

Hakka Architecture in China: Analysis of Rammed Earth Buildings

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Topic: T2.2. Study of traditional materials, techniques and construction crafts

How to cite: Ye, Fan; Mileto, Camilla & Vegas, Fernando (2025). Hakka Architecture in China: Analysis of Rammed Earth Buildings. In C. Mileto, F. Vegas, A. Hueto-Escobar & S. Manzano-Fernández (Eds.) *Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration* 10th – 12th, 2025, Valencia (Spain). edUPV. <https://doi.org/10.4995/HERITAGE2025.2025.19735>

Abstract

The architectural techniques and styles of Hakka Tulou, rooted in ancient Chinese residential architecture, reflect a harmonious adaptation to the natural environment and a profound connection to local culture. These structures embody the cultural identity and spiritual heritage of the Hakka people, representing a unique aspect of Chinese architectural history. This study selects Hakka Tulou, a traditional Chinese architectural form with distinctive Hakka characteristics, as the research focus to better understand the ingenuity and cultural significance of this ethnic group and their contribution to Chinese architecture. Drawing on existing literature and visual materials, this paper investigates the site selection principles, architectural features, typological evolution, and construction techniques of Hakka Tulou. It examines how these structures balance practicality, cultural symbolism, and environmental adaptability. Additionally, the current condition of Hakka Tulou is analyzed, alongside the challenges these buildings face in modern society. By addressing these topics, this research aims to provide a solid theoretical foundation for further studies. It offers valuable insights into the preservation and sustainable development of Hakka Tulou, ensuring their legacy endures in the evolving landscape of Chinese heritage.

Keywords: earthen architecture; rammed earth; Hakka; China

1. Introduction

With the rapid development of modern urbanization, traditional Hakka *Tulou* can no longer fully meet people's living needs or the demands of economic growth. Many young people have left Hakka villages, leading to a decline in the preservation of *Tulou*. At the same time, cultural exchange often flows in one direction—from dominant to weaker cultures—causing minority traditions to face the risk of fading or even disappearing in the context of globalization. This decline can occur both spiritually, such as in beliefs and customs, and materially, such as in village forms and architectural styles.

Hakka *Tulou* are large, enclosed traditional dwellings built by the Hakka people in China using rammed earth. Unlike typical rural houses, they are multi-storied, highly defensive, and designed for communal living. *Tulou* are typically built in circular or square shapes, but their height and form can vary depending on regional geography, social conditions, and the financial resources of the builders at the time.

Their unique structure reflects the Hakka's collective lifestyle, spatial wisdom, and strategies for coping with social unrest and harsh environments. As a vital part of Hakka culture and even a recognized World Cultural Heritage, Hakka *Tulou* reflects the essence of traditional

Chinese culture through its architectural style, internal structure, and *Feng Shui* principles. Known for their diligence and strong sense of community, they have developed a distinct language, customs, and architectural traditions—among which the *Tulou* stands out as a symbol of collective living and cultural resilience.

2. Methodology and objective

The Hakka people are a subgroup of the Han Chinese who originally migrated from central China and later settled in regions such as Fujian, Guangdong, Guangxi, and Jiangxi. Therefore, this study focuses on representative *Tulou* structures in these areas.

The research methods include literature review, field study, comparative analysis, and visual analysis of elements such as exterior appearance, internal layout, and historical context.

The aim is to explore the architectural and cultural features of Hakka *Tulou* and identify the risk factors affecting their preservation. Additionally, the study proposes conservation strategies that take into account their cultural and social significance.

To study and analyze rammed-earth architecture, exemplified by Hakka architecture, in order to propose effective solutions for its conservation and restoration, considering both its historical and cultural value as well as the technical challenges it presents.

3. *Tulou* Address Selection

Hakka culture is a tradition born out of mobility and migration, a characteristic reflected in the very origin of its name:

The Hakka, literally mean ‘guest families’ in Chinese, are Han Chinese people thought to have originated from the lands bordering the Yellow River. In a series of migrations (five times), the Hakka settled their present areas in Southern China (Guangdong, Guangxi and Fujian) (Yang & Tang, 2020, p. 1).

Throughout the process of migration, in order to adapt to the needs of social production, the Hakka people gradually developed a distinctive cultural and architectural identity through evolution and innovation. This process gave rise to a unique form of traditional Chinese architecture with pronounced Hakka characteristics: Hakka *Tulou*.



Fig. 1 – Hukeng Tulou Cluster, in Yongding County, Fujian Province, geographically located next to mountains and water (Cai, 2021).

From a historical perspective, the emergence of this architectural form is closely tied to the broader social context of China at the time. In traditional Chinese culture, clan-based communal living was the dominant mode of residence. Members of the clan shared a common ancestry, with kinship serving as the link between individual nuclear families. “The ancestral hall symbolized and centered the clan, genealogical records provided the relational framework, and clan-owned fields served as the material foundation—these were the main characteristics of the feudal family system” (Wang & Guan, 2021, p. 240).

Moreover, given the frequent wars and social unrest in ancient China, the need to defend against external threats became one of the fundamental concerns of the Hakka community. This communal living model significantly enhanced clan cohesion, thereby greatly improving the defensive capabilities of the Hakka people and ensuring the safety of its members.

Similarly, due to migration, the design and location of *Tulou* were, to a certain extent, tailored to “adapt to the particular local climate and environment where those dwellings were built” (Katayama, 2011). Natural factors were considered a fundamental criterion in the site selection of Hakka *Tulou*. The design of residential areas and the placement of individual structures took into account elements such as solar energy, wind energy, and water resources to ensure the basic survival needs of the Hakka community. This allowed the *Tulou* to fulfill essential economic functions, such as supporting agricultural activities, as well as basic living requirements.

As “the traditional Chinese art of designing environments and physical spaces” (Kryżanowski, 2021, p. 60), *Feng Shui* has been widely practiced in Chinese folk traditions for thousands of years. Its principles are also evident in the site selection of Hakka *Tulou*,

characterized as incorporating “both scientific elements and strong superstitious overtones” (Luo & Lin, 1997, p. 61).

“*Feng Shui*’s fundamental rule in determining location for settlement is a landscape with abundant clear water and fertile land with good environmental conditions to provide good production, life and prosperity of descendants” (Katayama, 2011).

This reflects the inheritance of *Feng Shui* as a traditional Chinese philosophy with intrinsic ecological adaptability. It also embodies the Hakka community’s ideal model of life, integrating cultural values into the natural environment to maximize the functionality and value of living spaces.

Furthermore, Lowe (2012), in his analysis of the structural elements supporting Hakka *Tulou*, pointed out that the architectural design not only prioritized defense and the shared use of courtyards and staircases among families of the same lineage but also ensured comfort with warm winters and cool summers. Thus, mountains (or farmland) and water (such as rivers or lakes) played an indispensable role in the site selection of *Tulou*.

4. The definition and characteristics of Hakka *Tulou*

- **Space Utilization:** the area of a circle with the same circumference as a square is larger, which means that constructing a round *Tulou* provides more usable space compared to a square one.
- **Savings on Construction Materials:** the round roof requires only two slopes, simplifying construction and reducing both labor and material costs.
- **Uniform Size:** the structural wooden components of a round *Tulou* are of uniform size, allowing craftsmen to calculate the necessary dimensions more efficiently during the design process.



Fig. 2 – Square and round Tuqiang components (Ye, 2024).

5. Morphological changes of Hakka Tulou

The more primitive *Tulou* is surrounded by a circle of *Tuqiang* (which means a wall made of rammed earth).

Compared to ordinary residential buildings, Hakka rammed-earth buildings are larger in scale. The rear and side sections of a *Tulou* consist of four stories, while the front hall comprises two stories, connecting seamlessly with two horizontal rows of two-story houses at the front. This design aims to enhance the defensive capacity of the structure.



Fig. 3 – Hefu County, Quzhang Township, “Weilong Building” (Ye, 2022).



Fig. 4 – Yongding County, Hukeng Town, “Fuyu Building” (National Geographic Chinese, 2020).



Fig. 5 – Yongding County, Gaopi Township, Shangyang Town, “Yijing Building” (Jianshu, 2020).

Completely straighten both vestibules and the two horizontal roofs to minimize changes in the eaves, and enhance the lower corridor to make it appear simpler and more defensive.



Fig. 6 – Yongding County, Hukeng Town, “Jiusheng Building” (National Geographic Chinese, 2020).

As Huang (2013) pointed out in his related study, it evolved into a building with two vestibules and two horizontal sides of the same height, approaching the shape of a standard square building. However, the four sections of the roof have not yet been connected. As is typical in square *Tulou*, the roof will eventually be reduced to a single strip. Therefore, the square *Tulou* is a fully defensive building structure.

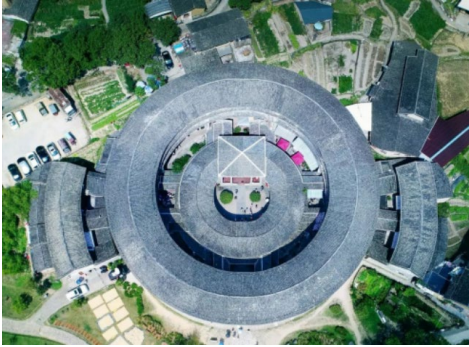


Fig. 7 – Zhencheng County, Hukeng Village, Yongding County, Longyan City, Fujian Province, China (Wei, 2018).

Round *Tulou* are famous for their unique ring-shaped structure. Typically, they expand outward from a central point to form one or more concentric circles. Each circle represents a different living space, and there is usually a *Citang* (which means family ancestral hall) at the center.

This design makes this type of building uniform in terms of lighting and ventilation, and it provides strong defensive features. At the same time, the interior space of the round *Tulou* is spacious, which supports collective living and community activities among family members, reflecting the popular customs of the Hakka people to live together as a group.

6. Construction process Hakka *Tulou*

6.1. 打石脚 *Dashijiao* (Foundation and footing)

The foundation of a wall is constructed during the *Dashijiao* phase. Before laying the foundation, it is essential to determine the type and characteristics of the building, such as its shape (square or round), the number of floors, and the number of rooms, all based on the size of the base, the required number of rooms, and the available resources.

The foundation pit is commonly known as *Dajiaokeng* (大脚坑), which translates as trench located beneath the ground, while *Xiaojaokeng*

(小脚坑) refers to the foundation of the wall and the base of the waist-high wall situated above the ground.

6.2. 行墙 *Xingqiang* (Rammed earth wall)

In *Tuqiang*, bamboo or cedar branches are placed horizontally. Typically, two layers of wooden bars are laid in each *Hangtu*. *Haangtu* is a traditional construction technique in which moist earth is compacted layer by layer within temporary molds to form solid walls or foundations. It is known for its durability, thermal performance, and sustainability. The front and rear ends of the bamboo bars are aligned with each other, forming a circle, which in the Hakka village is known as *Tuogu* (拖骨), translating as "dragging bone," because bamboo or wood can be used as the skeleton of a building. The square corners of the exterior earth wall are also reinforced with a special weave, namely thicker cedar or thick cedar boards fixed in an "L" shape. In common parlance, it is said, "seven of bamboo, eight of wood," because bamboo harvested in the seventh month of the lunar calendar and cedar harvested in August contain less water, making them less susceptible to moths and other insects. These reinforcement measures significantly enhance the integrity of the *Tuqiang*.

Some *Tulou* are equipped with defensive cannons and shooting holes, which are mainly made of chiseled stone in the shape of cannons or buried in the walls with bamboo tubes.

6.3. 献架 *Xianjia* (Wooden frame construction)

Each layer of the *Hangtu* wall must have a well-excavated groove at the top, where wooden layers, pillars, and beams are placed.

The exterior of each floor rests on a *Tuqiang*, which acts as a load-bearing wall, while the interior is supported by wooden pillars. Normally, a beam is raised between the wooden pillars, on which several joists are placed in each room. The other end of the joists rests directly on the exterior wall.

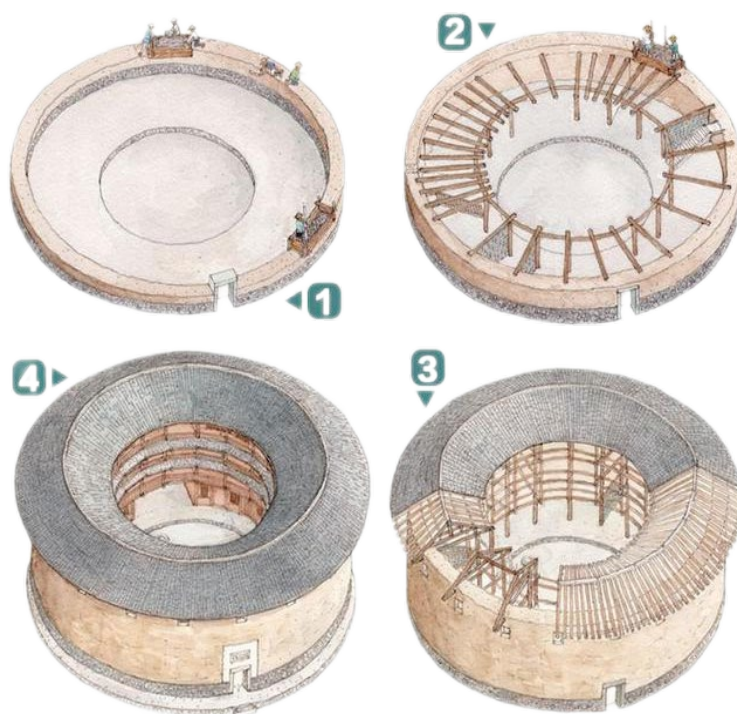


Fig. 8 – Tulou's construction method (Xie, 2021).

The end of the joist supported by the *Tuqiang* must be slightly elevated so that, when the wall dries and shrinks, the floor remains at the proper height. Each time a layer of high *Tuqiang* is tamped, a groove is excavated in the *Tuqiang* to insert the wooden keel of the floor. A pillar is placed at the opening gaps, and a beam is placed above it, a process known as “*Xianjia*.”

6.4. 出水 *Chushui* (Tiling and sealing)

When the *Tulou* is built to the final floor, a large beam (commonly known as the “load-bearing beam”) is placed in each gap, lifting the front and rear parts, serving as support for the eaves. The wooden frame used to support the cube-shaped roof follows a relatively simple method: the beams and columns are placed on the frame's belt, and the belt is fixed to the beams. Finally, the beams are placed on the lookout board, which is covered with cloth tiles.

They adopted the practice of *Jianwa* (剪瓦), meaning that round roofs are designed similarly to flat roofs, leaving the triangular roof to fill in. If the diameter of the round buildings is larger and the arch is smooth, the width of the tiles is properly adjusted to compensate for the difference.

7. Hakka *Tulou* spatial distribution

As shown in Fig. 9, the functional areas of the Hakka *Tulou* building structure are divided as follows: entrance (1), front yard (2), front hall (3), inner courtyard (4), back hall (5), hallway (6), storage room (7), and bedroom (8).

These functional areas are designed according to the spatial layout of traditional Hakka architecture, reflecting local residents' lifestyles and social structure.

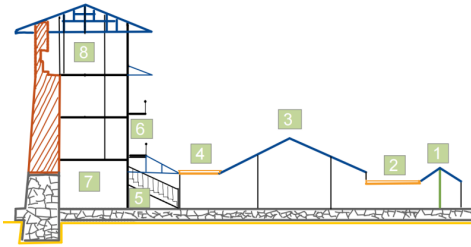


Fig. 9 – Structural schematic of Hakka Tulou (Ye, 2024).

The interior of the building is typically organized vertically, with shared staircases connecting different floors. These stairs serve continuous communal corridors, and each level provides access to individual living units.

At the center of the *Tulou* is usually a shared *Citang*, (symbolizing a common ancestor—like a node in a branching family tree). The first floor generally houses kitchens and grain storage rooms. Moving inward toward the central courtyard, there is usually a living room, while the outermost rooms are typically used as bedrooms.

8. Results and discussion

In conclusion, the decline of Hakka *Tulou* reflects a broader tension between cultural heritage and modern development. As construction of new *Tulou* ceased in the 20th century, many existing structures now face neglect, abandonment, and inappropriate renovations. Built in remote mountainous regions once ideal for security, these locations have become barriers to economic growth, prompting the younger generation to migrate to urban areas and accelerating the loss of traditional lifestyles.

While UNESCO's recognition has brought global attention to the value of *Tulou*, it has also led to challenges such as over-commercialization and insensitive alterations. The use of incompatible materials, removal of original structures, and tourist-driven modifications threaten the architectural authenticity and cultural significance of these buildings.



Fig. 10 – Converted units in the secondary building of the Lianxin Village Revitalization Block, Pinghe County (Aitachuanqi, 2019).

Effective preservation must begin with respect for traditional materials and craftsmanship. Rammed earth, timber, and clay tiles should be prioritized, alongside selective use of modern sustainable materials. All interventions must be minimally invasive, reversible, and consistent with the original structure and style. Enhancing vertical circulation and infrastructure should be done without compromising historical integrity.

Tulou conservation should embrace a dynamic and community-based model. Local residents should be actively involved in the planning and revitalization process to strengthen social ties and ensure long-term sustainability. Spatial reprogramming can introduce new public functions—such as cultural spaces, community centers, or guest accommodations—allowing *Tulou* to serve both residential and communal roles in the modern era.

Most importantly, public awareness and cultural education are key. Through schools, exhibitions, media, and digital platforms, the younger generation should be encouraged to engage with and reinterpret *Tulou* heritage. By combining architectural sensitivity with cultural participation, we can ensure that *Tulou* remain not only standing structures, but living symbols of identity, resilience, and continuity.

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