

# Analysis of Kiln Dwelling Buildings in Shouyang, Shanxi, China

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**Abstract:** This research analyzes four typical kiln dwellings in three traditional villages in Shaoyang County. Although kiln dwellings are the main architectural form in these villages, the architectural structures and courtyard features vary, all representing the conventional kiln dwellings of Jinzhong in Shanxi. The kiln site in Shouyang County of Jinzhong City is analyzed in detail by means of field investigation and data collection. Through on-site survey and interviews, the author documented the different types of kiln dwellings in Shouyang. The courtyards of kiln dwellings in Shouyang County mainly fall into three categories: subterranean pit kilns, cliff kilns, and courtyard-style kilns. The main feature is the integration of kilns and houses, with courtyard styles including kiln courtyards and compound courtyards, following a layout of axial symmetry. The dwellings reflect the traditional Chinese hierarchy of superiors and inferiors, with decorations combining practicality and aesthetics. This research provides a solid theoretical basis for further improving and enriching the theoretical achievements of traditional residential architecture in Jinzhong, and offers theoretical support for the protection, inheritance, and reuse of residential architecture in Shouyang.

**Keywords:** Shouyang; Traditional Dwellings; Kiln Dwellings; Architectural Forms; Morphological Characteristics

## 1. Introduction

The Yellow River Basin was the central area of activity for the early ancestors of the Chinese nation and the primary birthplace of early Chinese cultural forms. Due to differences in geographical conditions, historical traditions, cultural deposits, and cultural influences, the missions undertaken in showcasing Yellow River culture vary. As a

result, a wide variety of ancient residential buildings with rich architectural, historical, cultural, and artistic research value have emerged along the Yellow River. Traditional cliff kilns and wooden houses are common architectural types in the northern regions. The independent kiln dwellings in Jinzhong region integrate the characteristics of both, forming a unique kiln dwelling combination model with exceptional environmental adaptability<sup>[1]</sup>. The three traditional villages of Nandong, Nanhe, and Longmenhe in Shaoyang County are highly representative examples of local residential architecture. The current conditions of these villages are in imminent danger, with population loss and natural erosion leading to a pessimistic outlook for the current state of residential buildings. Urgent action is needed for the protection and research of these village.

## 2. Geographical Location and Folk Customs

### 2.1 Geographical Position

Shaoyang County is located in Jinzhong City, Shanxi Province, China. It is situated in the central part of Shanxi Province, east of Jinzhong City, and is adjacent to the Taihang Mountains. The area is predominantly mountainous, with a terraced distribution of higher elevations in the west and lower elevations in the east (Figure 1).

Nandong Village is approximately 40 kilometers from Shaoyang County town and 20 kilometers from Yuci District in Westliao Town, Shaoyang County, Jinzhong City, Shanxi Province. Nandong Village, as a prominent location in Westliao Town, plays a significant role in the local economic and cultural development and has been known as the "Little Taigu." The village covers an area of 4.42 square kilometers, mostly consisting of farmland and hills. The village has a well-preserved historical and cultural heritage,

with 96 residential courtyards and 20 public architectures. Nandong Village was listed in the "Catalogue of Chinese Traditional Villages" and the "7th China Historical and Cultural Famous Towns and Villages" between 2016 and 2019. Nanhe Village in Westluo Town, Shaoyang County, Shanxi Province, China, is located in the southwest region of Westluo Town, on the border of Yuci District, in the mountainous area southwest of the county town. It is an ancient city with a long history. In the village, old houses are interconnected, watchtowers stand side by side, there are 52 temples, opera stages, ancient mansions, and more than ten ancient trees. In ancient times, people in the village were addressed by a common hall name, and 21 hall names have been passed down to this day, preserving the ancient customs. Longmen Village belongs to Pingshu Township, Shaoyang County, Jinzhong City, Shanxi Province, located approximately 10 kilometers northwest of Shaoyang County town. It is a historical and cultural famous village in Shanxi with a history of over 500 years. The Wang Family Courtyard in Longmenhe Village is said to have been built by Wang Wuke, a royal architectural official from the Qing Dynasty, who was a resident of Longmenhe Village in Shaoyang during the mid-Qing Dynasty.



**Figure 1. Shaoyang County, Jinzhong City, Shanxi Province, China**

## 2.2 Folk Customs

Nandong Village is influenced by the Confucian philosophy of "harmony between heaven and humanity" and the Daoist belief in "following the natural order." The layout of the courtyards in the village is characterized by axial symmetry, with clear distinctions between the interior and exterior, reflecting a culture of hierarchical order. The inscriptions

on the door plaques often quote Confucian classics, such as "Promote Ethics" and "Be Humble and Benefit." The traditional culture of Nandong Village includes folk beliefs, and many of the customs and activities passed down to this day are related to these beliefs, such as the activities on the second day of the second lunar month and the ritual of chasing away the "fox spirit." The diverse cultural influences have contributed to the unique regional culture and folk characteristics of Nandong Village. Under the influence of its culture, the village residents live in harmony with each other, enjoying a peaceful and prosperous life, showcasing a harmonious relationship between humanity and nature in the picturesque rural landscape [2]. Nandong Village has existed since before the Ming Dynasty. During the Ming and Qing Dynasties, the prosperity of commerce led to the flourishing of Nandong Village, and the villagers who engaged in business outside brought their wealth back to their hometown. At the peak of its prosperity, five families, namely Li, Zhao, An, Ma, and Bai, jointly built nearly 20 temples in Nandong Village. However, with the decline of the Jin merchants, Nandong Village lost its former prosperity and was once known as the "Little Taigu." The overall layout of Nandong Village is complete, with clear street and lane structures. The houses are built according to the mountain terrain, with a rational layout. The architectural form and layout adhere to the Chinese concept of "harmony between heaven and humanity," making it a representative village in the Jinzhong region. The villagers of Nandong Village have always been simple and honest, surrounded by lush trees, and have followed the concept of harmonious coexistence between humans and nature from ancient times to the present. The villagers have always cherished trees, and several ancient trees in the village have a history of hundreds of years, complementing the residential buildings. The crops are naturally stacked after harvest, creating a picturesque village landscape. As a unique form of local Chinese architectures, the watchtower is a multi-story tower-like building that combines functions of defense, residence, and architecture. Qixing Ancient Village once built many watchtowers, each over 20 meters high and covering an area of

125 square meters, known locally as the "Qixing Watchtower" or "Men Tower." This ancient fortress has a long history, having experienced destruction, reconstruction, and repairs over several dynasties. During the Cultural Revolution of the last century, only two watchtowers were left and almost demolished. Today, only two buildings restored to their original style remain.

According to the records of Shouyang County Annals: Nanhe Village is located south of the ancient city of Chengzhi, commonly known as Nanhe. Due to its location at the source of the river, the village was named Nanhe Village. Many prominent families in Nanhe Village have their own hall names, and they hang their hall name plaques in the halls. On festive occasions, they hang large red lanterns with the hall names in front of the doors, and even mark their agricultural tools and utensils with their family hall names. When local people talk, they often refer to each other using the name of the hall. And to this day, 21 hall names are still passed down, including Tianshun Hall, Jingan Hall, Guangyu Hall, Hongshun Hall, Dehou Hall, Donglun Hall, Qingyun Hall, Yongqing Hall, Zhushou Hall, Dunhou Hall, and etc, with physical objects such as seals, thin ropes, baskets, pockets, measures, forks, food boxes, and shoulder bags used as evidence. In this ancient village of about 50 households, over half of the families use hall names, which was extremely rare at the time. The villagers adhere to Confucian ideology, inherit the teachings of Confucius and Mencius, and emphasize morality, etiquette, and rituals.

The economic environment of Shanxi during the Ming and Qing Dynasties was a major factor in the formation of traditional dwellings. Economic levels, social and cultural environments, site selection, ritual ideas, the integration of architectural culture, and military defense all contributed to the formation of traditional dwellings in Shanxi. These three factors complemented each other, had a comprehensive effect, and gave Shanxi's traditional dwellings distinct regional characteristics<sup>[3]</sup>."

### 3. Subterranean Pit Kiln Dwelling

#### 3.1 Nandong Village

The street and lane in villages serve as

important places for residents' public life, primarily fulfilling transportation functions. They also play a role in commercial, cultural, and living functions<sup>[4]</sup>.

The streets and lanes, as a link connecting different courtyards and the external world, can reflect the development of a region. Nandong Village has not been planned but has developed naturally. Therefore, its streets and lanes, following the changes in terrain, curved and criss-crossed, forming a zig-zag shaped transportation network system. The streets and lanes in Nandong Village range from 1 meter to 4 meters, with the largest being only 6 to 8 meters. Apart from the five main roads, the rest are pathways between houses. Most of the buildings along the streets are single-story residential houses. The outer walls of the streets and lanes are mainly made of unprocessed materials such as adobe, blue bricks, and rough stones, giving a natural feel with their rough and protruding surfaces. The outer walls are primarily grey, and although the materials vary, the color tones are harmonious and coordinated (Figure 2).



**Figure 2. Overview of Nandong Village, Jinzhong City**

Nandong Village's subterranean pit kiln, also known locally as Gedong courtyard, is a type of residential dwelling that best reflects adapting to local conditions, with distinctive Shanxi characteristics. Located on the Loess Plateau, it benefits from good wind and sand protection and insulation. The buildings are mostly made of earth, wood, bricks, and stones, with the architectural form mainly consisting of kiln dwellings. The main room is often accompanied by side wing rooms on both sides or on one side.

Due to the influence of the terrain and landforms, the orientation of courtyards is not fixed in Nandong Village. Residents flexibly

and freely choose the layout of the courtyards based on their positions and the distribution of roads, resulting in a rich variety of spaces. Nandong Village is a unique case where kiln dwellings and courtyard-style residences are mixed. During the Ming and Qing Dynasties, several prominent families moved into the village after engaging in business outside. In order to build houses and make bricks, many large pits were left on the ground after construction. The soil around these pits was hard and had strong plasticity, so residents preserved them and horizontally excavated them to create kiln dwellings for living. This led to the formation of the preserved subterranean pit kilns. These kiln dwellings were originally the residences of laborers hired by landlords. The dwellings built by landlords were all above ground. Due to this historical background, Nandong Village features a unique combination of subterranean pit kilns with above-ground courtyards (Figure 3).



**Figure 3. Dikengyuan, Nandong Village, Jinzhong City**

The subterranean pit kiln typically occupies around 10 square meters, with a depth of about 5 meters and a width of approximately 3 meters. The entrance is built at ground level, and the interior and exterior are connected by a narrow ramp or staircase. Opposite the main entrance, there are three or four kiln dwellings, with a niche in the center of each kiln. To address drainage issues, the top of the kiln slopes outward, preventing rainwater from entering the courtyard. Additionally, a deep pit is constructed in the courtyard to collect rainwater, providing water for people and animals. This setup effectively meets the water needs in the semi-arid climate of the area.

The houses are covered with raw earth, providing excellent insulation properties that

keep them warm in winter and cool in summer. They are built using locally available materials, making construction easy, saving land and energy, and offering significant ecological and environmental benefits. During the feudal era when productivity was relatively low, this construction style also played a role in promoting the development of Nandong Village. Well-preserved courtyards that blend harmoniously with nature reflect the local people's concept of living in harmony with nature.

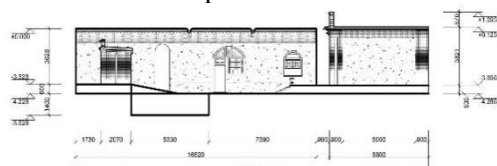
The top and facade of the kiln dwellings are reinforced with bricks and stones, while the top is made of raw earth integrated with nature. Nowadays, most inhabited dwellings use concrete for waterproofing to meet residential needs. Although the parapet walls are structurally simple, they are designed with simple blue bricks, reflecting the pursuit of the spirit of the hardworking.

The doors and windows of the kiln dwellings are mainly made of wood, with a relatively simple structure. In the main kiln, where there is a need for natural light, the doors and windows are combined to form a unified structure with the platform. In terms of decoration, the doors and windows are all mortise and tenon structures. The residents of Nandong Village prefer to use horizontal and vertical patterns, which have strong traditional aesthetic value, adding beauty to the monotonous main structure of the kiln dwellings. The decorations are mainly concentrated on the upper door panels and windows. In the local area, doors and windows are generally narrow and deep. Due to the dry climate and occasional strong winds and sandstorms, these types of doors and windows can provide good defense against harsh weather conditions (Figure 4).

In China's Loess Plateau region, especially in the Shaanxi and Shanxi areas, the subterranean pit kilns are widely distributed. This indicates that the subterranean pit kiln, as a form of residential architecture, was spontaneously developed by the indigenous people at that time and served as a superior solution to meet their housing needs. As an important traditional dwelling in the Loess Plateau, cave dwelling has the advantages of warm in winter and cool in summer, saving farmland, simple construction, low cost, and conducive to ecological protection and



sustainable development [5].



**Figure 4. Section of Dikengyuan in Nandong Village, Jinzhong City**

## 4. Cliff Kiln Dwelling

### 4.1 Nanhe Village

The Houde Hall of Nanhe Village is located deep in the mountainside of Nanhe Village. It is a residential courtyard that integrates living with vinegar brewing and processing. The ancestors of the residents made a living by brewing vinegar, so in their own courtyard, some of the excavated kiln dwellings are used for living, some for storing vinegar, and some kiln dwellings are directly used as workshops for producing vinegar. According to the residents, the kiln dwellings were built over a hundred years ago. Later, due to the development of the times and various reasons, the residents abandoned the production of vinegar, but the vinegar workshop has always been preserved. Due to the need for residential space in the main room, renovations and modifications have been carried out since the establishment of the People Republic of China.

Although kiln dwellings are widespread throughout Shanxi Province, not all loess areas are suitable for digging kiln dwellings. Kiln dwellings should be selected in loess layers with stable development, and the depth should be chosen according to the soil conditions of the loess. The strength of loess is related to the historical time of loess formation. The longer the history, the denser the loess and the higher the strength. The Lishi loess layer is most suitable for digging kiln dwellings, while secondary loess and Malan loess are not suitable. Due to the porous and collapsible nature of loess, it may cause collapse when eroded by water. Places with landslides, collapsed ridges, and high groundwater levels are not suitable for digging kiln dwellings [6]. The walls on both sides of the courtyard gate extend outward, enclosing a private space that blends with the surrounding mountains. The entire courtyard is built along the mountainside, without

strictly adhering to symmetrical rules, but instead flexibly presenting an irregular arrangement.

The entire courtyard consists of kiln dwellings made of raw earth. The parts that were once used for living are reinforced with bricks and stones. The pathways in the courtyard are also made in the same way, using materials sourced from the mountainside. The pathway at the entrance of the courtyard is shown in the figure. In this courtyard, the main room locates behind the courtyard wall, which is different from other areas. This location choice allows for both staying away from the mountainside to avoid the hazards of landslides and overseeing the entire courtyard site as a whole (Figure 5).



**Figure 5. Overview of Cave Dwellings in Nandong Village, Jinzhong City**

## 5. Courtyard-style Kiln Dwelling

### 5.1 Nandong Village Li Family Old Courtyard

Near the entrance of Nandong Village, along the road, the Li Family Courtyard is a two-entry courtyard, which is an above-ground building where the landlords used to live. The first courtyard has been damaged, with only the original foundation structure faintly visible on the ground, while the second courtyard remains largely intact. As the courtyard faces the street, the original structure of the first courtyard has been completely converted into modern architecture due to the residential needs of the occupants, while access to the second courtyard can be found through the rebuilt main gate. Based on the relics and existing preserved buildings, the overall layout appears to be symmetrical along the central axis, with meticulous construction. Apart from the main room being a brick-encased kiln dwelling, the rest of the buildings are all wooden structures.

From the location and details of the architecture, it can be seen that the original residents had a certain level of wealth and high status in the local area. The buildings are

all above ground, which sets them apart from other structures in the village, especially the kiln dwellings, reflecting a clear hierarchical system. Situated at the entrance of the village, the buildings enjoy a superior geographical location, indicating the wealth of the residents at that time.

The gate of the second courtyard adopts a double-sloped roof with post and lintel construction. Decorations, which can be found on the ridge, purlin, bracket arms, door frame, column base, and lintel, reflect the aesthetic demands of the residents at that time. On the column base, the overall circular stone structure is divided into four parts, each side carved with decorative patterns such as auspicious clouds, mythological figures, and plants symbolizing good fortune, which were favored themes in stone carving by the residents, reflecting their aspirations and pursuit of a beautiful life. The craftsmanship of the lintel is similar to that of the column base, using large stone blocks for shaping and then carving on the stone surface. The lintel is approximately 30 cm long, 20 cm wide, and 60 cm high. Positioned at the corner between the door and the wall, the lintel is carved on both sides. The content of the lintel carvings, mainly featuring plants and animals, differs slightly from the figures depicted on the column base. Stone carvings are also prominently featured on the courtyard's screen wall, which is about 2.2 meters tall and aligned with the gate of the second courtyard. The screen wall is entirely made of bricks, with a decorative fret pattern on the base, floral carvings in the center, floral patterns on the four corners, and a stone-wood beam structure on the top, harmonizing with the overall architectural style. The screen wall is a unique cultural expression in ancient Chinese architecture, symbolizing gathering positive energy and ensuring the safety of the household. It further highlights the distinct status of the residents and represents a unique architectural form influenced by traditional Chinese Feng Shui beliefs.

The painted decorations are mainly concentrated on the lintel and purlin of the gate of the second courtyard, with the overall painted decorations being well preserved. Traditional paintings are generally elegant, and the color scheme in this courtyard mainly consists of shades of blue and green. The

themes chosen include auspicious cloud patterns, Ruyi motifs, as well as characters representing blessings, prosperity, longevity, and happiness. The painted wooden surfaces not only have rich aesthetic value but also serve to better protect the wood. Paintings are only applied when the quality of the wood material is not ideal. The painting style and content in residential buildings are not as strict as those in palaces and temples, allowing for more flexibility and personal expression.

The wing rooms are single-sloped roof brick-wood structures with a depth of about four meters. However, the doors and windows still retain the rounded dome shape of kiln dwelling doors, maintaining the overall unity and harmony of the courtyard. The decorations on the doors and windows are simple, mainly featuring fret patterns, with coin-shaped ventilation holes on the upper door panels. While meeting practical needs, these elements also serve an aesthetic function, enhancing the overall visual appeal of the architecture (Figure 6).



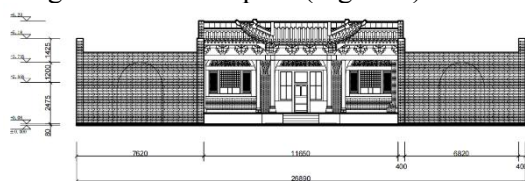
**Figure 6. Residence Painting of Nandong Village, Jinzhong City**

The main hall of the main room features niches on the exterior, used for enshrining deities and Buddhas, meeting the cultural needs of the residents' religious beliefs. The main room is a brick-encased kiln dwelling with three rooms, each room with a narrow and tall doorway, approximately three meters and eighty centimeters in height and sixty centimeters in width. While meeting the requirements for wind and sand protection, the design also maximizes natural lighting efficiency. Additionally, there is a Buddhist Hall on the roof of the main room, reflecting the influence of religious beliefs on house construction and emphasizing the importance

of faith in this cultural context.

## 5.2 Longmenhe Village Wang Family Courtyard

The main entrance of the Wang Family Courtyard connects with the high courtyard walls, and the connection between the main entrance and the courtyard walls is sloped, creating space for the main entrance and gatehouse, ensuring overall harmony and aesthetics. The gatehouse of the main entrance features a canopy roof with flying eaves construction, adorned with brick carvings on the ridge, reflecting the high status of the Wang family and showing their unique aesthetic taste. Upon entering through the main entrance, the courtyard consists of a central courtyard with wing rooms. The main room, wing rooms, and reversely set room are all brick-encased kiln dwellings. The front of the main room is connected to a covered corridor, with the corridor featuring a canopy roof with flying eaves, emphasizing the importance of the main room. This design creates a spacious front porch in front of the kiln dwelling, a common feature in economically prosperous areas, often accompanied by exquisite wood carvings under the eaves. This combination of traditional kiln dwellings with Chinese wooden architecture represents a typical integration of the two architectural styles [7]. The wing room is topped with a parapet wall, and one side of the wing room leads to the side courtyard, which includes wing rooms and the main room. However, one side of the wing room has collapsed (Figure 7).



**Figure 7. Facade of Shouyang County Royal House**

The reversely set room is the smallest part in terms of area and volume among all the structures, with a width of about 2.5 meters and a depth of about 2 meters. It is integrated harmoniously with the main entrance passage, forming a cohesive unit with the second gate. The overall depth of the courtyard is about 15 meters, with a width of approximately 12 meters, presenting a symmetrical layout. The

wing rooms are three rooms wide, with each room being around three meters wide and five meters deep. One side of the wing rooms serves not only as living quarters but also as a passage connecting to the side courtyard. The wing rooms feature a unique cross-shaped structure, which, while not affecting functionality, creates a more distinctive architectural space compared to traditional kiln dwellings. This design improves natural lighting deficiencies in traditional kiln dwellings, making the space more transparent and enhancing the overall living experience.

The main room is constructed on a raised platform, distinguishing the overall status of the courtyard by height. The main room undoubtedly occupies the most central position in the courtyard. The covered corridor built in front of the main room further emphasizes this point. The main room is three rooms wide, with a width of about 3.15 meters and a depth of around 7 meters, making it the largest part of the courtyard in terms of volume. A staircase between the wing rooms and the reversely set room allows access to the roof, where a square pavilion is located at the northwest corner. The roof of the residence is typically the highest point in the village, serving the dual purpose of facilitating house maintenance and showcasing the status of the homeowner in the local community (Figure 8).



**Figure 8. Overview of Wang's Household Architecture in Shouyang County**

The local craftsmen in the Jinzhong region have been influenced by the construction techniques of "official-style architecture", leading to the development of a similar "small-style architecture" with the width of the main hall as the standard for the composition and proportion system. However, due to various factors such as geographical environment, customs and culture, residential

needs, ethical order, construction materials, and etc., their construction activities have formed a unique proportion relationship with distinctive characteristics [8].

The decorations in the Wang Family Courtyard mainly focus on wood carvings, with some stone carvings complementing the wooden structures. Three sets of brackets are made above the main entrance, all of which are three-layer flat-body brackets. The brackets on the sides have more complex structures and a greater quantity. The main ridge of the door is adorned with plant-carved stone carvings and animal-head tile drip edges. The structure of the main room's covered corridor is basically the same as that of the main entrance, with the main difference lying in the volume. The covered corridor features four sets of brackets on the front, with corner brackets under the eaves complementing the flat-body brackets. The corridor has three sets of brackets, all of which are flat-body brackets.

## 6. Conclusions

Through the analysis above, detailed data and drawings have been obtained, leading to the following conclusions: First of all, in Shouyang County, kiln dwellings mainly exist in three forms: subterranean pit kilns, cliff kilns, and Courtyard-style kiln dwellings. The form of kiln dwellings is greatly influenced by the terrain and environmental conditions. In flat areas, subterranean pit kilns are suitable, while in valleys and mountainous areas, cliff kilns are more appropriate. Courtyard-style kiln dwellings are generally the residential choice of families with better economic conditions. Secondly, the residential courtyards in Shouyang County feature a combination of kiln dwellings as the main structure, integrated with conventional houses. Thirdly, the complexity of the volume and decorative structure in the courtyards highlights the grade and status of the residences, and the layout also adheres to the etiquette of respecting seniority. The last but not the least, each building in the architecture serves a dual purpose of practicality and aesthetics. Practicality is reflected in the construction of the buildings themselves, while aesthetics is expressed through cultural sentiments. The use of carving techniques further enhances the rough yet beautiful

feeling of the cold stone, wood, and earth materials.

People often say that the development of regional architecture should be based on traditional residential buildings. Therefore, traditional dwellings are the foundation of regional architecture. Traditional kiln dwellings in China have evolved over a long history, with their unique geographical and cultural environments giving them distinct ethnic characteristics. Kiln dwellings are closely linked to the climate, topography, and social culture of their respective regions, forming a unique architectural culture. Protecting these kiln dwellings is essential for preserving the historical and cultural heritage accumulated over thousands of years. Only through active preservation can they effectively promote sustainable development between urban and rural areas, thereby ensuring their inheritance and continuation.

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