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Safeguarding the Memory of Cultural Heritage: Protection and Restoration Strategies for Dong Village Settlement Architecture

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Abstract

The architectural settlements of the Dong people are the core representatives of China's Dong culture. The unique architectural forms created by the Dong people, such as stilted houses, drum towers, and wind-and-rain bridges, demonstrate the wisdom of the Dong people in adapting to mountainous environments and their exquisite construction techniques. However, with the acceleration of urbanization and the impact of tourism development, Dong village architecture is facing multiple challenges, including settlement hollowing-out, the discontinuity of traditional craftsmanship, and the destruction of authenticity. This study proposes a series of protection and restoration strategies by integrating relevant domestic and international theories and practical experiences based on the formal characteristics, cultural value, and current issues of Dong village settlement architecture. It emphasizes the principle of holistic protection, advocates for the combination of authentic restoration and adaptive renewal, and aims to achieve the inheritance of cultural heritage through means such as digital technology, community participation mechanisms, and cross-regional collaborative protection. Furthermore, this study explores the path toward balancing traditional architecture with modern needs, intending to provide theoretical support and a practical reference for the sustainable protection of Dong village settlement architecture and the continuation of cultural memory.

Keywords: Dong architecture; Dong village settlements; cultural heritage; architectural protection; restoration strategies



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1. Introduction

The preservation and restoration of traditional architecture are crucial for safeguarding cultural heritage and maintaining a sense of identity. As an important material carrier of human civilization, it is facing a global survival crisis [1]. According to UNESCO and ICOMOS analyses, many regions in Asia contain a large share of the world's at-risk historic structures, and the vulnerability of these sites has been repeatedly emphasized in heritage monitoring and gap-filling reports [2,3]. Globally, significant changes have occurred in architectural preservation methods, which now emphasize the importance of authenticity and the original state of buildings. For example, the International Council on

Monuments and Sites (ICOMOS) has established fundamental principles—as enshrined in the International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter)—that guide the analysis, preservation, and structural restoration of architectural heritage by combining traditional philosophy with modern conservation concepts [4]. However, challenges still exist in their application, such as balancing the preservation of original uses with the demands for new functions, and ensuring sustainable maintenance strategies [5,6].

The crisis faced by traditional architecture primarily manifests as the disconnection between traditional spaces and modern demands [7], the risk of a skills gap in wooden construction techniques [8,9], and the commodification of cultural symbols due to excessive tourism development [10,11]. Among these, protection and improvement strategies at the technical level are relatively easier to implement. However, the functional disconnection between traditional architecture and modern demands has seriously impacted the practical significance of traditional architecture. Modern architectural forms often fail to resonate with the historical experiences and customary lifestyles of communities, which often leads to the loss of cultural identity, historical continuity, and community cohesion embodied by these buildings [12]. The choice of building materials and political decisions that prioritize contemporary design over traditional forms exacerbate this disconnection; the obsession with progress and modernist practices marginalizes traditional architecture and building methods [13]. This shift has led to the forgetting of vernacular architecture, which once reflected the traditional values and identity of local communities, for a period of time [14]. Tourism development can, to some extent, transform the functional nature of traditional buildings, effectively preventing them from being erased in the process of urbanization [15]. However, the degree of tourism development is difficult to control [16,17], and its forms and methods are also uncertain.

The protection of traditional architecture is deeply rooted in national culture and historical background. In response, the Chinese government has formulated a strong strategy to maintain historical wooden-structured buildings, emphasizing minimizing changes to the original state to maintain authenticity [18]. However, even with such policies, China's rapid urbanization and modernization processes still pose significant challenges to the protection of traditional architecture, and many valuable traditional rural buildings are frequently demolished or abandoned [19]. The Dong ethnic villages in southern China are typical cases of traditional Chinese architecture and the local architecture of ethnic minorities. The forms of these villages and their residential buildings reflect the adaptation of the Dong people to natural and geographical conditions. Dong ethnic settlements, as living fossils of the East Asian stilt-style architectural system, include important representatives of Dong ethnic architectural types such as drum towers, wind-and-rain bridges, and stilt houses [20]. The Dong people have migrated and settled in the course of historical development, forming Dong villages with ethnic symbolic significance. The layout and unique architectural forms within the villages reflect the unique culture and life wisdom formed by the Dong people in adapting to the geographical environment. They not only showcase the exquisite architectural craftsmanship of the Dong people but also carry rich ethnic memory and cultural value. The uniqueness of their value lies in the following aspects: first, the ecological wisdom of adapting to the environment in the layout of villages and realizing the synergy between humans and the land through the use of dry railing structures in building organization [21]; second, as the material carriers of Dong culture, they carry the social system organized by "Kuan" (Kuan: Dong traditional communal self-governance system) and the Dong ethnic customs formed around it [22]; furthermore, there are unique aesthetic features and construction techniques of Dong ethnic wooden architecture that reflect mathematical harmony and structural aesthetics [23]. The research on the protec-

tion and restoration of Dong ethnic architecture not only provides a Chinese solution to mountain cultural heritage protection but also has significant reference significance for the protection of Southeast Asian stilt-style architecture.

With the acceleration of urbanization and the rapid development of the tourism economy in recent years, the settlement buildings of Dong villages are facing severe problems. On the one hand, against the backdrop of the times, the hollowing out of settlements caused by the migration of indigenous residents for work is serious [24]. The ancient buildings in the village also show a relative decline tendency due to the lack of effective maintenance resulting from the reduction in the labor force and the difficulty in inheriting construction skills, which leads to the deconstruction of ethnic culture; on the other hand, unreasonable modernization and tourism development have damaged the original spatial pattern and regional style of Dong villages to a certain extent [25]. In the face of the above problems, how to effectively protect and restore the settlement architecture of Dong villages and continue their cultural memory has become an urgent issue to be solved. Existing research on the protection of traditional buildings in the settlement architecture of Dong villages and even in the whole southwest China mainly focuses on isolated aspects, such as maintaining the physical structure or formulating building renewal strategies, and there are few systematic solutions. Many scholars have put forward various opinions on the protection of traditional buildings: Jiang proposed to transform traditional buildings into museums by changing the nature of the buildings, so as to prevent them from being annihilated in the process of urbanization [26]; Ferretto believes that the protection of traditional buildings should integrate local crafts and customs, allowing them to gradually modernize without eroding the heritage [27]; Han's plan focuses on the field of materials and passive sustainable methods to improve the thermal comfort and functionality of traditional buildings [28]; and Suvi Rautio is a rare scholar who focuses on the relationship between the protection of Dong village settlement buildings and residents' lives from a social perspective. In his book, he describes the contradiction between "authenticity protection" and the failure to provide more living convenience for villagers in the reconstruction process of Dali Dong Village. The author calls for avoiding ignoring the needs of villagers and adopting "top-down" planning in the protection process, but rather paying more attention to the perspective of villagers, so as to achieve a balance between protection work and the actual needs of villagers [29]. From a more macro perspective, this study discusses the sustainable protection strategy that integrates theoretical strategy, technology implementation, and protection system construction as a whole. Through in-depth analysis of the form characteristics, cultural and historical value, and current situation of Dong village settlement architecture, combined with relevant theories and practical experience at home and abroad, the author puts forward a series of protection and restoration strategies for the special situation of Dong villages, and emphasizes the necessity of balancing cultural heritage protection with the needs of modern life. In addition, this study highlights the importance of establishing protection mechanisms at the institutional level and promoting community participation, and advocates fully mobilizing the enthusiasm of local residents in the process of building protection and restoration, making the protection of cultural heritage more practical, and ensuring the preservation and continuation of cultural memory and the development of regional characteristics in modern society.

1.1. Research Overview

The main contents of this study include the formal characteristics of Dong village settlement buildings, their cultural heritage value, the current dilemmas and challenges in protection, the discussion on the theoretical methods of protection and restoration, and the analysis of relevant existing excellent protection cases. This study aims to provide useful

ideas and references for the protection and restoration of Dong village settlement cultural heritage through systematic theoretical discussion and practical case analysis, and then contribute to the cultural inheritance and sustainable development of Dong village areas.

1.2. Research Method

1.2.1. Literature Research Method

By collecting and extensively reading papers, monographs, reports, and other literature related to the architectural heritage of the Dong ethnic group, strategies for architectural preservation value, and the preservation of traditional Chinese wooden architecture, this study systematically sorts out the construction techniques and methods of Dong ethnic architecture, the evolution history of settlement space, and the protection theories related to cultural heritage. Key information is selected, summarized, and organized to establish a theoretical framework for the value assessment and protection principles of Dong villages. This aims to clarify the cultural logic and technical key issues of protection and identify the focus of research.

1.2.2. Case Analysis Method

We conducted a field survey and image record collection in Dali Dong village, Zhaima Township, Rongjiang County, Guizhou Province. We recorded and summarized the architectural features and cultural environment of the residential houses and drum towers in Dali Dong village, analyzed their architectural aesthetic value, and explored the morphological structure and social life culture of the Dong ethnic group's settlement area. This research aims to provide supporting information and data for further studies.

1.2.3. Field Survey Method

This study compares the advantages and significance of two design approaches, i.e., adaptive renewal and modern reinterpretation, through two case studies: the drum tower renovation of Dali Dong Village and the design of the wooden structure building “Huanggang village, Collection of Homestay” by Chinese architect Chen Guodong. By drawing a contrast, it provides ideas and references for architectural preservation design work.

2. Overview of Dong Village Settlement Characteristics and Analysis of Cultural Value

2.1. Historical Development of Dong Settlements

The Dong people are one of the ethnic minorities with a long history mainly distributed in China. They are primarily concentrated in the border areas of Guangxi Zhuang Autonomous Region, Guizhou Province, and Hunan Province in Southern and Southwestern China, with some also living in Enshi Tujia and Miao Autonomous Prefecture in Hubei Province. Their ancestors can be traced back to the Gan Yue tribe, which was part of the Bai Yue ethnic groups during the Qin and Han dynasties. In the agricultural society, the Dong people formed settlements by living together in villages, with clan ties—either one surname per village or multiple surnames per village—serving as a bond. A Dong village usually geographically includes several Dong hamlets. In primitive society, adjacent villages and hamlets would form an alliance organization called “Kuan” to manage important local affairs [30]. Evolving over time, this has developed into village settlements with unique ethnic characteristics scattered across various parts of China. Among them, representative Dong villages include Zhaoxing Dong Village in Liping County, Guizhou Province, which is known as the “Largest Dong Village in China” and considered as the “First Village of Dong Region”; Baojing Dong Village in Zhenyuan County; Dali Dong Village in Zaima

Township, Rongjiang County, Guizhou Province (Figure 1); and Chengyang Eight Villages in Sanjiang County, Liuzhou City, Guangxi Zhuang Autonomous Region.



Figure 1. Dali Dong Village, Zhaima Township, Rongjiang County, Guizhou Province. Photograph by the author.

After the 1980s, research on traditional Dong architecture began to increase, among which public buildings represented by drum towers were the most distinctive, and drum towers, wind-and-rain bridges, and the Grand Song of the Dong were considered as the “Three Treasures of Dong Culture” [20]; the unique construction techniques of the Dong people, as highly valuable intangible cultural heritage of China, were included in the first batch of national intangible cultural heritage protection lists in 2006.

2.2. Spatial Layout Characteristics of Dong Villages

2.2.1. Geographical Distribution: “Nestled Against Mountains and Beside Waters”

Dong villages are often “nestled against mountains and beside waters” due to their production practices, the need for river water irrigation in agricultural cultivation, the demand for wood materials in housing construction, and the adaptation to the climatic characteristics of simultaneous rain and heat in South China and the terrain features of dense hills. According to differences in terrain, their locations can be classified into the foot-of-the-mountain riverside type, flatland rural type, and mid-mountain pass type [31]. Such terrain facilitates water access, farming, and logging activities, while the natural barriers formed by high mountains and dense forests also served as ideal defensive measures for the migrating Dong ancestors during turbulent times in history. In terms of geographical distribution, Dong villages show the obvious characteristics of circular distribution leaning against hillsides or linear distribution along rivers; from a macro perspective, the layout modes can be roughly divided into strip-like extensions along both sides of rivers, construction on one side of major mountains and rivers with “slopes behind and facing rivers”, adaptation to the natural terrain, and clustered distribution in river valleys and basins.

2.2.2. Village Layout

In the internal layout of the village, the drum tower and wind-and-rain bridge—also the most artistically beautiful buildings in a Dong village—are often considered as the core of the village, which serve as the main public activity spaces in the village. Most activities are carried out around these two places and rarely extend beyond the village. The remaining residential spaces are usually distributed radially around the drum tower, forming an “introverted and enclosed” “centripetal” spatial layout type [32]. The outer

area of the village is a residential zone dominated by stilted houses, which are usually distributed on relatively high hillsides. The houses are backed by the hillsides and stand high above the core area, forming a vertically layered spatial structure. As shown in Figure 2, the residential houses in Dali Dong Village, Rongjiang, Guizhou, are distributed around the central basin along the hillside at the edge, which directly reflects this feature. The clear separation between the public area at the core and the private areas arranged around it reflects the Dong villagers' emphasis on public activities and their awareness of clearly distinguishing between public and private spaces in daily life.



Figure 2. Aerial photography of Dali Dong Village. Photograph by the author.

2.2.3. The Extreme Emphasis on Public Activity Spaces Under the Spatial Evolution Oriented by Public Activities

The spatial evolution of Dong settlements is strongly influenced by their ethnic social culture. In traditional Dong society, adjacent villages formed alliances based on geographical ties, establishing a folk autonomous and self-defense organization later named “Kuan” [22], which bears the characteristics of a clan commune. The “Kuan” organizational system, as the core form of traditional Dong society, emphasizes collective political deliberation and public activities, featuring distinct collectivist traits and thus becoming one of the prominent cultural characteristics of the Dong people. This collectivist cultural trait profoundly shapes their lifestyle and spatial construction. Therefore, the need for spaces for public activities, such as organizational discussions, has become a core factor in the spatial evolution of villages, leading to the development of settlement layouts centered around public activity spaces, such as the aforementioned “centripetal” layout [33]. Due to such cultural traits, collective activities have become an indispensable part of their lives. Whether traditional festivals or daily rituals, they are often conducted collectively, even giving rise to the unique custom of “collective village visits.” In this cultural context, public spaces are endowed with multiple social functions: internally, they serve as important venues for villagers to hold sacrificial ceremonies and cultural activities; externally, they act as windows to receive guests from other villages and showcase the style of the local village. These spaces are not only practical activity venues but also spiritual symbols that consolidate the village’s sense of identity. For this reason, the Dong people attach great importance to the construction of public spaces, often devoting the efforts of the entire village to make them important carriers of the village’s collective will [34].

2.2.4. Road Distribution

A clearly hierarchical road system winds along the mountainous terrain, connecting various functional areas of the settlement and ultimately forming the overall layout of the village, presenting natural and inherent organic beauty. These settlements nestled in valleys and by rivers are not the result of deliberate prior planning and design; instead, they have grown naturally along with natural conditions and the life experiences accumulated by people in their labor practices. Both the residential buildings and the road traffic are distributed in a scattered manner following the terrain, like the texture of the Earth, forming a spatial fabric with a well-proportioned density after being carved by time. This naturally derived and casual layout has formed a unique spatial rhythm through long-term evolution, and each building adapts to the local conditions and has a different form, yet maintains overall harmony and unity through a common material language and construction wisdom. This settlement form, which embodies order within freedom and unity amid changes, demonstrates the Dong people's profound understanding of the natural environment and fills the entire village with a vivid sense of life and artistic beauty [32].

2.3. Architectural Form Characteristics and Material Craftsmanship

2.3.1. Wind-and-Rain Bridges

Due to the geographical environment and the Dong people's need for agricultural production, which has fostered a closeness and reverence for water, "water" has become the most striking core element in Dong villages. Almost every Dong village is adorned with weirs, springs, and streams. The social interactions, festivals, and sacrificial activities that the Dong people carry out by the water have given birth to the highly distinctive "wind-and-rain bridges," also known as "flower bridges" or "blessing bridges." These are the most iconic artistic masterpieces of Dong architecture, perfectly integrating practical functions with cultural symbolism. These covered bridges spanning streams and rivers effectively connect traffic on both banks, and with exquisite wooden craftsmanship, they create a unique "bridge-corridor-pavilion" integrated structure: bridge piers built with bluestones firmly anchor in the riverbed, the roof is covered with multi-eave blue tiles, and the long corridor provides shade and shelter from wind and rain.

The sharply pointed plowshare-shaped water splitter at the pier's prow skillfully dissipates the impact of floods caused by heavy rainfall in South and Southwest China. The bridge superstructure employs a cantilever bracket-supported wooden beam system, achieving a maximum span of over 30 m without intermediate piers. Covered corridors flanked by "Mei Ren Kao" (literally "beauty's rest") benches provide spaces for communal repose. The most distinctive feature, however, lies in the multi-tiered pavilions crowning the bridge: three to five pavilions with pyramidal, hip-and-gable, or overhanging gable roofs are strung like pearls along the span, framing the central main pavilion—the tallest of all. Inside, the painted beams (and crossbeams) depict Dong cosmogonic myths and nature-derived totems. These elements transform the wind-and-rain bridge from mere infrastructure into a social hub and cultural landmark of Dong villages, hosting a rich array of communal activities [34]. Among these bridges, the Chengyang Yongji Bridge in Sanjiang, Guangxi (Figure 3), is a quintessential exemplar—the best-preserved and largest extant wind-and-rain bridge. Its "pavilion-stabilized" structural ingenuity and ornate artistry have earned it the designation of a National Key Cultural Relic Protected Unit.



Figure 3. Dong wind-and-rain bridge in Sanjiang, Guangxi, China. Note: Dong wind-and-rain bridge, San jiang, by Sanlie, 2017, Wikimedia Commons (<https://commons.wikimedia.org/wiki/File:%E7%A8%B%E9%98%B3%E6%B0%B8%E6%B5%8E%E6%A1%A51.jpg>, accessed on 9 September 2025). Licensed under CC BY-SA 4.0.

2.3.2. Drum Towers

The drum tower stands as a quintessential symbol of Dong architectural culture. Its pagoda-like form (Figure 4) invariably features an odd number of tiers. The elevation can be divided into three distinct sections: the base, the main body, and the crowning roof. Neither the base perimeter nor the walls of the main body incorporate load-bearing enclosures; instead, the entire structure relies on four, six, or eight massive central columns (revered as “golden pillars”), encircled by twelve peripheral eaves columns, all interlocked through sophisticated mortise-and-tenon joinery (Figure 5). Each tier of the main body showcases multiple layers of upturned eaves, while the roof typically adopts hip-and-gable, overhanging gable, or polygonal pyramidal configurations, often crowned with a sacred calabash ornament [35]. The tower’s structural ingenuity commands admiration—these soaring timber edifices, with their distinctive silhouettes, dominate Dong village skylines as their most conspicuous landmarks. Functionally, they serve as central communal spaces for social gatherings, council meetings, recreational activities, and ritual ceremonies within traditional Dong settlements. Consequently, drum towers invariably surpass all other village structures in height and are invariably surrounded by expansive plazas to accommodate diverse communal functions.



Figure 4. The front and sides of the drum tower in Dali Dong Village. Photograph by the author.



Figure 5. The interlocking structure of the tenon and mortise within the drum tower of Dali Dong Village. Photograph by the author.

In terms of political governance, the drum tower served as the venue for both the formulation and enforcement of “Kuan regulations”—the customary laws established by the Dong’s socio-military organization, “Kuan.” Upon ratification, these regulations were inscribed on steles housed within the tower, enabling effective village governance in traditional Dong society, which lacked a written script and operated under relatively low technological development. The tower derived its name from the presence of a drum, which was beaten to alert the community during emergencies or invasions, facilitating collective mobilization. Thus, the drum tower functioned as the political nucleus of the village—hosting council assemblies, mediating disputes, and coordinating communal action. Its spacious interior also served as a natural auditorium for performing Dong grand songs, with its unique architectural acoustics enhancing vocal resonance. Here, residents socialized, conversed, sang, and danced, reinforcing communal bonds. On a spiritual level, the drum tower was revered as the village’s guardian deity. Major sacrificial rites were conducted within its precincts, while its interior and exterior surfaces featured elaborate paintings and carvings—the artistic expressions of collective spiritual devotion. As a symbol of familial or clan prosperity, the drum tower became an enduring emblem of lineage identity [36].

2.3.3. Dong Dwellings

Residential architecture represents a distinctive building style with profound cultural significance, developed by the Dong people through long-term production and living practices. While conventional ground-level dwellings exist, the stilt-house structure—known as “Diao Jiao Lou” (hanging-foot houses)—stands as a quintessential representation of Dong vernacular architecture (Figure 6).

The stilt-house architecture is most distinctly characterized by its elevated ground floor, which is either partially or entirely raised approximately 2 m above the ground. Supported by wooden columns—primarily constructed from locally abundant fir timber—the structure employs a mortise-and-tenon joint system entirely devoid of iron nails. This design effectively prevents damage caused by moisture and insects while providing space for livestock pens or agricultural tools. Additionally, it ensures ventilation and damp proofing, maintaining dry living conditions despite the frequent rainfall prevalent in the southeastern regions of China [37].



Figure 6. The dry-column-style residential houses with an elevated ground floor located in the Dali Dong Village. Photograph by the author.

The second floor serves as the primary living area, featuring a fire pit, bedrooms, an exterior corridor, and communal spaces. Its most prominent elements are the expansive, overhanging eaves and the exterior corridor, which occupies one-third of the floor area. The eaves provide shade and rain protection, while the exterior corridor—bright and spacious—creates a semi-open transitional zone between the indoor and outdoor environments. This design promotes natural ventilation in the humid, subtropical climate of southwestern regions, enhancing living comfort. The exterior corridor also functions as a well-lit, semi-outdoor workspace for Dong women engaged in textile weaving, embroidery, and other handicrafts.

The top floor typically serves as a granary or lodging for unmarried children. As illustrated in Figure 7, the interior layout follows a traditional “front hall, rear chamber” plan, longitudinally divided into three zones (front, middle, and rear) along an entrance-oriented axis. This results in a spatial sequence characterized by a “staircase—wide corridor—fire pit—bedroom” arrangement [38].

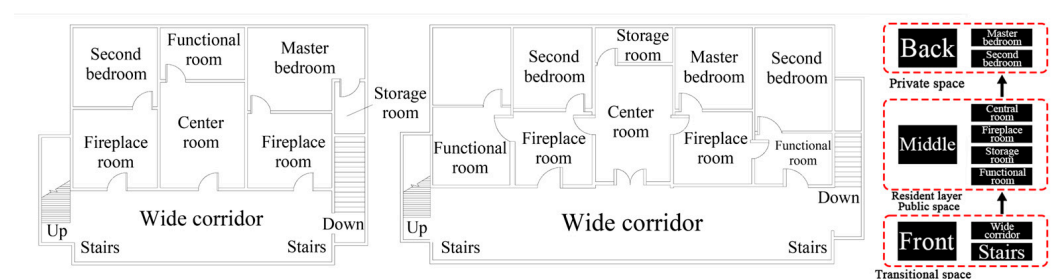


Figure 7. The planar sequence characteristics of the living floors of the stilted buildings in Chengyang Bazhai, Sanjiang Dong Autonomous County, Liuzhou, Guangxi Province. (Source: [38]).

2.4. Analysis of Dong Village Cultural Value

Dong Villages: A Three-Dimensional Crystallization of Millennial Living Wisdom.

The Dong village represents a three-dimensional crystallization of the Dong people’s thousand-year living practice. Its architectural ensemble—featuring the stacked eaves and soaring angles of drum towers and wind-and-rain bridges, combined with the vertical grain of stilt-house timber frameworks—creates a pagoda-and-pavilion-like vertical rhythm. In residential architecture, the stone masonry foundations contrast with the rugged wooden facades, generating a rhythmic interplay of density and void. These structures epitomize

the pinnacle of traditional construction techniques. Comparable vernacular ensembles in mountainous regions have been highlighted by UNESCO and ICOMOS as outstanding demonstrations of human adaptation to challenging environments, underscoring their universal value as cultural landscapes [39,40].

These architectural spaces embody intangible cultural heritage, including the carpentry techniques of Dong wooden architecture, polyphonic choir traditions (Dong grand songs), and the Kuan organizational system. They constitute a living laboratory for studying East Asian community governance, vocal music esthetics, and architectural craftsmanship. The ethnic culture underlying Dong villages reflects ecological wisdom, social ethics, artistic expression, and spiritual beliefs accumulated over millennia, collectively forming a living ecosystem unique to the Dong people. Their contemporary cultural value manifests not only in the dynamic preservation of tangible and intangible heritage but also in their inspirational significance for modern society. Consequently, the conservation and restoration of Dong village architecture hold profound importance across multiple domains: tourism resource development, protection of ethnic cultural diversity, transmission of traditional intangible heritage, and research into historical building techniques.

3. The Dilemmas and Challenges of Protecting the Architectural Heritage of Dong Village Settlements

3.1. *The Impact of the Transformation of Local Residents' Lifestyles Brought About by Urbanization and Historical Context*

3.1.1. Population Reduction in Villages Due to Urbanization

The rapid urbanization process and subsequent shifts in modern lifestyles and production methods have rendered traditional Dong village architecture functionally inadequate to meet contemporary needs. Consequently, Dong settlements are experiencing varying degrees of decline, with their architectural heritage facing unprecedented preservation challenges. These timber structures, embodying millennia of Dong wisdom, now struggle to survive between tradition and modernity. China's regional economic disparities have driven many indigenous villagers to leave Dong settlements in search of higher-paying jobs in more developed coastal areas, mirroring trends seen in traditional villages nationwide. According to the Seventh National Population Census, urban populations increased by 14.21% compared to the 2010 census, while mobile populations grew by 69.73% [41]. This demographic shift has altered traditional settlement structures, with significant outmigration—particularly among young laborers—leading to pronounced village hollowing. The dwindling indigenous population, who serve as the primary bearers of cultural traditions, has accelerated the reduction in both the variety and richness of village cultural activities. The lack of young labor has indirectly resulted in the abandonment of numerous wooden structures, leaving them vulnerable to long-term neglect and partial disrepair. Prolonged exposure to natural elements such as rain and high humidity has caused mold growth and wood rot in some components, exacerbating structural deterioration and increasing the risk of eventual collapse [42].

3.1.2. The Transformation of Lifestyle Due to Modernization and Villagers' Pursuit of Improving Their Quality of Life

As demonstrated above, the natural evolution of traditional Dong village spaces was fundamentally based on the social organizational systems of Dong settlements and their resulting ethnic cultural characteristics. With the transformation of modern lifestyles, spaces that originally accommodated traditional ways of living inevitably face neglect or transformation. Changes in the administrative organizational structure of Dong communities have occurred, and they are as follows: the establishment of village committees and other

grassroots organizations has replaced the drum tower-centered village elder management system; the practice of conveying messages through drumbeats has been substituted by public notices posted on bulletin boards; in terms of recreational activities, the popularity of modern media like internet and television has changed the types of entertainment activities for residents, diminishing many traditional cultural activities such as “Yue ye” social gatherings, floral songs, and Dong opera performances. Consequently, the drum tower, which once served as a space for village meetings, rest, and entertainment, has inevitably lost its functional foundation. This phenomenon has weakened the building’s functional value, gradually reducing it to merely decorative architecture [43], thereby diminishing its significance and inevitably leading to relative neglect by villagers.

Furthermore, with socioeconomic development and the rise in national living standards, the desire for modern lifestyles among village residents—particularly the younger generation—has inevitably led to growing demands for improved housing conditions, which traditional timber-framed architecture struggles to meet. Through field investigations in Chengyang Bazhai of Sanjiang, Wu (2022) [44] identified several issues compromising the aesthetic integrity of the village’s architectural landscape: as shown in Figure 8a, some newly constructed concrete buildings have been abruptly inserted amidst traditional timber-framed structures; as seen in Figure 8b, villagers’ renovation efforts have resulted in jarring “grafting” phenomena where brick–concrete structures awkwardly merge with traditional column-and-tie timber frames, disrupting visual harmony; as illustrated again in Figure 8a, the height of new constructions now rivals that of the village’s central drum tower, severely diminishing its visual prominence and disrupting the settlement’s traditional skyline. This study attributes these issues to residents prioritizing modernization of their dwellings to achieve better living standards while neglecting to preserve the authentic features of traditional timber architecture [44].

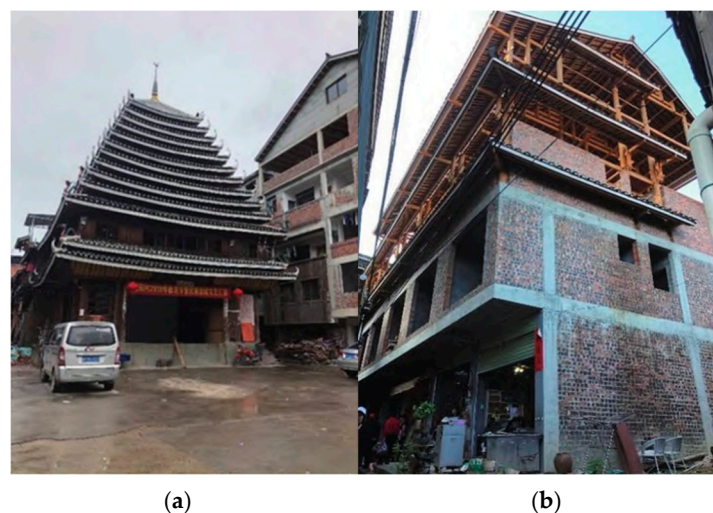


Figure 8. (a) A comparison of the traditional wooden drum towers of the Dong ethnic group in Sanjiang and concrete houses. (b) A combination of a low-rise brick–concrete structure and a high-rise wooden structure with the post-and-lintel system. (Source: [44]).

Beyond individual buildings, the transportation network within villages also suffers from inappropriate development practices. Peng (2022) [45], through fieldwork in Dong ethnic concentration areas of southwestern Hunan, documented cases where original cobblestone roads have been uniformly widened into cement pavement. The former bluestone paving leading to central communal spaces has been replaced with concrete surfacing. The original bluestone’s densely fragmented surface texture had created visual harmony with the wooden architectural facades, forming a distinctive material aesthetic. This alteration

of road materials has eliminated the harmonious textural dialog between pathways and traditional architecture, compromising the visual unity of village textures [45].

As mentioned in the introduction, the above behaviors are summarized as “infatuation with progress and modernist practice”. But the pursuit of a better life is the common right of all mankind, and the villagers’ pursuit of modern life cannot be summarized as a “sin”. On the one hand, the ability of traditional architecture to meet the needs of modern life is indeed limited. On the other hand, the villagers’ relatively limited understanding of the living environment they are accustomed to around themselves and the habitual inertia and aesthetic fatigue formed by living for a long time make them ignore the value of the existence of the Dong village to a certain extent. For outsiders, the freshness of the unique Dong architecture in life gives the observer more “cultural value” in feeling, which is the embodiment of the typical “one man’s meat is another man’s honey.” Therefore, it has become one of the basic issues in the issue of building protection in Dong village to promote the building to adapt to modern life while respecting the reasonable needs of villagers for life improvement.

3.2. The Contradiction Between Tourism Development and Authenticity Preservation

Due to its unique ethnic style and features, the Dong village has greatly met the spiritual enjoyment and psychological needs of tourists for “novelty, novelty, pleasure and knowledge” with its mysterious, primitive and peculiar characteristics [46]. Based on such needs, many Dong villages have vigorously developed the tourism industry. However, in the development process in recent years, some deep-seated contradictions have gradually emerged. Although the protection value of cultural diversity has been generally recognized by all sectors of society, with the intervention of tourism development business, developers use tourists’ enthusiasm for exploring national culture to over package and transform the original simple national culture, resulting in the core connotation of national culture being continuously diluted in the wave of Commerce, and the authenticity of tourism experience gradually losing [47]. Dong villages around the country are also tourist attractions with unique ethnic minority regional culture. Taking the Dong village buildings in Sanjiang Dong Autonomous County in Guangxi as an example, due to the intervention of real estate developers in the reconstruction of tourist attractions, they continue to use the traditional cultural resources of the Dong nationality for unscientific “processing” in the construction of local tourism resources, lacking consideration from the protection level of the traditional wooden buildings of the Dong nationality, and demolishing and reconstructing the traditional stilt style dwellings, drum towers, wind and rain bridges, etc.; this lack of consideration for building protection has caused serious damage to the traditional wooden buildings of Sanjiang Dong village. Driven by short-term economic interests, local villagers rebuilt their own traditional wooden buildings and built new-style dwellings with “foreign and earth”. The building structure was changed from traditional wooden buildings to cement concrete. This seemingly reinforced building reconstruction, to a certain extent, caused these wooden buildings in Dong ancient villages to suffer varying degrees of damage in their original style. Over developed shops and homestays have disrupted the spatial texture of the original settlements, and the core areas of Zhaoxing and other well-known Dong villages have gradually evolved into commercial blocks, losing the flavor of life in the past [35].

3.3. Limitations in Inheriting Traditional Architectural Techniques

The most fundamental crisis actually comes from the fault of traditional construction techniques, that is, the older generation of craftsmen who master the construction techniques of Drum Tower and wind rain bridge are getting older, while the younger generation

has little interest because of their low income and long learning cycle, so it is difficult to find a suitable successor. Many exquisite mortise and tenon techniques and construction formulas are disappearing with the death of the old craftsman. Due to the lack of written books on the compilation of the technical knowledge system, the traditional construction skills of Dong village buildings are basically passed down from oral and field practice. In the construction process, most of them are dominated by subjective experience, and with the reduction in inheritors and local craftsmen and the increasingly scarce adverse conditions, there is a high loss crisis of skills, making the repair and maintenance of buildings face the shortage of technology and human resources at the same time. In addition, the lack of funds and effective policy support also restrict the sustainability and effectiveness of the protection of Dong Village architectural heritage [48].

4. Discussion on Material-Level Protection and Restoration Strategies for Dong Village Settlement Architecture

4.1. Elaboration of Relevant Protection and Restoration Theories and Principles

There are many relevant strategies and theories in the repair and protection of traditional settlements like Dong village, which carry many cultural values. Since the *Charter of Athens* (1933), from the *Venice Charter* (1964) to the *Nara document on Authenticity* (1994), the *Charter for the Conservation of Historical Towns and Urban Areas* (1987) and *The Operational Guidelines for the Implementation of the World Heritage Convention* developed by UNESCO [4,49–52], international conventions and international technical standards have been successively established, authenticity and holistic protection has been widely recognized in the field of historical building protection and has become the basic principle for the protection of historical buildings in the world. The former advocates maintaining the authenticity, primitiveness and faithfulness of the heritage itself in terms of material elements, while protecting intangible elements such as traditional knowledge and oral legends related to the heritage to ensure the continuity of its spiritual and emotional values; the latter emphasizes the need to treat the heritage and its surrounding environment, cultural background and other elements as an organic whole for comprehensive protection in the process of protection, avoiding the local perspective of protection only for a certain part, which also covers material and non-material elements.

In the local context of China, as early as around the 1930s, the Chinese architectural historian Swithin Liang (1901–1972) systematically put forward the protection concept of “Repairing the old as the old”, so as to ensure the consistency between the original appearance and the original cultural significance of traditional buildings after restoration. Its core and the principle of authenticity protection are similar [53]. In modern China, since the promulgation of *Law of the People’s Republic of China on Protection of Cultural Relics* in 1982, “the original state of architectural heritage shall not be changed” has been officially regarded as a basic principle in law [18]. In practice, in order to achieve the purpose of authenticity, the “reversibility” and “minimum intervention” in the process of protection are bound to become the strategies for its cause and effect. The Ministry of housing and urban rural development, an official institution of China, also formulated the *Basic Requirements for the Compilation of Traditional Village Protection and Development Planning (Trial)* in 2013 [54], which clearly put forward the requirement that traditional villages should be protected as a whole by “dividing villages and areas with important visual and cultural connections into protected areas”. This Regulation establishes that both the building itself and its surrounding environment are protected at the institutional level [55]. Integrity and authenticity is an effective way to preserve the overall and local vernacular architectural features and their consistency, preserve the cultural traditions

of the Dong nationality, and continue the Dong nationality's national identity, relevant regional cultural values and the overall national cultural diversity.

4.2. Settlement-Wide Protection Planning Strategies Based on Traditional Dong Public Activity Needs

4.2.1. Prioritizing Improvement in Residents' Quality of Life and Production

Although more and more Dong villages have been developed as tourist attractions with the cultural experience of ethnic minorities as the core selling point of tourism, it has not changed the essential attribute of villages as living and production space, and the main user group is still local residents. Therefore, the protection and repair work should serve local residents first. From the perspective of traditional village architectural design, the protection and renewal of buildings should first meet the modern living conditions, and improve the rural residential environment through the improvement of building space and supporting infrastructure.

In a field survey on the protection of Dali Dong village buildings in 2015, Suvi Rautio (2021) recorded that some villagers hoped to change the wall in the original building into a concrete brick wall to improve their daily living experience, but the county government rejected it out of the concept of "authenticity protection" to avoid the destruction of the original village style. Finally, under the coordination of the project architect Ms. Wu, a compromise scheme was adopted to paint the brick wall to achieve the original effect on the surface, so as to solve the contradiction. The author believes that this incident reflects some contradictions between the government's protection strategy for architectural villages and the needs of local villagers, and points out that in the process of protecting architectural heritage such as Dong villages, we should avoid considering the protection object as a top-down visual aesthetic consideration based on "apparent authenticity", which ignores the actual needs of the villagers, and should turn to pay attention to the social dynamics behind the planning, emphasizing that architects, scholars and government officials should face up to the dominant position and actual needs of the villagers, and advocate jumping out of the cognition of "planning is the end product" and emphasizing the active attribute in village protection [29]. Based on the experience of this event, we know that we should not only emphasize the "original visual perception" in the protection work, but also update the facilities in the village that fall behind the needs of improving the quality of life in the contemporary era if conditions permit. At the same time, buildings in danger should be removed in time to avoid potential threats to personal and property safety, and effective fire-fighting facilities should be established at the same time. The tourism industry, which is also a rural industry, is also an important source of income for villages in the current era. The development of commercial tourism resources and the protection of village features should be given equal attention. The development of tourism resources can bring economic benefits, improve the living standards of villagers, and also bring financial support for the settlement protection work, but it is necessary to grasp the size and avoid the excessive commercialization tendency such as homogenization; the protection measures based on the principle of authenticity can also strengthen the unique regional cultural attributes, which is conducive to the good protection of the "authentic" feature, improve the tourist experience, and feedback the development of the tourism industry, so as to promote the development of each other, and better realize the advocacy of the specific implementation of the protection results in the villagers and the sharing of the development results with the society. It is the protection strategy based on human experience that should become the fundamental principle of the overall protection work.

4.2.2. Integral Protection Strategy

As early as the 1960s, the concept and policy of “Integrated conservation” for historic towns were proposed and implemented in Europe’s preservation practices for historic villages and towns, achieving numerous successful outcomes. This philosophy emphasizes that conservation should encompass not just individual buildings but also the integrity of natural environments, social structures, and cultural life, while fully respecting residents’ wishes throughout the process [56]. Therefore, viewing Dong villages holistically—moving beyond the isolated maintenance of single structures to emphasize comprehensive protection and renewal strategies for organically connected landscapes and entire cultural ecosystems—represents an essential approach to ensuring the integrity and continuity of these cultural heritage landscapes after conservation and restoration. This includes preserving their natural environment, spatial layout, community living patterns, and the continuity of cultural traditions. This principle has been widely adopted by the international community and has become one of the core criteria for assessing architectural heritage value and formulating conservation plans [57].

At the micro level, individual architecture covers both the material architecture itself and the non-material cultural attributes such as architectural skills, living customs, religious beliefs and so on. The two are interdependent. While protecting one side, we should not ignore the other. Only by combining the two can we achieve the desired protection effect. In Asia, especially in eastern Asia, due to the similarity of traditional architectural culture, traditional wooden architecture has become the symbol and identity carrier of various countries and nations to a certain extent. As an important part of traditional wooden architecture in China and Asia, the inheritance and protection of Dong wooden architecture should not be limited to the Dong village itself, but should be linked and promoted with the research on the protection of wooden architecture in China and other parts of Asia, so as to achieve academic synchronization in the protection strategy. For example, “Chinese traditional wood structure building construction technology” was selected into the world intangible cultural heritage list in 2009, and then in 2010, South Korea, following China, successfully declared the world heritage of “great carpenter and architectural art”, indicating the important value and world significance of wood structure building technology across ethnic groups and regions [48]. Therefore, the significance of holistic protection is self-evident.

Based on the above, specific to the protection strategy of the Dong village, the author puts forward the following suggestions: (1) The exterior facade design, decorative colors, and structural main body of the buildings must not be altered arbitrarily. The architectural styles and styles of the entire village, such as material texture, facade proportion, and color tone, must be unified. Materials with colors or textures that are not coordinated with the overall style, such as concrete, must not be used on the exterior facade. (2) Appropriate protection areas should be designated according to the site’s functions, with areas designated for key protection and commercial development zones. Targeted protection strategies with different degrees of limitation should be implemented for both zones, and a buffer zone should be established between them to reduce the impact of tourism resource development on the traditional architectural style. (3) Infrastructure such as roads, street lamps, and seating should be coordinated to achieve uniformity in formality while ensuring their functionality. (4) The principle of minimal intervention should be adhered to, with prevention as the main approach and intervention as a supplement. Regular inspection and maintenance should be carried out to ensure the safety of the building structure. Reinforcement measures should be taken immediately for parts that exhibit weathering, insect infestation, and other issues. A periodic maintenance system should be simultaneously established to

systematically maintain and color repair decorative components such as carvings, paintings, and other artistic elements. This can effectively maintain the architectural style.

The protection efforts should simultaneously incorporate the village as an organic whole interconnected with its natural and production environments. These protection efforts are as follows: (1) implement controlled logging of fir timber resources—the primary construction material for Dong villages; (2) introduce sustainable agricultural practices for the protective development of farmland within the village; (3) conduct proactive prevention and monitoring of potential flood and landslide risks in mountainous and riverine environments; (4) exercise prudence and moderation in developing tourism resources by carefully planning heritage architecture forms and spatial configurations along tourist routes; and (5) create cultural tourism IP brands for Dong villages, complemented by visual identity systems and cultural creative products, while leveraging advertising and internet media to enhance the scenic area's visibility and influence, thereby promoting high-quality cultural tourism development.

4.2.3. Make Full Use of the Original Customs and Lifestyles of the Settlement and Create Conditions to Promote Their Continuation

The core buildings in a Dong village, such as the drum tower and the wind-and-rain bridge, and their “centripetal” layout that extends outward from the center of the settlement evolve around the needs of the masses’ public activities; the emphasis on public activities is one of the distinctive features of the Dong lifestyle, and it is also the result of the lifestyle of the villagers formed by the Dong village, rather than the purpose of prior planning. Therefore, special priority must be given to the preservation and revitalization of these communal spaces, with all conservation or renewal efforts fundamentally oriented around them. This approach stems from the core design principle of Dong village layout—its inherent focus on facilitating public activities. Accordingly, restoration and adaptive reuse strategies for communal structures should primarily aim to enable event hosting, encourage villager interaction, and activate these spaces as vibrant community hubs, while systematically creating the necessary supporting conditions.

The strategies for collectively ensuring the continuity and revitalization of traditional practices are as follows: (1) The central positioning of core public structures like drum towers and wind-and-rain bridges should be maintained as the village’s focal points, while optimizing spatial layouts to enhance accessibility for both villagers and visitors. (2) As the paramount architectural feature of the settlement, the drum tower—being both the tallest and most ornate structure with a landmark status—must preserve its “tallest” and “most elaborate” characteristics. New constructions should ideally not exceed three stories to prevent visual obstruction that would compromise the village’s architectural harmony. (3) The preservation of fire pits as essential activity spaces that embody traditional customs, daily practices, and spiritual significance should be prioritized. These should be conserved or modernized to re-establish their role as social catalysts, effectively maintaining community cohesion. (4) Both the physical form and symbolic status of the Sa Altar as the village’s spiritual center should be sustained through conscientious maintenance and updates that perpetuate its ceremonial functions.

Wang (2024) [58] through observational studies of public building functions in Jichang Village of Linxi Township, Sanjiang, concluded that Dong village public architecture can be categorized into three types, each with distinct functional or formal deficiencies: tourist-service buildings designed with striking volumes and visuals to attract visitors; traditional buildings overemphasizing preservation at the expense of modern functionality; and naturally utilitarian public buildings with relatively outdated facilities. The research proposes upgrading strategies that maintain authentic structural, material, craftsmanship, and aesthetic features while incorporating modern smart technologies to support diverse

cultural activities. For spatial expansion, volumetric enlargement should be avoided in favor of morphological layering or building clusters that harmonize with village character. Functional zoning must integrate residential needs with industrial development, creating multifunctional spaces that connect daily life, social interaction, cultural practice, and economic activities around human-centered design. These integrated spaces should serve both local communal life and external demonstration purposes, simultaneously benefiting residents and tourists while strengthening community cohesion [58].

4.3. Adaptive Renewal and Reuse of Buildings and Modernization of the Translation of Design Schemes

Regarding the development of architectural landscapes within the village, except for historical buildings with high cultural value that should not be altered, the design of renovated or newly constructed buildings should maintain consistency with the overall esthetic character. However, building components made entirely with traditional techniques or materials often fail to meet contemporary comfort requirements. Therefore, the adaptive renovation of existing structures and the creation of “neo-vernacular architecture”—which incorporates traditional regional design elements into modern architectural concepts—represent solutions to overcome the limitations of traditional buildings in modern contexts. The former approach emphasizes restrained updates to existing structures under the principles of authenticity preservation and minimal intervention, ensuring they meet modern functional needs. The latter focuses on retaining regional characteristics while integrating contemporary design philosophies, reinterpreting traditional forms, materials, and construction techniques through modern methods to align with current aesthetic and functional expectations. This “interpretative” expression of local spatial qualities within a modernist framework has been described as “creative conservation, rather than static preservation and imitation” [59]. Compared to purely “static” preservation, this design-driven approach actively revitalizes traditional vernacular architecture often deemed “outdated.” It has more positive significance in building protection. This kind of design technique can maintain the distinctive local style characteristics of the original village and buildings, achieve the modern innovation of coexistence in form and function, and bring a deeper regional cultural value identity behind the building.

Li (2016) [60] in his study of the drum tower in Dali Dong Village, summarized key findings regarding its functional restoration: The Dali Dong Village drum tower was reconstructed in 2003 based on historical documentation. However, due to the absence of essential facilities like guardrails and seating, the tower’s practicality remained limited, resulting in low utilization rates among villagers—a phenomenon confirmed by the authors’ observation that only 11% of villagers visited the tower daily. This underscored how the structure’s symbolic significance outweighed its functional value. Initially, local cultural heritage authorities insisted on preserving the tower’s original form during restoration, preventing the addition of functional improvements and consequently generating dissatisfaction among villagers. Through subsequent negotiations between villagers and heritage officials, several pragmatic modifications were implemented, such as raising the ground level of the first floor, reconstructing the fire pit, adding perimeter seating, and installing carved wooden railings. These functional enhancements, executed without compromising the tower’s overall architectural integrity, successfully increased usage rates and revitalized the space, serving as a model for balancing preservation with practical adaptation [60].

The “Huanggang Village Granary Homestay Cluster” wooden architecture designed by the architect Chen Guodong and his team “Nameless Workshop” in Liping, Guizhou, uses fir and retains Dong stilted features like elevated ground floors, sloped roofs, and overhanging eaves. Functionally, it creates semi-open social spaces with “blurred indoor–outdoor boundaries,” such as entrance stairs designed as “staircase theaters,” second-floor

corridors connected to outdoors via folding windows, and waterside platforms with leisure facilities, integrating the indoor and outdoor environments [61]. This unique shape design breaks the closed nature of traditional architectural space, increasing interaction with the outside, inheriting tradition while meeting modern functional needs—an excellent neo-vernacular practice based on Dong and southwestern stilted dwelling characteristics.

4.4. Technical Restoration Strategies

4.4.1. Fire and Corrosion Prevention Treatment of Buildings

Dong architecture, which predominantly uses fir wood as its primary building material, faces inherent vulnerabilities due to the material's flammability and susceptibility to decay. The compact layout of these buildings, with fire separation distances typically under 2 m, further exacerbates fire risks. Therefore, under appropriate conditions, fire prevention measures should be implemented by selectively demolishing non-essential structures to create firebreaks, systematically organizing firewalls, water sources, and open emergency spaces to contain potential blazes. Additionally, basic firefighting infrastructure such as looped water supply networks and fire hydrants spaced at intervals under 120 m should be installed, while key structures like Drum Towers should be equipped with automated sprinkler systems. These comprehensive measures can effectively reduce fire hazards while respecting the architectural integrity of Dong villages [62].

In terms of material treatment of the buildings, the pre-treatment of the timber materials can effectively reduce flammability and decay risks. For instance, subjecting the wood to prolonged natural drying in shaded conditions reduces internal moisture content, preventing cracking and deformation. Creating a carbonized layer through controlled surface charring effectively isolates the internal wood structure, while subsequent tung oil soaking significantly enhances resistance to insects and rot. Applying fire-retardant coatings or sprays to the wood surface remains an essential fire prevention measure [63]. Non-intumescent fireproof coatings, which do not expand when heated, can form protective layers through their inherent high-temperature resistance, safeguarding the underlying building materials without altering their appearance. This makes them particularly suitable for wooden heritage structures. By carefully proportioning four key components in the coating (expanded vermiculite, expanded perlite, sepiolite, and hollow glass microspheres), the duration of fire resistance can be effectively extended [64]. While fireproof gypsum boards represent well-established fire-resistant building materials widely used in contemporary construction, their direct application to heritage building facades would compromise architectural authenticity. Therefore, their use should prioritize concealment, installing them in non-visible areas and adopting “additive” approaches—such as applying them to interior spaces rather than exterior surfaces—to preserve the building's historic character.

At the same time, updating electrical wiring and circuits within village buildings represents an effective measure for reducing fire risks. Du and Okazaki (2018) [65] conducted a questionnaire survey on the improvement in fire prevention facilities among residents of Dali Dong Village, and found that 67% of the villagers believed that the renewal of the circuit significantly reduced the risk of fire. The authors also concluded that, based on the unique architectural characteristics of Dong dwellings, developing small household-specific fireproof stoves and replacing the surrounding walls of cooking hearths with brick or stone materials could effectively mitigate fire risks [65].

4.4.2. Structural Reinforcement

In fact, wooden buildings have natural disadvantages in terms of survival. As organic wood, if it has not undergone perfect special treatment, it is more vulnerable to environmental changes, especially the change in moisture, including air humidity, which will lead

to aging problems caused by corrosion, moth eaten, structural deformation, etc. In order to ensure its long-term stability, it is necessary to adopt scientific structural reinforcement technology, which should not only maintain the traditional style, but also improve the safety. The replacement and addition of structural components is a traditional method for the repair of Chinese historical buildings. According to the scale of the repair plan and the function of the replaced components, it is decided whether to retain the original size, materials and style. For example: (1) The decayed components should be replaced in situ in a timely manner, and they should be inlaid with homogeneous wood by strictly following the original mortise-and-tenon production specifications. (2) This can be used in conjunction with the use of hidden tenon reinforcement, epoxy resin grouting, and reinforcement treatment of damaged wooden components inside the building to improve the strength of the joint, or a hidden iron hoop or “L”-shaped steel plate can be added to enhance the stability of the loose mortise and tenon. (3) Modern technologies should be introduced such as carbon fiber cloth pasting and built-in steel–wood composite structure, including pasting carbon fiber cloth at the bottom of the beam to enhance the bending resistance and embedding H-shaped steel into the fir pillar to improve the seismic resistance of the building while maintaining the traditional appearance. (4) For the overall stability, multiple measures such as a diagonal bracing system, a steel cable tension balancing device, and a rubber seismic isolation foundation can be used in synergy [63,66].

Zhang (2018) [67] in his research on the reinforcement and restoration of drum towers in Dong villages along the Pingtan River basin, proposed a structural strengthening method utilizing thin-walled stainless steel tubes to reinforce mortise interiors combined with carbon fiber fabric hoops wrapped around the upper and lower exterior sections of mortise joints. This approach effectively prevents the initiation or propagation of cracks in columns and beams (crossbeams), serving as a valuable reference for structural reinforcement strategies for drum towers [67].

4.5. Digital Technology Intervention

The application of digital technologies in the conservation research of Dong village architecture enables effective information documentation without physical interference or impact on the actual structures. Compared to paper-based records, digitally acquired data offer superior storage capacity and dissemination potential. For instance, Building Information Modeling (BIM) technology facilitates the creation of three-dimensional digital models that comprehensively preserve architectural information of Dong villages. These models overcome spatial and temporal constraints, allowing researchers to conduct surveys, collect data, and perform analyses anytime, anywhere, unaffected by real-world limitations. Similarly, Geographic Information Systems (GISs), designed for acquiring, storing, analyzing, managing, and displaying geospatial data, transform information such as Dong village site selection patterns and tourist hotspot distributions into visual formats. This enhances the understanding of spatial relationships and supports critical decision-making processes including the delineation of core protected zones, the establishment of construction control areas, and the assessment of tourism development suitability.

In practical implementation cases, Mo and Yi (2025) drew the two-dimensional plan, elevation, section, and mortise-and-tenon component drawings of the entire Ma'an Drum Tower using the AutoCAD 2021 software and a 1:1 digital model using the software SketchUp 2018, and they converted the 3D model into visual images and animations to reproduce the texture and details of the Ma'an drum tower and to accurately restore its architectural style [68] (Figure 9).



Figure 9. The effect drawing of the drum tower in Ma'an Village [68].

Xu, F. et al. (2024) [69] employed parametric methods to decode the construction principles of Gaobupian craftsmen. Through oral interviews, on-site documentation, and 3D architectural data collection of the “Four-Turn Eight” Drum Tower’s timber framework in Hunan’s Dong region, the team identified a “fixed prototype + variable parameter redesign” logic governing its construction. Specifically, the tower’s primary wooden structure follows a composite system combining “four-slope column-and-tie”, “eight-slope column-and-tie”, and “eight-slope umbrella-frame” techniques as fixed patterns, while incorporating flexible parameters like maximum column span, roof-tier count, and water-step and water-division measurements to determine final morphology. The researchers validated these findings through digital modeling, successfully constructing a parametric analysis framework after achieving anticipated results. This methodology provides a parametric toolset for drum tower restoration, replication, and virtual representation [69].

Huang, W. et al. (2024) [70] collaborated with the drum tower construction experts from Guizhou Province to comprehensively document the internal and external structures (Figure 10) and architectural detail components of the Drum Towers in Chaoli, Zeli, Congjiang, and Zengchong through integrated manual measurements, 2D imaging technology, and drone oblique photography. The team utilized BIM technology to record and reconstruct the towers’ internal structural engineering details, demonstrating these through case simulations. By combining drone-acquired point cloud data with 2D image models, they achieved high-precision digital 3D reconstructions of all four Drum Towers. This methodology provides innovative technical support and new approaches for digital representation, conservation, and restoration of these structures [70].

Overall, digital technology has brought about revolutionary improvements in the protection and research of Dong village buildings, broadened the protection and research methods, means, and strategies, and provided technical support for more possible protection and restoration ideas for Dong village buildings.

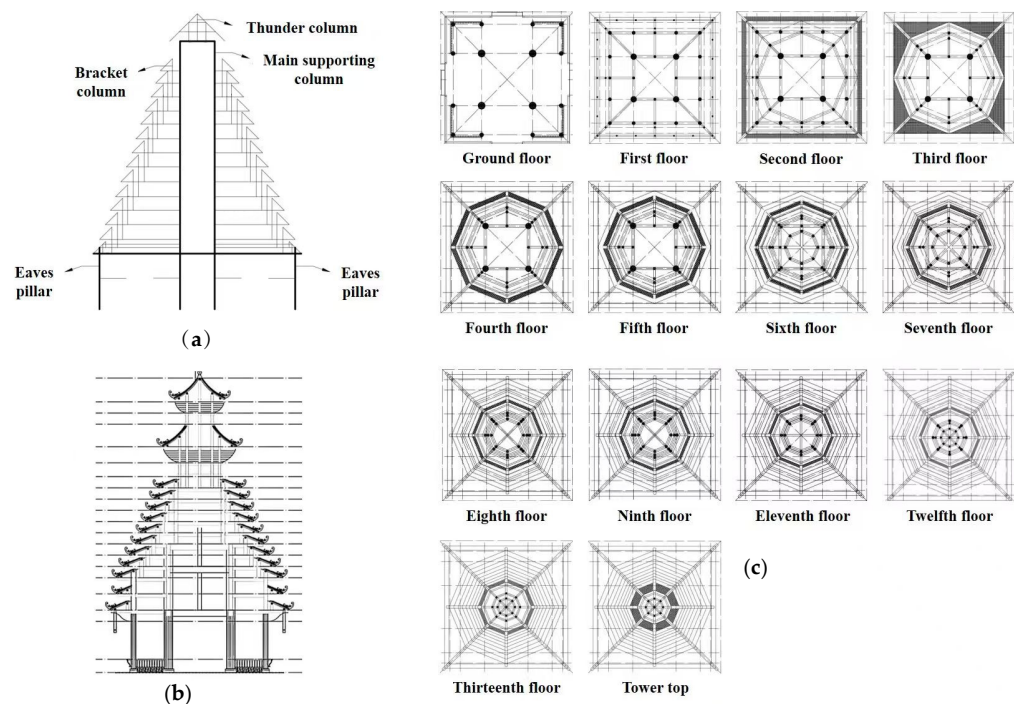


Figure 10. (a) The schematic of the drum tower structure, (b) cross-sectional elevation, and (c) plan sections from the ground floor to the thirteenth floor [70].

5. Safeguard Mechanisms for Dong Village Settlement Protection and Restoration

5.1. Hierarchical Protection System

Hierarchical protection refers to the classification of the buildings to be protected according to the damage situation, and the establishment of a primary and secondary repair strategy. The traditional Chinese intervention in the protection of architectural heritage is divided into four strategies according to the damage level: minor repair, renovation, overhaul and reconstruction. For example, in the case of wooden buildings that have been listed in the protection list, the roof components will be inspected and repaired at least once a year, specifically “quarterly repair” or “annual repair” according to the time interval. This intervention usually involves only small-scale repair and maintenance, such as removing weeds on the roof, sealing brick joints, replacing glass, etc., and such protection measures often do not have high priority. When the damage degree of the building exceeds the scope of annual maintenance, large-scale maintenance will be carried out. This level of work will inspect each part and replace the damaged parts. This work will cost more human and material resources, and its priority will be higher accordingly. Reconstruction is aimed at buildings that have been completely or mostly damaged but also have great historical value, involving historical value and practical significance. Reconstruction is strictly restricted by laws and regulations in China [71]. This kind of primary and secondary protection mode, which is clear and orderly, can help the staff concentrate more and reduce the repair cost.

5.2. Establishing an Academic Database of Dong Architectural Techniques

Historically, the construction techniques of Dong architecture have primarily been transmitted orally, lacking systematic academic documentation, which has significantly increased the difficulty of preserving this knowledge. Currently, academic research on Dong architecture is growing, alongside the heightened awareness of protecting and inheriting intangible cultural heritage of ethnic minorities. In 2006, the construction technique of Dong wooden architecture was selected into the first batch of national intangible cultural

heritage list in China, which improved the comprehensive protection of inheritors, relevant documents and architectural entities. This has opened up a new starting point for the inheritance and protection of the construction skills of the Dong wooden architecture [48]. This presents a crucial opportunity to establish written records of Dong architectural techniques, effectively facilitating their preservation and transmission. Beyond written documentation, implementing a “Certification System for Dong Architectural Craftsmen” could provide standardized professional recognition—such as Junior Engineer or Senior Engineer qualifications—for individuals engaged in technical training or architectural conservation. This system would ensure individual competency while enabling the effective division of labor and collaboration in future projects.

5.3. Promoting Resident Participation and Empowering Decision-Making

The Dong people, who have resided in these villages for generations, are the creators, owners, and inheritors of village culture—groups closely tied to Dong villages. They possess a fuller, more nuanced understanding of the Dong villages’ natural and cultural environments, historical development, and local industries; even local residents’ daily lives are an integral part of this cultural heritage [72]. Therefore, their active participation is key to achieving truly sustainable protection. In practice, we must fully recognize and respect the Dong people’s primary role, regarding them as the primary guardians and inheritors of cultural heritage.

Most tourism development initiatives in traditional villages are often led by governments and enterprises. This “top-down” approach has enhanced the scientific rigor and efficiency of decision-making; however, as seen in the earlier case of Dali Dong Village, it risks overlooking local residents’ needs, leading to conflicts of interest between decision-makers and local participants [73].

Interest alignment between the Dong people and their villages is the first step toward enabling effective resident participation. Notably, the sustainability of such participation in Dong ethnic village tourism largely depends on the level of community support for tourism activities—a support that is closely tied to residents’ perception of tangible benefits [74]. Tangible benefits are fundamental to stimulating residents’ enthusiasm for participation, including improved quality of life facilitated by public facility renewal, increased income from high-quality tourism, economic gains from enhanced local industrial productivity, and a stronger sense of cultural identity fostered by greater community prestige [75,76].

Beyond the protection of physical architecture, we should also prioritize the preservation of community networks and the safeguarding of traditional lifestyles. For instance, preserving traditional culture and maintaining community harmony can strengthen villagers’ shared sense of value, encouraging residents to view the village as a collective closely linked to their own identities [77]. Thus, while protecting physical heritage, it is also necessary to establish a robust community participation mechanism and build long-term, stable trust relationships among governments, experts, and residents—an approach rooted in Lang et al.’s (2012) [78] transdisciplinary research framework, which highlights the need to integrate academic expertise (experts), policy support (governments), and local knowledge (residents) for sustainable development. This enables local residents to play a core role in protection planning, decision-making, and implementation—leveraging their profound understanding of local culture while ensuring that protection efforts align with the Dong people’s traditional way of life [78].

Only when the Dong people truly gain a voice, transition from passive recipients of protection to active protectors, and acquire tangible cultural identity and economic benefits in the process, can their internal motivation to protect their cultural heritage be sustained.

This will achieve a fundamental shift from “being asked to protect” to “taking the initiative to protect,” ultimately developing a community-led sustainable protection model [79].

5.4. Establishing a “Cross-Regional Collaborative Protection Mechanism”

Due to the characteristic of “large-scale agglomeration and small-scale dispersion” in the distribution of the Dong ethnic group, Dong villages are scattered in Guangxi, Guizhou, and Hunan Provinces. Therefore, these three provinces can jointly formulate relevant protection conventions, unify repair standards, and set red lines for tourism development. For example, on 18 December 2018, the “2018 Joint Application for World Heritage Consultation Coordination Meeting of Chinese Dong Villages” jointly held by four cities (prefectures) and six counties in Hunan Province, Guizhou Province, and Guangxi Zhuang Autonomous Region signed the “*Memorandum of Understanding on Joint Application for World Heritage Consultation Coordination of Chinese Dong Villages*”, establishing a joint application mechanism for the protection of Dong villages and providing institutional guarantees for the cross-regional joint protection of Dong villages [80]. The establishment of such mechanisms can be further explored and attempted in the future.

6. Conclusions and Outlook

Dong village settlement architecture, as a three-dimensional representative of Dong culture, represents the irreplaceable integration of tangible and intangible heritage. Its mountain–water spatial configuration, architectural landmarks like drum towers and wind-and-rain bridges, sophisticated timber craftsmanship, and profound socio-cultural significance collectively demonstrate exceptional human adaptation to mountainous environments [81]. The conservation and restoration of these structures constitute a systematic endeavor merging traditional wisdom with modern technology [82]. Authenticity-preserving repairs, discreet technical enhancements, and adaptive functional updates allow these iconic structures to incorporate contemporary safety features (fireproofing, seismic resistance, etc.) while maintaining their historic character, achieving living heritage transmission. Digital technologies provide innovative solutions for architectural documentation and monitoring, while community participation and cross-regional collaboration ensure social sustainability in preservation efforts. Future pathways should explore the deeper integration of technological empowerment and cultural revitalization. By respecting Dong lifestyles, protection models could evolve from government-led to community-autonomous approaches, transforming traditional villages into vibrant spaces blending cultural depth with modern vitality. Ultimately, preserving Dong architecture transcends physical restoration—it safeguards a nation’s cultural memory and rural identity.

From the perspective of results, the ultimate goal of protection, restoration, and even renewal still lies in meeting the needs of modern production and the villagers’ own livelihoods. It should effectively improve the quality of life of the original residents on the premise of preserving the traditional architectural style, meet the demands of high-quality tourism development, and facilitate the inheritance of traditional intangible cultural heritage. Of course, protection is a continuous and dynamic process; the work is long-term rather than an overnight project. At the same time, the protection in question covers both the physical buildings themselves and the cultural and value identity that underpins the intangible aspects; this, too, demands our continuous investment of attention and resources. In a word, the protection of Dong village settlement buildings is not only about repairing buildings, but also about preserving the national cultural memory and local sentiment [83].

Meanwhile, Dong village protection practices offer important insights for the sustainable development of ethnic settlements: cultural heritage survival depends not only on material restoration but also on building a virtuous cycle of “cultural identity–economic

benefits—ecological protection.” Dong villages are expected to become models of harmonious coexistence between tradition and modernity through innovative benefit-sharing mechanisms like tourism dividends and intangible heritage IP development [84], improved policy support, and learning from international experiences. This process requires continuous technological innovation, community empowerment, and interdisciplinary collaboration to achieve a mutually beneficial win–win situation for both perpetual cultural memory inheritance and rural development [85].

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