very stylish. Five entrances divide the apartment into five sections, each of which is independent and interconnected. The building has 360 rooms, a shared kitchen, a study, a lounge, bicycle parking, a large number of public places. In the center of the building there is a round garden filled with plants, which is equivalent to the inner courtyard of the Hakka Earth Building, where there is a comfortable lounge chair where students can sit or lie down, relax and chat.



Fig. 3. The University of Copenhagen student residential building

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ЗДАНИЯ ИЗ ЗЕМЛИ

Абстракт. В статье рассказано о зданиях, созданных из песка и глины без прокаливания, на примере уникального в мире крупного жилого района– Хакку Тулу, известного как сокровище китайских жилищ. Традиционные и современные дома этого района можно разделить на три основные системы: изогнутый круг, прямоугольная система и кривая система слияния кругов. Строительство зданий из глины и песка экологично, так как при нём используются натуральные чистые материалы, а также современно, так как является энергосберегающим. Возведённые здания из данного материала воздухонепроницаемые, они эффективно поддерживают тепло и комфорт в помещении. Старинные технологии актуальны и в современном строительстве.

Ключевые слова: земляные здания, строительство Хакка, традиционное жилище.