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# The Characteristics of Traditional Folk Houses in the Laoxiancheng village Town of Houzhenzi in the Northern Foothills of Qinling Mountains

**Hongyi Lin[1]**

*[1]Xi 'an Academy of Fine Arts, Xi 'an, 710065, China*

***Abstract***:*This paper aims to study the architectural structure and functional layout characteristics of traditional folk houses in the Laoxiancheng village, and obtain some building data and form preliminary drawings through field investigation. This paper first studies the structural characteristics of traditional residential buildings, analyzes the form and function of building frame, roof structure, building wall and eaves space, and summarizes the construction characteristics of traditional residential buildings in the central and southern Guanxian county village as an example. Secondly, through surveying and mapping the living environment of some local villagers, the uniqueness of the traditional residential environment of the Laoxiancheng village is explored, so as to summarize the characteristics of rural construction, which plays a promoting role in promoting the construction of beautiful villages.*

***Keywords***:*Northern foothills of the Qinling Mountains，Laoxiancheng village, traditional residence, architectural features*

## 1. The geographical overview of the Laoxiancheng country

The Laoxiancheng village of Houzhenzi is located in the southeastern part of Zhouzhi County, Xi'an City, Shaanxi Province, China, and belongs to the southern part of the Guanzhong region at the northern foot of the Qinling Mountains. It is an administrative village under the jurisdiction of Houzhenzi Town. The village is situated at the northern foot of the Qinling Mountains, with rolling hills and plains as the main terrain. The climate belongs to the warm temperate semi-humid monsoon climate zone, with distinct four seasons and moderate rainfall. Geographically, the old county village of Houzhenzi is adjacent to the Qinling Mountains, boasting abundant natural resources and a relatively unique geographical environment, providing favorable conditions for local agricultural production and ecotourism. The village's agriculture is mainly focused on cultivation, with primary crops such as wheat and corn. The average altitude is higher than that of the central region, with the Qinling Mountains to the south and the Weihe River to the north. Apart from some low hills of the Qinling Mountains, the terrain is relatively flat. When traveling from Xi'an City to the Laoxiancheng village, the terrain gradually descends from the southeast to the northwest. Surrounded by mountains, the village forms an enclosed shape, with an altitude of 1737.2 meters and a north-south longitudinal layout resembling the shape of a boat basin.

Most of the ancient village environments that can be seen today survived after the Ming and Qing dynasties[1].The Laoxiancheng village is the place where the old debt-locke road must pass through. Formerly the county town of Foping County, the village has the best-preserved Qing Dynasty Hall City site and a number of cultural relics, which have important historical, cultural and archaeological value, while the Laoxiancheng village is more to assume the role of heritage protection[4].

## 2. The traditional residential building structure features in Laoxiancheng Village.

### *2.1 Characteristics of building structures*

The traditional mountain dwellings in the Xi'an area at the northern foothills of the Qinling Mountains are less constructed with the cantilever beam structure, and more with the raised beam wooden frame system. Meanwhile, the cantilever beam structures are more concentrated in the regions south of the Qinling Mountains. In the mountainous areas of southern Shaanxi, due to geographical constraints, the cantilever beam structure is often used in roof construction. This form of structure is commonly used in southern regions as a regular building structure. The cantilever beam structure is a load-bearing structure

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that incorporates brackets, beams, and purlins.

*Figure 1: Interior structure diagram*

Firstly, the biggest advantage of the Through-Tenon Structure is its adaptability, as it is not limited by terrain and can be customized to fully utilize the terrain features. It can be appropriately designed and adjusted according to different climate conditions and geographical environments, for example, increasing the length of eaves in rainy areas and increasing wall thickness in cold areas, making it quite flexible. Secondly, the Through-Tenon Structure can largely ensure the stability of houses, to some extent absorbing and dispersing seismic forces, improving the seismic resistance of buildings. As the load-bearing components of the Through-Tenon Structure are composed of beams and columns, they can withstand large loads, resulting in high structural strength, even if they collapse during an earthquake, it will not collapse too quickly. Thirdly, the construction of the Through-Tenon Structure is relatively simple and cost-effective. Due to the form of the Through-Tenon Frame structure, its construction cost is lower than other structural forms, and the mortise and tenon connection method of the Through-Tenon Structure can maximize the utilization of wood, reducing waste. Fourthly, the Through-Tenon Structure has a certain decorative function, as it belongs to one of the traditional residential types, and its architectural form is mainly decorated and painted, making it highly decorative.

The local residential buildings in Laoxiancheng Village, Zhouzhi County, Chang'an District, Xi'an City, are mainly constructed using columns, rafters, beams, through brackets, and bucket arches to form the interior space, as shown in figure (1), with the inserted brackets extending to the outside of the eaves.In order to take over the gable trusses of the beam, instead of the position of the head of the play, so the length of the square sticking out of the building wall determines the depth of the space under the eaves, the side interface of the building from the inside to the outside into the indoor space, the indoor-outdoor transition space, outdoor space, the length of the space under the eaves depends on the functionality of the building points to the living habits of the local residents closely related to the eaves of the inhabitants often set up some firewood for the winter according to the residents' description of this space. Therefore, it plays the role of moisture-proof and sun-proof, and even part of the building adopts the addition of small buildings, the structure is more simple to build, two columns and two thin square beams plus a purlin interspersed from the building's mountain wall surface, cleverly constituting a small "grey space", so as to increase the use of efforts to use the penetrating wooden frame structural system, the wood more than the lifting beam beam beams more Tiny wood, less material and refined, more conducive to saving the cost of wood, local residents building more near the Qinling Mountains, easier to collect to the unexpected Luo ancient road on both sides of the peaks on the arbor as the building foundation materials, while the beam structure did not see the carving style, to ensure the stability of the building structure is not easy to collapse. The division between the first and first floors of the indoor space is made up of thin timber arranged in a compact manner up to a quarter of the depth of the house (Fig. 2).

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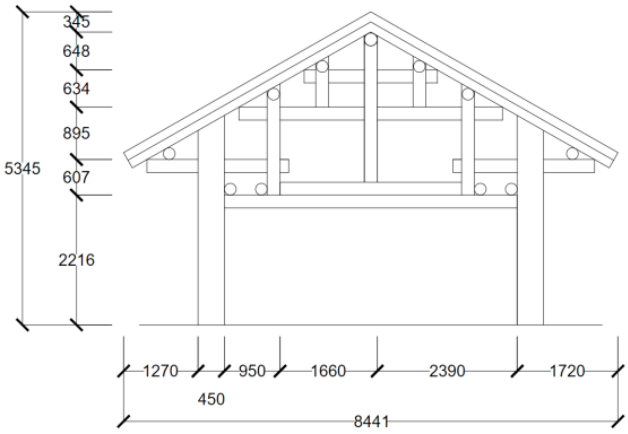


*Figure 2: Interior section view*

In Laoxiancheng Village, Zhouzhi County, Chang 'an District, Xi 'an City, local residential buildings are mostly built with columns, purlins, rafters, square, and bucket square composed of interior space appearance, as shown in Figure (1), and the square extends to the outside of the eaves column as the beam to carry on the eaves girder, instead of the position of the playing head, so the length of the square extending out of the building external wall determines the depth of the space under the eaves. The side interface of the building is transformed into an indoor space from inside to outside. The transition space between indoor and outdoor, outdoor space and the space under the eaves are closely related to the functional orientation of the building and the living habits of local residents. According to the oral instructions of residents, some firewood for winter is often placed under the eaves, so this space plays a role of moisture proof and sun protection. The structure is more simple to build, two columns and two thin square beams interspersed from the building gables plus a purlin, cleverly constitute a small "gray space", in order to increase the use of strength, the use of the perforated wooden frame structure system, the wood is smaller than the lifting beam frame, the use of less materials and fine, more conducive to saving wood costs, local residents are more close to the Qinling Mountains, It is easier to collect the trees on the peaks on both sides of Tangluo Ancient Road as the basic building materials, and there is no carved pattern in the beam structure, so as to ensure the stability of the building structure and not to collapse. The boundary between the first and second floors of the interior space is usually arranged in a compact sequence of thinner wood to a quarter of the depth of the house. (Figure 2)

### *2.2 Building Roof Construction Forms*

Through the field research and literature study, it is concluded that the roof style of traditional residential houses in Guanzhong area is divided into double-slope and single-slope, and the double-slope roof style in the traditional residential houses in the northern foothills of the Qinling Mountains is mostly the hard mountain roof, and the overhanging mountain roof is comparatively less, among which the single-slope is the most prominent feature of the architectural structure of Guanzhong area, and the "Eight Stranges in Shaanxi, the house is half-covered" is said the characteristic of residential mansion houses in Guanzhong area. The old county town village is in a long and narrow boat-shaped basin, mostly using single-slope roofs, which are more adaptable to different terrain and space constraints, and then again in summer, single-slope roofs are conducive to the rapid dissemination of hot air rise, the use of indoor temperature regulation; the old county town village roofs in a free style, double-slope to do the main room, connecting single-slope to do the different functions of the kitchen, storage, etc., and then connected to the double-slope roofs Do circle, toilet, etc., and appeared a long side, a short side of the gentle slope, according to the living habits of the residents will be different functional space through the different roof styles affected by the indoor and outdoor space qualities, the flexible combination of the single building will be linked together to form an organic whole, which may produce strip, enclosure and semi-enclosed group space, residents more use of single-slope roofs under the broader space The residents use the wider space under the single-slope roof to store firewood and so on; the main use function of the monolithic buildings is built with asymmetrical roofs and different slope lengths, which has greater flexibility, and is influenced by the uniqueness of the residents' lifestyles, and the specificity of the environment and the differences in the lifestyles of the residents lead to different kinds of roofs for each household building. From the aerial view of each building block in Laoxiancheng Village, there are obvious features of enclosing style, and there is no structure of inverted sitting at the entrance, which is

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more open and diversified than the layout of non-traditional mountain dwellings in Xi'an area. (Figure 3).

Figure 3: Roof style diagram of residential houses

### *2.3 Building wall features*

Due to the geological and geomorphological factors in Guanzhong, the soil is hard and easy to be plastic, which is suitable for the production of rammed earth and adobe, so the foundation and walls of the buildings are usually made of rammed earth and adobe, and through the evolution of time, the composition of the courtyards of the traditional dwellings in Guanzhong is a manifestation of the adaptation to the natural environment, and the result of the symbiosis with the natural environment. [2]Building wall materials with the timeline unfolding, traditional mountain residential from the earliest settlements using adobe masonry technology gradually transitioned to rammed earth version of the wall, to the present preserved most of the brick masonry or even a hybrid masonry, the old county village of smaller single building walls show a combination of brick masonry and stone masonry characteristics. In terms of architectural style, one of the monolithic buildings adopts design elements such as horse-head wall and eaves, which adds to the sense of hierarchy and visual effect of the building, helps rainwater drainage and prevents rainwater from directly washing away the wall.

The building itself has good physical properties of heat preservation and insulation, and at the same time, it fits the culture of "taking from nature, using in nature", while the wall of the mountain houses in the northern foothills of the Qinling Mountains is more important for maintaining the safety of human existence, and the masonry wall of any material thus acts as a shelter for the natural dangers of the region. In the Guanzhong region, because of the fertile and loose soil, which is very suitable for rammed earth construction, the rammed earth version of the wall structure was used. In this structure, rammed earth is the most important building material, which can be locally sourced and can greatly save on construction costs. There are many types of rammed earth walls, such as: rammed earth arch coupons, rammed earth earth walls, rammed earth hollow slab walls, rammed earth plywood walls, etc.. Among them, the rammed earth slab wall is a wall made of local loess, with the following layers in order from bottom to top: bedding layer, rammed earth layer, insulation layer and waterproof layer. Since it is built directly on top of the loess, it is very strong. Moreover, the rammed earth panel wall is also warm in winter and cool in summer, which is very suitable for the characteristics of the mountain dwellings in the northern foothills of the Qinling Mountains.

The wall characteristics of the recently built houses in the village settlements in the old county are still characterised by the red brick structure as the skeleton and the gravel solidified waterproof coating, and the locally native materials are mainly red bricks and fine arborvitae as some of the materials for the construction of the building walls, and the wooden skeleton facade is concentrated in the single-slope xiazihua houses, which take the wood from mountainous areas close to the house, and have the characteristics of easy camping and cost-saving etc., so most of the fine arborvitae facade become the material for the xiazihua houses of each family. Materials. There are fewer styles of adobe walls, and most of the architectural walls between the north and south gates are made of rammed earth, and the rammed earth walls are integrated with the ground.

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### *2.4 Spatial characteristics of architectural cornices*

Corridor space is an important form of space in traditional Chinese architecture, in addition to indoor space and courtyard space.[3]In China's traditional houses, the eaves porch refers to the porch set on both sides of the roof and before and after. It usually exists as an independent space, and there are also corridors dependent on other buildings, generally placed under the roof, and other buildings combined to form a complete space, playing a role in separating the indoor and outdoor, and harmonising the building as a whole with the surrounding environment. In addition, it can achieve sunshade and rain, because the eaves of traditional residential buildings are low, and most of them use wooden structure, if not to do shading measures, direct sunlight on the roof in summer is easy to cause the temperature of the roof to rise, set up a porch under the eaves to shade, to avoid direct sunlight, which is more conducive to the occupants to carry out outdoor activities; the eaves of the eaves of the traditional residential buildings are often set up adjacent to the eaves of the building, which can lead to the occupants of the traffic flow; the eaves porch As an independent space in residential buildings, in addition to the role of sun and rain, it also has the role of enriching the spatial level and enhancing the aesthetic value of the building. The side interface of the building transitions from the one-sided building wall to the virtual interface of the gable side wall, which is visually richer and spatially divided into indoor space, transitional space and outdoor space.

The eaves of the gable end of the residential house not only provide shade in the summer, but also save energy in the rainy season to prevent the erosion of building components caused by the direct contact of rainwater with the building, and it is usually appropriate for the eaves to be around 900mm. The angle of inclination of the sloping roof is about 30°, which is suitable for the drainage of rainwater from the roof. In the Laoxiancheng villages, the eaves are generally long in the early residential buildings, and in the newly renovated houses, the residents would put horse zones and long narrow benches under the eaves for sitting, and seldom store a lot of burning wood such as firewood and grey tiles on the roofs, and the houses with small spaces under the eaves would usually create a new building space such as a mansion house or build a small double-slope space for storing goods. The depth of the eaves space can potentially reflect some of the living habits of the occupants. In the Old County Village, the area preserved from the Qing Dynasty, such as the former site of the Temple of Literature, has been converted into residential houses, and the use of colonnade space appears in its side interface, with the gable columns leaning out, and the distance between the golden columns and the gable columns determines the depth of the colonnade space, and at the same time, a "floor" is built in the outside of the wall on the first floor of the building, and the wood sticks collected nearby are lifted by the beams to be used for a little space, and partly for the heart space to be used as a storage space for goods, and partly for the heart space to be used as a storage area. At the same time, a "floor" was built on the second floor on the outside of the building wall, using sticks collected nearby and held up by a raised beam to be used as a space for storing maize and other crops. (Figure 4)

*Figure 4: Corridor space*

## 3. Characteristics of the Functional Layout of Traditional Houses in Laoxiancheng Villages

Natural resources and climatic conditions constrain the creation and development of Guanzhong houses, mainly in the two main elements of water and soil, the nourishment of soil and the scarcity of water. The Guanzhong region has a low rainfall, dry climate and deep, malleable loess is the best building material. Loess is cheap, heat-insulating, readily available, inexhaustible and recyclable. The agriculture in Guanzhong is mostly dry-field crops and basically relies on the weather to feed the people. The size and shape of the villages are determined by the amount and distribution of land rather than the proximity

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to the riverside. [5]

The functional layout of the traditional houses in the Laoxiancheng Village shows obvious regional characteristics and cultural traditions. The residential houses are scattered along the main road, and each "building group" is adjacent to a field. Due to the restriction of the long and narrow terrain, the relatively flat terrain occupies less space, which results in the distance between each field and the residential houses being brought closer together. Residential houses usually follow the pattern of "front garden and backyard", with the overall layout emphasising symmetry and harmony, as well as the reasonable division of internal and external space. The front yard serves as a space for receiving guests and carrying out daily activities, as well as a place for family members to engage in outdoor activities. The backyard is close to the mountain, and it is the core area of family life, including the main house, the rooms and the kitchen. The main house, usually located at the north end of the courtyard, is where the elders of the family live and where important family ceremonies and gatherings take place. The rooms are located on either side and are usually used as residences for young couples or children. Kitchens and utility rooms are usually located in the corners of the courtyard to minimise the impact of fumes on the living area. In addition, traditional houses also emphasise the greenery of the courtyard, planting trees and flowers to beautify the environment and regulate the climate, and in earlier times some local residents had wells in the courtyard to provide water for daily use by the family.

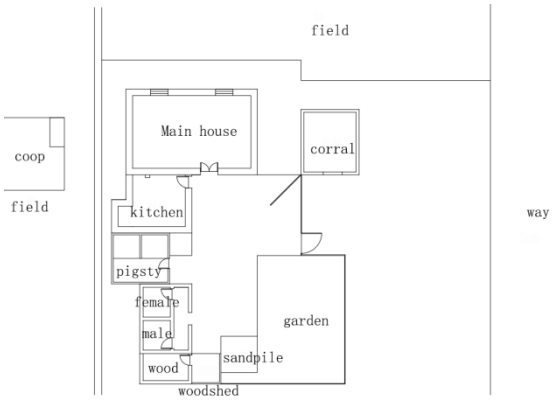


*Figure 5: A schematic diagram of Fa Li's home*

The architectural fieldwork focused on three typical traditional residential compounds, namely Zhang Fali's house (Fig. 5) and the house of a famous pig-raising demonstrator in the village (Fig. 6). Most of the traditional residential environment layouts in the Laoxiancheng county are mostly illustrated in square plan, in which a central axis runs through all the architectural functional subdivisions, starting with the front yard, a more spacious open space, followed by the main entrance, which leads into the indoor space, and then through the back door into the outdoor backyard, with fields of crops in the near vicinity, and more than enough view of the Qinling Mountains in the distance. The atrium part of the indoor space of the building plays a transition area between outdoor and indoor, the villagers will receive guests here, set up a few benches to communicate and talk, as the main living space, the different functional spaces in the four directions will always be related to the central area on the central axis, the living room of the modern indoor home is similar to this, but the old county village indoor "living room" has a much better relationship with the other rooms. The living room is similar to this, but the "living room" in the old county village has a closer connection with other rooms. The depth and width of the openings are mostly about 4m square, and the depth of the main house is mostly the depth of two openings with the same width, which is a form of layout with less wasted space and fuller use of area. Area increase on this basic layout, using the opening of new doors to the area. The increased area is juxtaposed with the basic layout, such as new kitchens and new stoves. Most of these functions such as toilets, pens and firewood huts are located in square rows in their own compounds. Farmers mostly raise livestock, and most of the pens they set up are close to the fields, where the livestock and the fields form a virtuous ecological cycle system.

We can see through the plan of Zhang Fali's house that the layout of the main functional zones is symmetrically distributed along the central axis, and the backyard is set up with auxiliary rooms such as laps, toilets, etc.with pavilions set up on one side and trees planted on the other, and the overall distribution of the buildings is close to the fields, with tall mountains behind them, which is in line with the traditional architectural siting and layout of Chinese buildings and embodies the ancient Chinese view of the cosmos and the social order, and is in a special boat-shaped basin under the geographical conditions. Due to the special geographical conditions of the boat basin and the living habits of the villagers, the

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architectural layout has formed a style with many subtle variations. The architectural layout of the pig-raising demonstration household is special, because its main function is to raise livestock, and the courtyard consists of pig pens, cattle pens, firewood sheds, sand piles, gardens, the main house, kitchens, toilets and so on, with chicken coops outside the courtyard in between the fields, forming a good ecological cycle. This architectural layout is an example of different needs and adaptations to local conditions, each functional partition is square and freely combined, and in the plan language, each space exists within the square skeletal line, which is in line with the law of the plan layout, and this naturally formed architectural layout is the key example we learnt from the countryside camping.

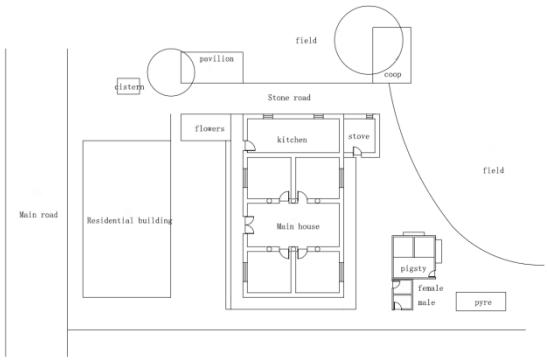


*Figure 6: Schematic diagram of pig demonstration household*

## 4. Conclusion

As a traditional village in the south of Guanzhong, through fieldwork and interviews, further excavation of the unique charm of traditional villages is a task I will always insist on doing, through the research of Laoxiancheng village will find that each independent residential building construction ideas are inseparable from the local villagers' living habits and the natural environment, this is the preliminary exploration of the architectural structure, the layout of the function, in fact, it is a better summary of the unique characteristics of the village's own folk construction. In fact, it is a better summary of the unique folk wisdom of Laoxiancheng Village, which focuses on the exploration of the characteristics of the traditional residential buildings in Laoxiancheng Village, to explore the potential of rural construction, and hope that it will play a certain role in promoting the construction of beautiful villages in the future.

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