A Research on the Architectural Design and its Implementing of Dong Nationality in Northern Guangxi

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Abstract — The traditional architecture of national minorities is the phenomenon of national culture. Under the long history of history, each nation has a unique traditional architectural design and style. They are the treasures of Chinese nation. Dong architecture is one of the most classic type in Chinese minority architecture. Dong people take advantages of their natural and geographical conditionals to build unique all-wood architecture. Its unique architectural design is the embodiment of traditional Chinese excellent cultural heritage and the carrier of humanistic spirit. This paper mainly takes the Dong architectures in northern Guangxi as research objects, by analyzing the architecture modeling, inner building structures and building materials of the drum building, the wind and rain bridge and the dry-column style residential building, to display the creation of Dong architectural mode, and hope to provide some practical experiences for the construction of buildings with certain national characteristics.

1. INTRODUCTION

With the development of the social and multi-economic and cultural values, more people pay attention to the culture of ethnic minorities, especially the unique architecture culture of the minority. Guangxi, mainly in the northern part, has an ancient ethnic group called Dong People. They make good use of the environmental advantage to obtain the materials, and create a distinctive national living style. Among them, there are the dry-column-style residential buildings with special characteristics of the Dong nationality, which is “people live in the upper part of the house and domestic animals live in the group floor”[2]. Together there are Drum Building and the wind and rain bridge, all containing the rich Dong’s cultural connotation, which are called the 3 treasures of Dong architectures. The Dong people’s unique architectural culture has gained a lot of praise. Therefore, the study of the unique building structure of the minority nationality can further understand the cultural implication of the Dong nationality, and has an important economic value for the development of the architecture art [4].

2. THE HISTORICAL SOURCE AND LIVING ENVIRONMENT OF DONG NATIONALITY

2.1. The Historical Source of Dong Nationality

Dong is called “Qi Ling”, “Shantong Man”, “Dong Man” and so on. After the founding of the people’s Republic of China, the national unified its name is “Dong nationality”[8]. It is one of the oldest ethnic
minorities in China. At present, Dong nationality in Guangxi is mainly distributed in northern Guangxi, especially concentrated in Sanjiang county and Longsheng county. Dong nationality is a nation that likes to live in groups, so every nationality village is adjacent to one another, which forms a typical “Dong area”, and a unique Dong traditional architecture [17].

2.2. Site Selection of Dong Nationality

The Dong nationality in Guangxi is located in the mountainous area. 90% of the environment is mountains. The rest are water and farmland, each taking 5%[2]. Villages are normally built in the beallach area which is rich of spring. In addition, the Dong people have chosen the living place for groups by means of the “Fengshui” thought of China, so as to coordinate the development of the village and the natural environment. Therefore, the location of the Dong village can be summarized as follows: depending on the landscape, suit one’s measures to local, focusing on landscape configuration and living harmonious together with environment.

Dong people live in groups. The size of the villages is affected by the population, the living environment and productivity and other factors. So the scale of villages ranges from small one to relative large one. The villages located in the low-lying valley are more probable for the formation of the large-scale village because of the larger space and the better living conditions (Figure 1).

Figure 1. Sanjiang county

While the villages located in the half-mountain are limited by the terrain, the size of the village is small(Figure 2).

Figure 2. Sanjiang county

In the village, the height of the exquisite wooden house is well arranged and designed high and low around the patchwork, imaginative. The building process is exquisite and the shape is beautiful. The whole village is centered around the high-rise drum building, and the house is surrounded on the outside of the drum building to form a concentric pattern of central outward diffusion (Figure 3).

Figure 3. Gaoxiu villiage

The height of the building around the drum is generally lower than the height of the drum, in particular the house in the vicinity of the drum tower. As a symbol of the village of the Dong nationality, the drum building occupies a dominant position in the space form of the village in the height and the artistic image of the village. There are layers of residential clusters, in which are
occasional fish ponds, together around the center of the drum building, which creates a compact and concentrating space[5]

3. ARCHITECTURAL CULTURE OF DONG IN GUANGXI
Dong village has rich and complete environment and artistic image, which is not only unified and harmonious, but also attractive. This is determined by the representative environmental characteristics of Dong nationality. Dong architecture has formed a complete system in the process of long-term historical development, among which are the drum tower, the wind-and-rain bridge and dry column residence are the most famous architecture, attracting much attention from all over the world. Many scholars are attracted to investigate and study its architectural art and structure, so that more people can understand the architectural cultural treasures of Chinese ethnic minorities.

3.1. The Architecture Design of The Drum Tower

3.1.1. Historical and Social Function of The Drum Tower. In the early history, as long as it is the Dong nationality village, there must be a drum tower. Because there is an ideology rooting deeply in Dong nationality. That is “The drum tower is built ahead of the village.” The Drum Tower is the place of the Dong people’s gathering and discussion, leisure and entertainment. Besides these, there are other functions of the drum tower: one is the settlement of internal disputes. The other function of the drum tower is to anti-enemy and deal big event from outside. In the event of emergency or big event, the villagers boarded the drum tower to call the people to discuss in the tower. Villagers can distinguish that it is a good news or an alarm according to the length, volume and speed of the sound [3].

3.1.2. The Modeling of Drum Tower. The drum tower can be divided into two basic types according to its overall modeling,: Attic-style drum tower (Figure 4) and tower type drum tower (Figure5).

![Figure 4. matian drum tower](image1)

Attic-style drum tower is in rectangular shape with flexible layout, and looks soft and simple. Its height is similar to the common residential buildings. The attic-style drum tower is mainly distributed in the Dong area which is greatly influenced by the Han nationality. And it is not a typical representative of the architectural art of the Dong Drum Tower. What we would focus on is tower-style drum tower.

In contrast, the tower-style drum tower is much more colorful. It mainly composes of three parts: tower bottom, tower body, pavilion top. The bottom of the drum tower is square. The building is
similar to the ancient pagoda, beautiful in shape. This kind of drum tower is tall, high and straight, looking like a pagoda from afar, majestic and spectacular. It is a typical representative of Dong drum tower. Every floor plane of drum tower is regular polygon. Generally it is quadrangle, hexagonal, or octagonal. The curve roof is upward gently and beautifully. The floor of drum tower may draw lessons from the number of floors on the facade of Buddhist pagoda or under the influence of Chinese traditional culture, so it is generally built into odd numbers. Some are 3 or 5 floors; some can be up to 17 floors. The statement on each floor is not the number of space floors that can be accommodated, but the sum of eaves and eaves on the roof. The drum tower is multi-prism, shrinking from low to high, making the huge tower particularly stable and gorgeous, like a dragon winding up (Figure 5). The fascia board appear white color, and looks like the belly of a dragon from afar. And the top of the drum tower is like a dragon raising its head. The small green tile covered in the drum tower twinkles like a dragon scale, which makes it a real lively dragon. This type of drum tower is obviously developed in the form of "Luohan Building" (Buddhist character) architecture, which is the most widely distributed with the largest number. It is a typical local building of Dong nationality. Drum building does not need to nail a willow, all the components are connected by Xiangmao structure (a kind of architectural technology) to form a complete architectural system (Figure 6).

It can stand hundreds of years without rooting, which cannot help highly praising the wisdom of ancient ethnic minorities.

3.1.3. The Inner Structure of The Drum Tower . It can be divided into three parts: the foot of the building, the body of the building and the top of the building, or "attic bottom, tower body and pavilion top". The foot of the drum tower is a part of the first floor between the foundation and the eaves. The foot of the building is either one floor or two floors. Some drum towers are surrounded by plank walls and wooden windows, leaving only the entrance and exit doorways, while others are overhead with only a few columns, but usually at the center of the foot of the building, there is a pool of fire (Figure 7), which not only becomes the focus of this inward space, but also reflects the spiritual significance of the drum tower itself.

For the two floors towers, some first floors are surrounded by plank walls and wooden windows, leaving doors in and out. The central position of the building is also set as a fire pool. The second floor is a meeting place (Figure 8).
The tower-style drum tower structure system is usually supported by a big suspended column, four intermediate posts and twelve eave columns. Dong people regard it as twelve months of a year, which means "eternal life". The four intermediate columns are the main load-bearing columns. Every one of it is big enough to be hugged by at least two adult men. The outer column is the auxiliary column, which is relatively short. In order to support the eaves of the drum tower, they are in the same position as the inner column. Pavilion eaves are the focus of decoration, carved by dragons and Phoenix, decorated with colored flowers; or surrounded by wooden windows, embellished with angular wooden flowers. The eaves raised high, as if they are flying, or jumping (Figure 9).

It reflects the artistic level of Dong painting teachers, the artistic reproduction of Dong people’s life, and the prayer and sustenance of Dong people’s soul. The drum tower is the symbol of Dong nationality village and the symbol of nationality surname, which embodies the material and spiritual outlook of the village.

3.1.4. The Building Materials of The Drum Tower. The drum tower is mainly made of Chinese fir as a building material, and the wood chisel made by Chinese fir and the birch are connected close together. The top beam and column are arranged high up in the air, criss-cross, up-to-down and in consistent manner. It adopts the lever principle to support every floor from down to up. The drum tower is mainly made of four large circular Chinese fir as the main column, directly to the top of the building. The four slightly smaller round woods are used as the sub-column. The plugs are installed crossly and vertically, stretch to all directions (Figure 6). All the beams are punched holes by chisel made by birch without a nail. There is no gap between the knot and the buckle from the beginning of the construction to the completion of each process, this reflects the exquisite skill of the Dong people from the be ginning to the completion of each process. The beams and columns made of the drum tower are not optional. It is chose by the prestige man of the village. The wood should be old and high quality in the right size and height. Therefore, the chosen one should be the king of the Chinese fir. The roof was covered by green tile or the fir bark (Figure 9), which makes the whole architecture harmonious and spectacular.

3.2. The Architectural Design of The Win-and-rain Bridge
The wind-and-rain bridge is also another Dong village symbol that integrates the spirit of architectural art in Dong nationality area. It is mostly a corridor building. It is not only used as a traffic building, but also a place for leisure and entertainment of Dong nationality. It is the Dong people who make use of the local rich forest resources to build a variety of wooden bridges on streams and rivers, combining
corridors, buildings and pavilions, that is, “wind and rain bridge”. The Chengyang wind-and-rain bridge (Figure 10) in Sanjiang County, Guangxi, is a world civilization.

The bridge is 7.77 meters long and 16 meters high. There are five pavilions on the bridge [20]. With its unique shape and excellent decoration, this bridge attracts countless tourists from inside and outside.

3.2.1. *The Connotation of The Wind-and-rain Bridge*. It is mostly built at the water outlet at the entrance and exit of the village. A small number of the bridges are also built in the village. Where there is a village of Dong nationality, there is a wind-and-rain bridge. The wind and rain bridge is divided into two kinds: the beautifully decorated one called flower bridge, while the simply decorated one called lake bridge. On the surface of bridge, pavilions and corridors are closely connected on the bridge. The eaves on the upward are overlapping. There are two rows of benches on the bridge, which can be used for people to rest and cool when the weather is hot (Figure 11).

"Wind and rain bridge" and "Liangqiao" are all the terms of loanwords from other language. Dong people call it "Fuqiao". It is the balance of national spiritual crisis, and the "protective charm" of Dong family. The wind-and-rain bridge embodies its strong internal social function. Therefore, in Dong areas, even if people live in a poor condition, they still concentrate financial and material resources to build this village wind and rain bridge[10].

3.2.2. *The Construction modeling and materials of The Wind-and-rain Bridge*. Dong people living in mountainous areas, which is rich in forest resources. The wind and rain bridge makes use of the advantages of local resources to build the bridge with the combination of Chinese fir and stone. The room is built on the deck of the bridge, which adapts to the humid, hot and rainy climate of Dong mountain area, protects pedestrians from the wind and rain, and defends the wood components on the bridge from the influence of the sun and rain, thus prolonging the service life of the wooden bridge. Finally, the architecture of wind and rain bridge adapts to the environment of Dong area in line with the rational structure and form. The construction of the wind-rain- bridge is generally composed of stone pier and abutment, bridge deck and bridge span structure, bridge corridor and pavilion structure of beam-column system.

The pier and abutment is divided into the bridge abutment and the bridge pier. The abutment refers to the pedestal of the two ends of the bridge, most of which are constructed in combination with natural terrain and partially protected by blue stone. The external pier is stacked with turquoise and the interior is filled with material stone. The shape is usually hexagonal prism. The upstream side and downstream side are both acute angle, which can reduce the impact of the river on the bridge. The middle and both ends of the bridge porch are generally equipped with 3 to 5 pavilions with heavy eaves, which can fix the support of the simply supported beam, reduce the bending moment of the
simply supported beam, and bear reasonable force and transfer force directly. The building material of bridge deck, bridge body are Chinese fir combination across the river. The length of the bridge is generally 30 to 50 meters, up to 80 meters. The craftsmen of Dong nationality make full use of the principle of mechanical balance and lever in physics, and adopt the composite system of dense cantilever bracket beam and simply supported beam on the stone pier, which is lifted up layer by layer (Figure 12).

![Figure 12](image)

It skillfully increases the span of the pier, the weight of the wooden structure part of the bridge body, the bearing capacity and the bending strength of the bridge deck beam. Sanjiang Chengyang wind-and-rain bridge was built with this way, so the pier has a span of nearly 20 meters at both ends. It reflects the intelligent and superb skills of Dong people by using such rigorous and reasonable structural modeling to complete the construction of the long-span wooden bridge in the condition of low productive level. Both the porch and the pavilion use the combination beam-column system to form an integrated bridge deck, with a width of about 3-4 meters. Some have railings or wooden lattice windows on both sides, and some have only one side. The whole bridge deck is open and transparent, and the bridge body is equipped with four rows of columns with the post and lintel frame. There are long benches between the columns for passers-by to rest, cool, talk and overlook. There is also a layer of eaves outside the railing of the bridge, which not only increases the aesthetic feeling of the wind and rain bridge, but also protects the bridge deck and bridge body from wind and rain, so as to prolong its vitality, and at the same time enhances the integrity and stability of the bridge deck [9].

3.2.3. Interior decoration of the wind-and-rain bridge. The interior decoration of the wind and rain bridge is mainly painted with paint. It is matched with the stone carving and wood carving on the two sides of the handrail. The whole bridge corridor is a beautiful and colorful painting. The theme of the color painting is still the production of Dong people, their living customs, festival customs and folk stories. The painting not only reflects the people’s life, but also reflects the aesthetic interest of people. In addition, it is common to have a shrine at the beginning of the pavilion at both side of the bridge, such as the image of Guan Gong, the attic of Wen Chang, and the Ancestors Pavilion for pilgrims and passerby to worship. The inside pavilion was decorated by red and green color. The whole layout, the tile and ridge carving, the colorful tone and the original shape, and the romantic charm fully reflects the characteristics of the national art, which not only reflects the wisdom of the Dong people, but also the epitome of the traditional culture of the Dong people in the building.

3.3. The Dry-column Style Residential House of Dong Nationality
The dry-column style house is also a characteristic of the Dong people’s building culture.

3.3.1. The Origin of the Dry-column house of the Dong Nationality. The Dong is a minority calls themselves “Gan”. There is no exact meaning in “GanLan” in Chinese. “Gan” means to cover something by woods, while “Lan” means house in Dong’s dialect. The whole meaning of “GanLan” is a house covered by wood, which vividly express a special living form—to build a house with tree to live upward. It is suitable for the region with hot and humid climate in the south. It can be well ventilated, damp-proof, and anti-theft and wild animals. It is warm in winter and cool in summer.

3.3.2. The modeling and structure of dry-column residential house. The characteristic of dry column
style residential house of Dong nationality is similar to the stilted building, belongs to the stilted type dry column building. This construction method is based on the terrain selection, natural environment and climate characteristics and other specific factors. Most of these buildings are built by rivers, streams and mountains. The dry bars built by the water stand partly on the water and partly on the ground by the water. The overhead part up of the water is supported by a trunk. If it is built on the edge of a mountain, or on a hillside, where there is a slope, it is overheaded by using the column to form a stilted building style (Figure 13).

![Figure 13](image)

The bottom floor of the dry column built on the edge of the mountain is not all overhead, the rear part of the building is directly mounted on the slope. The front part is overhead with wooden columns or installed with wave columns according to the slope of the terrain, which look like hanging columns. Therefore, the dry column house has both the features of traditional stilted building, and the unique structure of Dong’s dry-column style architecture, which shows the living habits of the Dong people, emphasizes the harmony between people and the environment, and also displays the unique regional style and characteristics of the Dong people’s dry-column house. Because this kind of dry-column house are affected by the perennial rainy and humid climate and hilly environment, the first floor cannot be occupied. Some use the ground floor directly to pile up farm tools, firewood, raise livestock and poultry. Some of the dry column houses are in full open mode on the first floor, while others are surrounded by panels. There is is a large overhanging promenade, with railings or waist-length panels, connected to a staircase. Second floor is living space. Stairs are generally located next to the main house. From the stairs into the second floor you will arrive the main place for eating and drinking and play. Here mainly consists of hall house, corridor, bedroom and so on. Due to the humid climate in the Dong area, the Dong family will also set up a fire pond in the hall house, which can be used as both heating and food utensils. The second floor is spacious and bright, ventilated and warm. If there are guests in a family, they will gather here. So the fire pond is the symbol of the family. Behind the hall is the bedroom and the other side is the corridor. The semi-high railing is built outside the corridor. The third floor is the attic floor, spacious and bright. It mainly not used for living, but used to store grain or pile up debris. Some people will separate a room or two as kid’s room. And the roof of the dry building is also laid with green tile, here we do not repeat anymore. These house are mainly built together, layer by layer. People can feel the fine rhythm of this building from watching them. It is also a characteristic of Dong nationality architecture and has great research value.

4. CONCLUSION
The traditional architecture art of the Dong nationality is the important component part of the tradition national culture. It has outstanding social historical value and spiritual civilization value in our national building treasure house. This paper analyzes the historical culture, technology, structure, building materials and features of Dong’s architecture symbols ---the drum tower, the wind-and-rain bridge and the dry-column residential house so that people know more about the fantastic minority architecture style. Through the study of Dong nationality architecture in northern Guangxi, it is hoped that people may know more about the essence of its building art, so that more people can understand the systematic and scientific nature of the Dong nationality architecture culture and inherit the traditional architecture art.
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