The Research on Huizhou Traditional Dwellings in China from the Perspective of Green Architecture

Chen Juan and Sarawuth Pintong
Silpakorn University, Thailand
Corresponding Author, E-mail: chenjuan262@gmail.com

****

Abstract

Huizhou traditional dwellings occupy an important position in the history of Chinese architecture with their unique architecture style and cultural connotation. From the perspective of green architecture, this article explores the practice and wisdom of Huizhou traditional architecture in terms of ecological adaptability, resource conservation, and sustainable development. Firstly, the article introduces the theoretical basis of Chinese traditional architecture and explores its importance in sustainable development and environmental protection. Next, the traditional residential architecture of Huizhou is analyzed, including the Impact factors, the characteristics of the architecture types, and the Green wisdom embedded in them. To study the green architecture wisdom of Huizhou traditional dwellings, the researcher must not only focus on the architectures themselves but some relevant contexts around the research objectives must also be taken into account. This is because factors such as geographic environment, cultural heritage, and construction technology together shape the unique appearance of Huizhou traditional dwellings. After comprehensive analyses, it is concluded that Huizhou dwellings have achieved good natural ventilation, lighting, and water management through rational site selection, layout, material selection, and architectural structure design, reflecting the core concepts of green architecture. These traditional wisdom not only play an important role in traditional architecture but also have important reference significance for modern green architecture design.

Keywords: Huizhou Traditional Dwellings; Eco-wisdom; Green Architecture; Huizhou Cultural

Introduction

Green architecture refers to architectures that maximize resource conservation (energy saving, land saving, water saving, and material saving), protect the environment and reduce pollution during the whole life cycle of the architecture, provide people with healthy, suitable, and efficient use of space, and coexist harmoniously with nature. (Ministry of Construction of the People's Republic of China. (2006).) In the context of global sustainable development, green architecture has gradually become an important direction of modern architecture design. Green architecture is not only a form of architecture that minimizes the impact on the environment, but also a concept that embodies the harmonious coexistence of human and nature. In this process, the wisdom of Chinese traditional architecture green provides valuable reference and inspiration. Chinese traditional architecture has gone through natural evolution and social changes, and its ability to exist in a peaceful and low-energy-consuming way is not only an organic product adapted to the topography, natural climate, and social environment but

* Received: May 4 2024; Revised: July 9 2024; Accepted: July 10 2024

also the crystallization of people's wisdom from long-term architectural practice activities in the natural environment. However, with the accelerated development of Chinese society, the radical changes in people's lifestyles, and the constant updating of architectural technology, how to explore the traditional architecture experience of residential houses, and how to develop and pass it on, all of which require a review of the results of the research on traditional architecture by the predecessors.

In recent years, scholars from China and other countries worldwide have conducted a wide range of research on traditional architecture in their regions, including various aspects such as architecture materials and structures. It mainly focuses on how to inherit traditional architecture construction technology, how to combine it with modern new technology, and other aspects of research. Under the premise of ensuring the safety of architecture, traditional construction technology means responding positively to the ecological environment at the same time, to alleviate the pollution and destruction of the environment by modern technology, to achieve the sustainable development of architecture.

Professor Shan Deqi of Tsinghua University has divided Huizhou residential architectures into two categories, namely residential architectures and public architectures, in his book "Anhui Folk Houses", and expounded Huizhou residential architectures in all aspects from settlements to streets and lanes, to monoliths, to details. It summarises the various regional characteristics of traditional Huizhou Architecture and its construction techniques. It also puts forward the concepts of "Huizhou but new" and "new but Huizhou". (Shan, Deqi. (2009). In 2014, Qian Wei put forward a proposal for the renewal of modern new residential architectures by measuring the ventilation, lighting, and heat insulation techniques used in traditional residential architectures in Huizhou. From the Architecture layout, window openings, Patio size, and other aspects of the proposed transformation and optimization strategy for the new residential houses. (Qian W. (2014). In 2019, Huang W. et al. proposed suitable improvement techniques for envelope performance, plan performance, and defense performance in the study of suitable improvement strategies for traditional Architecture technologies in the Huizhou region. [(Wei Huang, & Hongliang Yan. (2019). discover the ideas and methods of Architecture technology from this traditional wisdom, and make suitable improvements to enhance its performance, to adapt to the needs of the development of contemporary society. 2020, Malsha S. Mendis et al. in "Unleashing the Potentials of Traditional Construction Technique in Bio-climatic architecture Designs: a Case of Ambalam, Sri Lanka', suggests that sustainable strategies in traditional tropical Architecture are found to be responsive to its users and climatic environment. (Halwatura, R. , & Mendis, M. . (2020). This scholar investigates the 'Ambalam' architecture, a sustainable traditional tropical architecture type in Sri Lanka. The architecture is an open-plan public architecture, somewhat similar in shape to the traditional Chinese pavilion, which is a roadside resting place for people. The main structure is also made of wood, and many of the construction techniques are similar to those of Chinese traditional architecture, such as placing the entire timber structure directly on the stone to protect it from rain and flooding. As a rich part of the cultural heritage, the traditional "Ambalam" builders have appropriately integrated affordability and sustainability through traditional architecture techniques to obtain a bioclimatic architectural design.

It can be seen that, whether in the renewal and reuse of traditional architectures or the design and construction of new architectures, the use of local traditional architecture techniques that optimize the environment and respond to the ecology is characterized by low energy consumption and high cultural value. Scholars hope to find a balance between combining local traditional architectural techniques with modern intelligent and advanced technologies to enhance the durability and life cycle of architecture and reduce environmental pollution and energy consumption. Complement each other and optimize each other, without forgetting tradition and abandoning technology.

The main objectives of this study are:

1. To analyze the unique advantages and wisdom of Huizhou traditional dwellings in terms of green architecture concepts.

2. To explore the specific performance and practice of Huizhou traditional dwellings in terms of ecological environment adaptability, resource conservation, and sustainable development.

3. To promote the combination of traditional architectural wisdom and modern green architectural concepts, and to enhance the ecological adaptability and sustainable development of architecture.

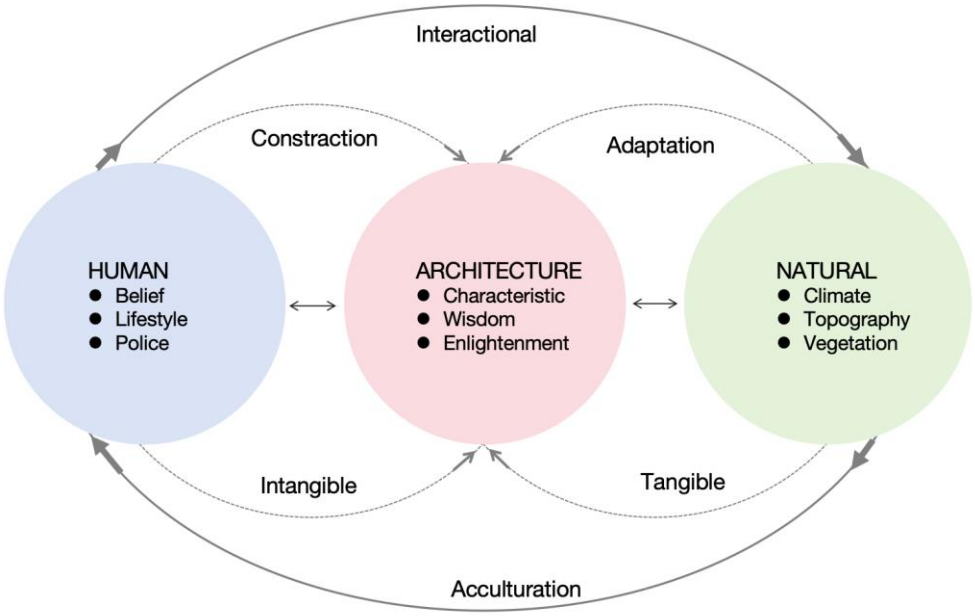


Figure 1: The Relationship Between Human, Architecture and Nature.(Chen Juan, 2024)

Analysis of the Characteristics of Traditional Dwellings in Huizhou

1. Influencing Factors of Huizhou Traditional Residential Architecture

Architecture will be subject to the comprehensive influence of many regional factors, and the proposition of regional architecture has a special value. On the one hand, the architecture needs to adapt to the natural geographic environment of the region and the objective impact of resource conditions; on the other hand, we cannot ignore the subjective role of human initiative. Therefore, it is necessary to clarify the relationship between the influencing factors and regional architecture through an in-depth analysis of nature, culture, and technology.

1.1 Geographical environment

"Huizhou" is a historical geographic concept; in the geographical space, it is located in southern Anhui, Huizhou's six counties [Shexian, Yixian, Jixi, Wuyuan, Qimen, Huining] and adjacent to the pan-Huizhou area (such as Jiangxi Fuliang, Dexing, Anhui Jingde, etc.) and its natural landscape is rich and colorful. The geographical location of Huizhou makes it unique in terms of topography, climate and natural resources.

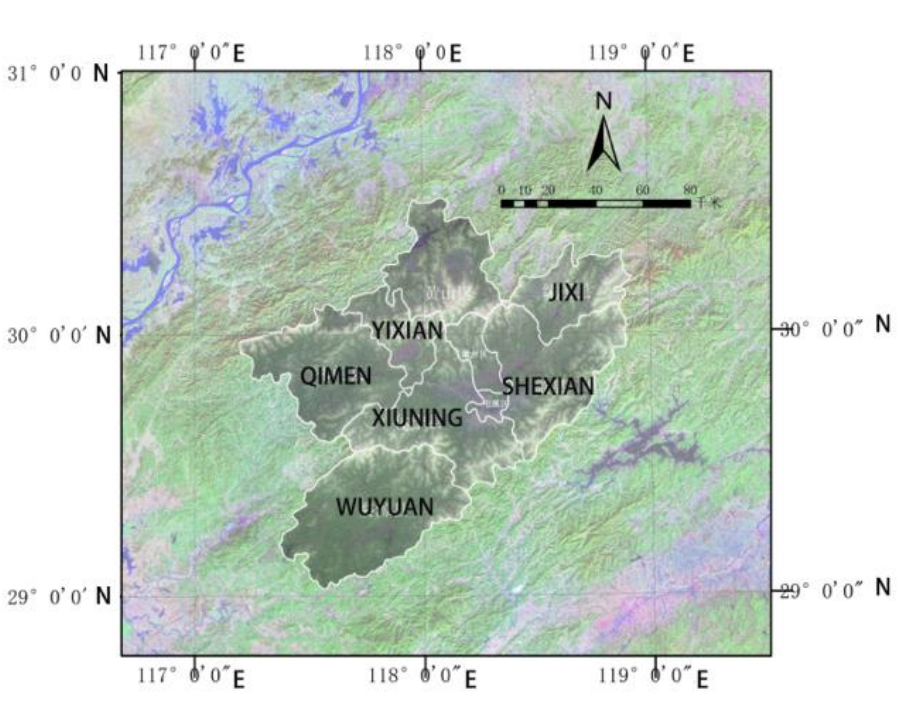


Figure 2 The map of Huizhou（Chen Juan,2023）

(1) Geographical environment

Huizhou has a varied topography, with mountains and basins interspersed, and the landmass accounts for about 1.3 percent of the country's total area, with the mountainous part accounting for about 90 percent of the total area. Most of them are about 200 meters above sea level. Moreover, there are many waterways in Huizhou, including the Yangtze River, Xin'an River, Qingyi River, Shuiyang River and other large and small waterways. Therefore, most of the villages in Huizhou were built beside mountains and lakes in ancient times, and

there were fewer plains, making land resources very scarce. The architecture layout is relatively dense, the streets and lanes are compact and narrow, and the residence is carefully calculated. Thus, it is clear that land use is one of the most important factors to consider.

Figure 3 Densely built-up Huizhou villages（Chen Juan,2022）

(2) Climate Characteristics

The Huizhou region experiences a subtropical humid climate characterized by distinct seasons: long winters and summers, shorter spring and autumn periods, ample rainfall, and abundant sunlight. However, despite being predominantly sunny, Huizhou, situated in a mountainous area, receives the least amount of sunshine hours in Anhui Province. The average annual sunshine hours within the territory is lower than 2,000 hours, between 1,750~1,960 hours, and the average yearly temperature is 15℃~17℃. (Zhai Tunjian. 2010.) This climatic feature influenced the structure and design of Huizhou architecture. For example, architectures usually provide good ventilation and shading in summer, while light and heat preservation are considered in winter. Meanwhile, Huizhou has a humid climate with abundant rainfall. architectures should be equipped with adequate drainage systems to mitigate the risk of flooding and safeguard the structural integrity of the architecture. The rainfall conditions may adjust the design and pitch of the roof. Moreover, due to the humid climatic conditions, the selection of architecture materials needs to consider their moisture resistance. Thus, Huizhou architecture often incorporates wooden structures, which require protection against moisture. Meanwhile, Huizhou architecture frequently focuses on ventilation and lighting design to adapt to hot and humid summers and rainy climates. The setting of courtyards and passageways helps to improve air circulation and establish an enjoyable residential atmosphere.

Figure 4 Seasonal Scenery of Huizhou (Chen Juan,2023)

(3) Resource conditions

Huizhou is located in a mountainous area, rich in soil, wood, and stone resources; the people take materials locally and nearby and generally use bricks, stones, and wood as raw materials to build houses. Huizhou architecture exterior walls are mostly masonry bricks, bricks from the local clay processing molding; the production process is complex; bricks are mainly used for the maintenance of the architecture structure wall, more than the use of empty bucket wall masonry method; the brick body flat long to reduce the load on the wall and save materials. (Zhou Hailong, Zheng Bin, Zhang Hong, & Fu Xiuzhang, 2010). Brick through the carving is also commonly used in decorative, because of the brick carving and beautifully carved and weather-resistant, commonly used in the doorway, door covers, walls and other places. architecture roof small green tile also made of clay firing, waterproof and thermal insulation. Huizhou abounds in stone, often using hemp stone, lapis lazuli, red sandstone, etc., used as road surfaces, plinths, corners, columns, and railings, holding drums and other requirements of the strong and moisture-proof parts of the stone, appearing calm and heavy. Huizhou has a warm and humid climate, which is suitable for the growth of trees and rich in forest resources. The internal structure of Huizhou architectures is mostly made of cedar and ginkgo wood, and different kinds of wood are used according to the types and parts of the architectures. The structure, construction, and decoration of wooden frames are a blend of craftsmanship and art. Generally, they are brushed with tung oil but not painted, which makes them look simple and elegant, reflecting the characteristics of Huizhou architecture. The

authors found in their research that villagers now recycle old materials dismantled during the construction process and that the use of indigenous materials and the recycling of old materials are in line with the inherent requirements of sustainable development of ecological civilization.

1.2 Cultural Factors

Architectural anthropologist Lapoport pointed out: "It is not the physical environment including a natural climate that affects the shape of the human house, and yet the social culture including ideology, religious beliefs, customs, as well as behaviors, which are the determinants of the shape of the house." (Lapointe Papoport, Amos. 2007.)

(1) Demographic and social factors

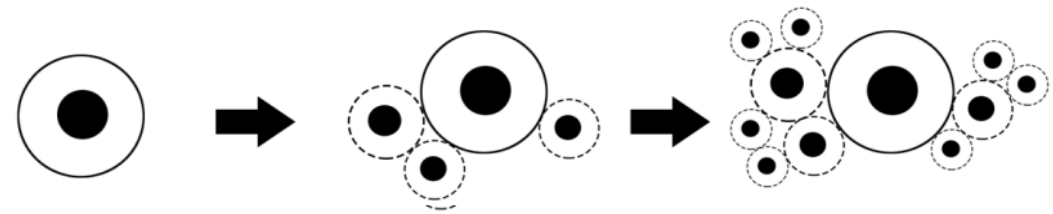
Huizhou is a secluded area with a beautiful natural environment, making it an ideal place for seclusion. During the long historical period from the Eastern Han Dynasty to the Southern Song Dynasty, there were three large-scale migrations in the history of Huizhou, predominantly to escape from the war. The significant migration of scholarly clans from the Central Plains altered Huizhou's population size and structure, introducing advanced Central Plains culture. The architectural forms directly reflected the exchange and fusion of the Central Plains civilization and the ancient Vietnamese culture. Furthermore, the typical "upstairs hall" in early Huizhou architecture was a spacious room, which was a place for individuals to rest and relax in their daily activities. This is due to the humidity in the mountainous areas, which prevents malaria and retains the Yue individuals' "dry fence" architecture pattern. Simultaneously, due to the influx of large numbers of immigrants, individuals, and narrow land, the construction of architectures has become the best choice, and yet more mountainous terrain, to solve the issue of ventilation and lighting, the Central Plains "courtyard" form has evolved to adapt to the treacherous mountain environment, both closed and open to the Huizhou "Patio. " The wooden structures of houses in mountainous areas are prone to fire hazards. To prevent the spread of fire, the horse head wall was developed. The early architectural form in Huizhou emerged from the cultural amalgamation of foreign immigrants and indigenous people.

(2) Philosophy

"The unity of heaven and man" is the simple concept of nature in Chinese culture. It is the philosophical foundation of traditional Chinese culture, which is expressed in “nature”. Huizhou villages and architectures are based on the natural concept of the unity of man and nature, and the village sites are in full compliance with nature; the architectural forms are metaphorical for nature and harmonious symbiosis; the architecture materials are taken from nature and are simple and natural. Traditional Chinese dwellings are square in form, rigorous in layout, symmetrical on the central axis, and in order of respect and inferiority. Huizhou has a large number of people and little land, so the architectures are compact, focusing on multi-level, overall order and harmony, the architecture form takes the square as the prototype to form the monolithic form, takes the square patio as the core to organize the internal space of the architecture, and coordinates and balances the space through the symmetry of the central axis, and the architectural group embodies the spatial structure of the hierarchical order of the center and the edges. Huizhou architecture conforms to the terrain, presents an irregular whole of regular individuals, and shows the flexibility of adapting to the local conditions. All these physical forms reflect the profound influence of traditional culture and philosophy.

(3) Patriarchal factors

The patriarchal system profoundly influences Huizhou architecture, which is reflected in the village's layout, the shape of the architecture monoliths, as well as the internal furnishings and decorative motifs. Besides, the overall planning of Huizhou villages is centered on clan temples, forming a hierarchical structure of clan temples, branch temples, and family temples. The hierarchical concept of the patriarchal system is spatially reflected in the monolithic form of Huizhou's traditional regional architecture, serving as the material carrier of the patriarchal system. The space of architecture groups is divided by the layout of blood relations, and the internal space of architectures is arranged by family ethics and the order of respect and inferiority. Furthermore, Huizhou traditional dwellings are rectangular or square, with closed outer walls and inward-facing patios forming a triple or quadruple courtyard and its combinations, which, even though adapted to changes in response to the topography of the terrain, clearly and distinctly demonstrate the inherent order of symmetry on the central axis. (Wu Yongfa, Xu Zhen.2010)



When a village is formed, the clan house is the center of the whole village, and houses are built around the clan house.

After the clan developed its branches, the residence was arranged around the ancestral shrine. The clan house is still the center of the village.

The clan grew, with smaller branches of each clan and the village expanding.

Figure 5 Schematic diagram of clan development （Chen Juan,2023）

(4) Customs and Folklore

Huizhou villages are rooted in farming culture and enriched by the influence of Confucian and commercial culture. Folklore activities are in association with festivals, rituals, celebrations, and other traditional days of life. In addition to ceremonial activities, they are frequently accompanied by recreational activities, including the Mulian Opera, the Grass Dragon Dance, the Zhong Kui Dance, the Battle Drums, the Pavilion Carrying Ceremony, the Beam Ceremony, etc., which provide villagers with opportunities for social interaction and recreation. Additionally, in many villages in Huizhou, there are frequently towers and bridges, pagodas, pavilions, ancestral halls, theatres, and other architectures at the entrance of villages, forming public spaces and landscape nodes in villages, which become the external hub for villagers' daily interactions during weekends, and public places for numerous activities during folk festivals, so that individuals’ joint participation increases the shared beliefs and cohesion of the villages. This interplay between activities, the built environment, and emerging cultural norms further shapes human behavior, fostering an interactive dynamic.

Figure 6 Receive the Bodhisattva and Mu Lian Opera（Chen Juan, 2023）

1.3 Technological Factors

The Huizhou region had already made specific technological achievements in ancient times, and its systematic development was founded in the Tang Dynasty, developed in the Song and Yuan Dynasties, and flourished in the Ming and Qing Dynasties. A large number of celebrities and skilled craftsmen appeared in Huizhou, covering mathematics, astronomy, physics, biology, geology, medicine, agronomy, and optics, as well as ink production, printing, dyeing and weaving, architecture, painting, and other disciplines, and achieved excellent results ahead of the whole country, which had an influence at home and abroad and also had an impact on Huizhou architecture. (Zhang Binglun, Hu Huakai. 2005.)

(1) Huizhou's emphasis on education

Since the Song Dynasty, Huizhou has attached great significance to the cause of education. There are many founding schools and colleges in Huizhou, and "hundreds of years of individuals are nothing but an accumulation of good deeds, and the first good deed is just to read books." Prosperous education not only makes Huizhou numerous individuals but also greatly improves their cultural literacy, for the development of culture, business, and technology provides the necessary conditions.

(2) Promotion of technology by the Huizhou merchants

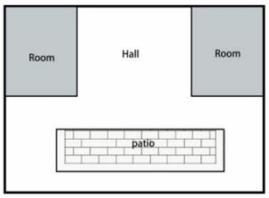
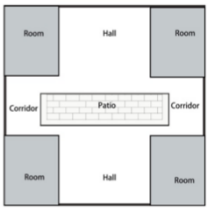
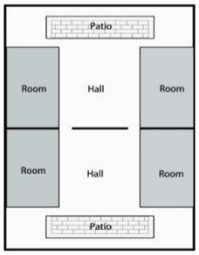
Following the mid-Ming Dynasty, Huizhou merchants ascended to prominence, wielding considerable influence in the commercial sphere of China. The Huizhou merchants with high cultural quality injected their views on the layout, structure, interior decoration, as well as hall arrangement of the houses into the architectures, which resulted in the gradual formation of the Huizhou architecture in a unique style of architectural system, which made the Huizhou architecture practical as well as containing a rich cultural connotation.

Through their robust commercial endeavors, Huizhou merchants furnished significant financial backing for Huizhou architecture, earning them the epithet "patrons of art" within the realm of Huizhou architecture. Secondly, Huizhou merchants paid attention to the feng shui theory; the patio is also called "four waters return to the hall," water in Huizhou is a symbol of wealth, so Huizhou residential architectures must have a patio on the condition that it rains, the rain flows along the eaves of the roof to the patio, which is symbolic of the "wealth flows into the home."

2. Architecture Types and Characteristics of Huizhou Traditional Dwellings

Among the architecture types in Huizhou, the number of courtyard houses is the largest and most typical. Huizhou patio-style residential architectures are adapted to the unique natural geography and cultural environment of Huizhou, showing distinctive regional characteristics. The Huizhou houses are compact and square in shape, occupying a small area but with a large effective use area; the main architecture is symmetrically laid out with a central axis, and the ancillary functions are flexibly arranged beside the main architecture, mostly two to three stories. The basic archetypal form of Huizhou houses is the triplex, i.e., the "T" shape, usually with three rooms, commonly known as "one bright and two dark" or "bright three rooms." The hall in the center faces the patio, forming a semi-open and bright space, while the bedrooms on both sides are smaller and darker, with the staircase behind the hall. As the basic form of Huizhou houses, the triplex is combined to form three basic architecture units, the "T" "H," and "✚" shapes. "✚" is docked by two triplexes, the middle of a patio, forming a courtyard form, commonly known as "up and down to the hall," "Two triplex halls partially connect H-shaped, each end of a patio, the halls are separated by a wooden wall, the middle of the set up in the middle of the hall on both sides of the passage. The overall layout is flexible in combining multi-directional growth, which can be adapted to the high-density living environment of Huizhou villages with many people and a small amount of land.

Table 1: The Plane Form of Huizhou Dwelling

Plan of the architecture	Plane Distribution Diagram
"T" type Basic type of the triple house courtyard	
"✚" type Parallel design, horizontal splicing of residential units	
"H" type Tandem design, vertical splicing of residential units	

The Wisdom of Green Construction in Huizhou Traditional Dwelling

The green wisdom of Huizhou traditional residential architecture is specifically expressed in three aspects: natural symbiosis adapted to the natural environment, cultural integration adapted to the cultural environment, and technological appropriateness adapted to the technological environment.

1. Space Creation Wisdom Based on Natural Symbiosis

Climate conditions have the most direct influence on regional architecture among all factors of the natural environment, which determines the original survival and production methods adopted by human beings in the face of nature, influences all stages of human civilization, and also influences the basic construction mode of regional architecture, such as the layout of architectural groups and the morphology of monoliths. To cope with the climate, the ancient Chinese took the benefits of nature. They avoided the harms of nature, creating places to shelter from the wind and the rain, reflecting the regional climatic characteristics of the residential houses. Charles Curia wrote: "At a deeper structural level, climate determines regional culture and its external forms as well as customs and rituals, and it can be said that climate is the source of myth." (Xu Qianli,2006).

(1) Patio

The patio is a representative transitional space in Huizhou architecture and is called "the most active element. (Di Peng, Wang ZhenZhen, 2013) It carries various functions, such as drainage, lighting, and ventilation. The patio space combines nature and architecture, fully echoing the natural concept of "unity of man and nature," and plays a positive role in energy saving and emission reduction and regulating the environment. Due to the influence of the natural environment and regional culture of Huizhou, Huizhou architectures generally have no windows or only small windows on the outer walls, and the walls are thicker, so the architectures have certain limitations in lighting and ventilation, and the patio space solves these contradictions. It is open through and through with the hall, without walls or partitions and other obstructions, which strengthens the airflow and, creates a good condition of heat-pressure ventilation, and circulates the input of fresh air. At the same time, the external colony drainage system is also processed through the patio space linkage; the patio floor is mostly stone-based, the architecture eaves under the ground width of about 30 cm part of the sink, and the drainage outlet channel. Rainwater drops through the drainage outlet into the total drainage system and then into the surrounding rivers, forming a living water system. Another form of patio in the middle of itself is a large pool, which has water storage, drainage, fire, and other functions.

Figure 7 The Patio of Hui Zhou Architecture（Chen Juan，2022）

(2) Ventilation system

Because of the high humidity in Huizhou area, all architectures have to give full consideration to moisture removal and ventilation. Therefore, Huizhou architectures have short columns on the ground floor and open small holes on the short wall surrounded by stone to strengthen the ventilation of the ground floor, i.e., the vents. Ventilators are mostly round with various shapes. Among them, the shape of Wan and ancient money are more common, and there are also similar discs like long shapes and some animal and plant motifs with the harmonies of fortune, luck, longevity, and happiness, which express the positive symbolism of the desire for a better life. These traditional architecture techniques, full of wisdom, fully embody the characteristics of energy-saving green architectures.

Because of the small windows on the exterior walls of Huizhou architectures, there is a certain impact on indoor ventilation. The openwork partitions in the architecture have cleverly solved the adverse effects of indoor ventilation and temperature. Most of the hollow parts are above the partitions, and the hollow parts can quickly exhaust the hot air to the outside, realizing the stratification and circulation of indoor hot and cold air and achieving a suitable indoor environment.

(3) Fireproof treatment

Many fire prevention concepts are embedded in Huizhou architecture, such as the horse head wall used at the top of the architecture, which is a good firewall. Once a fire occurs in a house, the horse head wall will block the fire and prevent a large fire. The load-bearing foundation of the architecture floor is still wooden planks, which are covered with a layer of dry fine sand, and the fine sand is covered with a layer of square bricks. When the fire spreads and destroys the wooden planks, the sand will automatically fall off and extinguish the fire. The square tiles will then fall as well, further consolidating the fire extinguishing effect and realizing automatic fire extinguishing inside the architecture. Such fire prevention wisdom is energy-saving and efficient and is worthy of reference in optimizing and renovating traditional architectures.

2. Architecture Wisdom Based on Cultural Heritage

The beautiful natural geographical environment and profound historical and humanistic environment of Huizhou region have nurtured the culture and art of Xin'an Science, Xin'an School of Painting, Huizhou Seal Engraving, Huizhou Architecture, etc., and formed the unique aesthetic psychology and aesthetic qualities of Huizhou people, which are reflected in the environmental concepts, form choices and decorative intentions of architectures in the design of Huizhou green architectures.

Traditional Chinese culture reveres nature, whether it is the Confucianism of the joy of landscape or Taoism of the law of nature, fully embodies the relationship between man and nature close, harmonious relationship, and embodies the "unity of man and nature" realm and ideals. Traditional Chinese architecture in the construction of the importance of nature is expressed in the overall organic relationship between the architecture and the environment. This ideal is particularly prominent in Huizhou culture and has become the eternal spiritual aspiration of the Huizhou people. The natural geographical environment of the Huizhou region is mostly low hills surrounded by mountains and water, and the site layout of traditional villages in Huizhou is based on mountains and water, conforming to the terrain and reflecting an organic and holistic relationship with nature. At the same time, the re-understanding of nature also greatly enriches the connotation and extension of modern architecture, making the original mechanical, monotonous modernist architecture gain vitality and diversity. (Zhang Man, Liu Songyu, Kang Jian,2011).

3. Wisdom of Architecture Technology Based on Ecological Sustainability

The idea of ecological sustainable development emphasizes the coordinated development of man and nature, economy and society. If ecological sustainability is a concept, then technology is the tool to realize it. The technology of traditional architecture contains local architecture materials and construction techniques and is the crystallization of practices and wisdom that have been adapted to the local natural and cultural environment over a long period of time. Refining the ideas, practices, and techniques from traditional technology and improving them allows the value of traditional technology to continue and the characteristics of regional architecture to be highlighted, with the dual values of inheritance and innovation.

(1) Brick structure

Most of the traditional regional architectures in Huizhou use brick structures. For the sake of structural safety, architectural heritage protection, and ecological environment protection, the structural form of traditional architectures is still needed in conservation, alteration, and new construction, but the structural performance should be upgraded to ensure structural safety and maintain regional characteristics, which is also the unity of the three values of technology, humanity, and ecology.

(2) Wooden structure

Huizhou traditional architecture also takes a wooden frame as the main structure and gradually formed the mixed structure form of lifting beam and piercing bucket under the influence of the environment, and developed the unique inserted beam structure form, which makes its adaptability of weaving and structural performance in the complex mountainous environment have been greatly improved. (Rong Man,2017) The large wooden structure in Huizhou architecture is mainly of pierced-double type and supplemented by lifting-love type, and the characteristics of a pierced-double type frame determine that its connection is stronger in the direction of house depth and weaker in the direction of parallel house trusses. (Ma Quanbao,2013) The beam and column members of the wood structure are connected by mortise

and tenon construction, so its damage is often in the form of structural damage at the mortise and tenon nodes rather than component damage. The straight mortise and tenon connecting the beams and spine columns on the floor of the ground floor and the floorboards may be the first of all to suffer from the folding mortise and tenon damage. (Wang Xingyi, Wang Jianguo,2011) Therefore, the structural system and mortise-and-tenon joints of Huizhou traditional wooden structures have room for further improvement.

(3) Wall performance

Huizhou architecture exterior walls closed thick, few and small windows, the air bucket wall for the air layer or filled with broken bricks and yellow mud, which to some extent is conducive to the architecture of heat preservation and insulation, but and the current energy-saving standards in the thermal conductivity of the exterior wall is less than 10 watts / (square meter - degree) of the value of the wall compared to the heat preservation and insulation performance of the air bucket wall is still not a small gap. The physical properties of the external wall are suitable to improvement can be used within the external wall insulation (conducive to the protection of the thermal insulation layer and the presentation of the texture of the external wall) or external insulation, or in the cavity bucket wall body filled with slurry insulation materials, this practice can be better retained in the original authenticity of the architecture wall, and to make its thermal insulation performance can be improved.

Conclusion

By sorting out the theory of Huizhou green architecture and analyzing the three factors of nature, culture, and technology of green architecture, it is proposed that based on the existing ecological foundation of the human space environment, the environmentally sustainable development experience formed by using the wisdom of the traditional green architecture strategy in the survival and development of thousands of years is used to generate the optimization strategy for the sustainable development of Huizhou architecture and space. Let more people make use of Huizhou architectural construction techniques, scientific and rational use of green technology, and collect and summarize the green eco-design experience of Huizhou residential houses, which is not only conducive to reducing energy consumption, ecological damage and improving the quality of the human environment, but also conducive to the realization of the traditional construction technology inheritance and renewal, and to the promotion of the inheritance and revelation of the contemporary regional green architecture and traditional architectural culture, and to explore new language modes for the current ecological architectural construction technology of the Huizhou area. It is also conducive to realizing traditional construction technology inheritance renewal, promoting contemporary regional green architecture and the inheritance of traditional architectural culture, and exploring new language modes for the current ecological architecture construction in the Huizhou area.

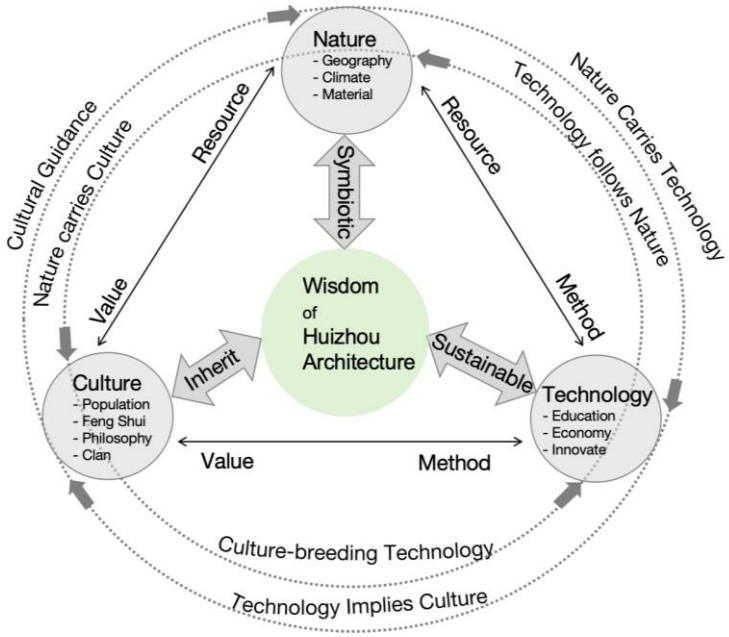


Figure 8 A Systematic Review of Huizhou Dwellings from the Perspective of Green Architecture (Chen Juan, 2024)

References

Di Peng, Wang ZhenZhen. (2013). *Traditional Ecological Energy Saving Concepts in Folk Houses in Southern Anhui.* Symposium on the 1000th Anniversary of the Completion of Baoguo Temple in Ningbo, China. 664-667.

Gao Jianfeng, Huang Yi. (2021). A Study on Green Building Experience in Ancient Chinese Architecture. *Chongqing Architecture*, 20 (10), 64-67.

Halwatura, R. , & Mendis, M. (2020). *Unleashing the potentials of traditional construction technique in bio-climatic architecture designs: a case of ambalam, Sri Lanka.* International Journal of Environmental Science and Development.

Lapointe Papoport, Amos. (2007). *House Form and Culture*. China architecture Industry Press.

Ministry of Construction of the People's Republic of China. (2006). *GB/T 50378-2006 green architecture evaluation standard.* China Construction Industry Press.

Ma Quanbao. (2013). *A Comparative Study of Jiangnan Wooden Frame Construction Techniques.* China Academy of Art.

Qian W. (2014). *Research on the indoor environment creation technology of traditional residential houses in Huizhou*. (Doctoral dissertation, Anhui University of Technology).

Rong Man. (2017). *A Comparative Study of the Residential Architectural Culture of Suzhou and Huizhou in the 16th-19th Centuries*. (Doctoral dissertation, Suzhou University).

Shan Deqi. (2009). *Folk houses in Anhui*. China architecture Industry Press.

Wu Yongfa, Xu Zhen. (2010). On the humanistic spirit of Huizhou Folk houses. *Famous Chinese Cities.* (7), 28-34.

Wang Xingyi, Wang Jianguo. (2011). Theoretical analysis of the rationality of the construction of Huizhou wood-frame ancient dwellings. *Journal of Hefei University of Technology: Natural Science Edition,* 34 (9). 1375-1380.

Wei Huang, & Hongliang Yan. (2019). Study on the Suitability Improvement Strategy of Traditional Architecture Technology - A Case Study of Huizhou Region. *Residential Science and Technology,* 39 (5), 6.

Xu Qianli. (2006). Territory - Space and Threshold of a Culture. *Urban Architecture*, (008), 6-9.

Zhai Tunjian. (2010). *Huangshan shanzhi: 2006.* Huangshan shusha. 94-100.

Zhou Hailong, Zheng Bin, Zhang Hong, & Fu Xiuzhang. (2010). *A preliminary study on the materials, construction, and thermal performance of masonry facades of Huizhou houses.* 2010 International Conference on Science and Technology of the Built Environment.

Zhang, Bing-Lun, & Hu, Hua-Kai. (1998). The origin and evolution of the term "physics" in ancient China. *Studies in the History of Natural Sciences*, 17 (1), 6-8.

Zhang Man, Liu Songyu, Kang Jian. (2011). A study on the ecological aesthetics of architectural symbols in post-industrial Britain. *Architectural Journal*.12 (6) 4-9.