



POLITECNICO DI MILANO

DEPARTMENT OF ARCHITECTURE AND URBAN STUDIES (DASU)
PHD PROGRAMME IN PRESERVATION OF ARCHITECTURAL HERITAGE

***Chinese Dong Minority Drum Tower: From
Knowledge to Preservation***

Doctoral Dissertation of:

SHIRUO WANG

Supervisor:

Prof. FRANCESCO AUGELLI

Co-supervisor:

Prof. CRISTINA TEDESCHI

Coordinator:

Prof. MARIACRISTINA GIAMBRUNO

2020 – XXXII Cycle

Contents

I Introduction	1
II Research motivation and objectives	5
III Research methodology	6
IV Literature review	7
V Previous contributions on Drum Tower.....	9
VI Research area.....	14
VII Field survey.....	18
Part I Knowledge of Dong minority Drum Tower	22
Chapter 1 Traditional Dong Drum Tower: Meaning and Characteristics	22
1.1 The socio-cultural significance of Drum Tower.....	24
1.1.1 History of Dong minority and its Drum Tower.....	24
1.1.2 Shan-mu (Chinese fir) as an analogy	26
1.1.3 Symbol of consanguinity	28
1.1.4 Cultural identity.....	30
1.1.5 Social custom.....	32
1.2 Typology of structural system.....	35
1.2.1 Chuan-dou typology	35
1.2.2 Tai-liang typology.....	46
1.2.3 Connection of elements	53
1.3 Dong carpentry and construction process	61
1.3.1 Construction material.....	61
1.3.2 Traditional hand-tools	67
1.3.3 Construction process.....	76
1.4 Evolution and geographical difference of structural typologies.....	88
1.4.1 Geographical distribution pattern: Between Chuan-dou and Tai-liang Drum Towers	89

1.4.2 Geographical difference: Within Chuan-dou Drum Towers.....	95
1.4.3 Han culture transmission.....	100
Chapter 2 Safeguard of Dong Drum Tower	104
2.1 First attention on vernacular architecture in China	105
2.1.1 From 1930s to1950s	109
2.1.2 From 1980s to the beginning of 21 st century	110
2.1.3 The beginning of 21 st century to the present	110
2.2 Current safeguard policy and system of Dong Drum Tower	111
2.2.1 Cultural Relics System.....	112
2.2.2 Famous historical and cultural towns/ villages System	123
2.2.3 Chinese Traditional Village System	128
2.2.4 UNESCO World Culture Heritage Tentative List System	137
2.3 Assessment of protected level.....	145
2.3.1 Assessment of significance	145
2.3.2 Process and method for assessment of significance	149
Part II Preservation of Dong Minority Drum Tower	156
Chapter 3 Dong Drum Tower at Risk	156
3.1 Fragile Drum Towers: recurrent problems	160
3.1.1 Fire risk	160
3.1.2 Alteration.....	166
3.1.3 Defect	167
3.1.4 Deterioration	169
3.1.5 Mechanical failure	171
3.1.6 Bad maintenance intervention	182
3.2 Case study: actual condition of Drum Tower.....	186
3.2.1 Mapang Drum Tower	189
3.2.2 Lusheng Drum Tower.....	201
3.3 Quality of intervention versus protected level.....	209

Chapter 4 Toward Recommendations for Preservation of Drum Tower	221
4.1 The Scandinavian experience concerning preservation of timber heritage: the Stave Church Program	221
4.2 Recommendations for acquiring knowledge of Drum Towers	226
4.2.1 Need for knowledge activities	227
4.2.2 Preliminary survey	228
4.2.3 Instrumental diagnosis	229
4.3 Vanishing tradition of fire prevention in Dong area	230
4.3.1 Dong traditional taboos on fire	230
4.3.2 Local custom on fire prevention in Dong villages	233
4.4 Adaptive proposals for risk prevention of Drum Tower	235
4.4.1 Principles and measures	236
4.4.2 Control fire risk	239
4.4.3 Control insect risk	248
4.4.4 Control fungi risk	251
Conclusions and Future Developments	253
Appendix: Survey cards	256
Bibliography	295

Acknowledgements

First and foremost, I would like to offer my sincere gratitude to my supervisor, Prof. Francesco Augelli, who has supported me throughout my thesis with his patience and profound education. This thesis would not have been possible without his kindly help and excellent guidance. He gave me the precious opportunity to study as his student. He taught me to return to the thing itself and think it in terms of its own. The knowledge and idea I have learned from him definitely will be a significant treasure of my life. Besides, I would like to thank prof. Claudio Chesi, who has offered his tremendous assistances and supports to my thesis in the last phases. Besides, I appreciate the Coordinator of the PhD Program in Preservation of Architectural Heritage (PAH), prof. Maria Cristina Giambruno and all members of PAH faculty board for their insightful comments and encouragement, but also for the arduous questioning which incited me to widen my research from different perspectives. I would like to thank prof. Mariapaola Riggio from Department of Wood Science and Engineering, Oregon State University, who did a detailed revision and provided valuable suggestions especially in technical aspects.

Special thanks go to prof. Ling Cai from School of Architecture and Urban Planning, Guangzhou University, who has always been my mentor as well as friend. She always shows her full understanding and kind support during my tough and frustrated period. Without her strong support and supervision, I cannot even start my PhD study in Politecnico di Milano. I also appreciate Xiaotie Chen, who has shared his wonderful and rich photograph with me. Next thanks extend to my lovely colleagues and friends in Guangzhou, Haoming Wu, Zhishang Huang, Ziwei Liu, etc. who have assisted me during my fieldwork drawing and the Chinese literature collection.

I wish to acknowledge Mrs. Zhen Su from Cultural Heritage Bureau in Tongdao, provided me the opportunity to consult the documents preserved at Institute's archive. I would like to thank prof. Hongbo Liu from Liuzhou City Vocational College and Mr. Quanzhong Yang from Sanjiang Dong Minority Museum, who have provided invaluable assistance during my field work in Sanjiang. Further, I would like to thank

all wonderful Dong people in Tongdao, Sanjiang, Congjiang, Rongjiang who welcomed me and opened the doors of their world to this curious outsider with their warm hospitality.

Thanks to my colleagues and friends near and far, for the stimulating discussions, support and for all the untamed laughter we have had in the last four years.

Finally, I cannot find words to express my gratitude to my dear parents. Their unselfish support and love have always been the power to me during my study and life. Their love and trust have kept my determination firmly despite the difficulties.

Abstract

The Dong minority people are one of China's 56 ethnic groups, who live in the region delimited by southwest Hunan, southeast Guizhou, and north Guangxi. With a population of almost three million and a long history of more than 1,000 years dating back to the Tang Dynasty. Their architecture is intrinsically connected with the land and the topography, generating a harmonious relationship between nature and man-made structures. The Drum Tower is the most crucial public building and the landmark venue. Dong people identify strongly with the wooden Drum Tower.

Over the last two decades, the first stage of Dong buildings studies has been carried out focusing on the buildings typology. However, a synthesis of the study of Dong Drum Tower, which involves an in-depth knowledge is still insufficient; current safeguard system concerning Dong Drum Tower are complicated as they require a re-organization and critical evaluation; the subject of preservation of the Dong Drum Tower has been rarely gained academic attention; The local villagers have insufficient financial support and knowledge for the preservation and maintenance although some of them have recognized the current problems.

Accordingly, this PhD thesis has been developed in two parts, part I is about the Knowledge of Dong Minority Drum Towers, part II is about Preservation of Dong Minority Drum Tower.

Part I includes two chapters, chapter 1 offers an in-depth description of the knowledge of Drum Tower with abundance of materials and documents based on the in-situ survey; chapter 2 displays an overview of the Chinese legislation context of Dong Drum Towers based on the previous exploration of Chinese vernacular architecture.

Part II also includes two chapters. Chapter 3 develops first research on the subject of recurrent problems of Drum Towers, ranging from fire risks, modifications, and bad maintenance interventions; chapter 4 starts from the Scandinavian experience of Stave Church Program, aiming to inspire and enlighten the preservation of Drum Towers; subsequently, the protocol for knowledge activities, which suggests how a knowledge activity should be carried out, is analyzed; thirdly, vanishing Dong taboos

and customs are addressed, aiming to regain the traditions of fire prevention; fourthly, multi-risks prevention in the Drum Tower is discussed, a huge project that integrates policies, regulations, technologies, engineering, local culture and other measures. Finally, recommendations are proposed with the purpose of controlling the most fatal risks, ranging from fire, insect and fungi risks, with operable acceptance by local people and authorities.

Keywords: Dong minority; Drum Tower; knowledge; preservation; safeguard; development; recommendation; cultural material; authenticity; anthropology.

I Introduction

The Dong ethnic minority people are one of China's 56 ethnic groups, who live in the region delimited by southwest Hunan, southeast Guizhou, and north Guangxi. With a population of almost three million and a long history of more than 1,000 years dating back to the Tang Dynasty. Dong people live in a mountainous area, where the landscape of rice terraces, bamboo forests, and tea plantations are still predominantly intact. Their architecture is intrinsically connected with the land and the topography, generating a harmonious relationship between nature and man-made structures (Fig.1). The Dong minority settlement is typically a collection of densely populated villages with small centers, showing a remarkable feature of internal contraction. The *clustered* centers of Dong settlements are mainly constituted by Drum Towers, including other public buildings like the Drum Tower plaza, and a drama stage. The tower is the center of the order in this settlement and the source of the impetus for generating a cooperative settlement community.



Fig.1 Man-made structures harmoniously coexist with nature, Gaobu village, Hunan

(Photograph by author, 2017)

Dong, as one of the minorities in southern China, has been widely regarded by the Han as *Nan-man* (literally “southern barbarians”). Historically, there has always been this paradoxical consciousness among the Han about non-Han people on their frontiers. The Han, by contrast, being the majority, are known to have a self-assured ethnocentrism, not only against the background of minorities within China, but also the rest of the world: “China,” literally means the “Middle Kingdom”. The Dong territory is highly inaccessible, which suggests that until the 18th century the Han Chinese were not really able to take the upper hand over the minorities who had settled there. Based on the historical background and geographical limitation, Dong community experienced a low-speed development, which has caused an “isolated” world from the outside “modern world”.

During the establishment and evolution process of Dong minority culture, Dong people have gone through the self-created ethnic culture, the influence of different ethnic culture as well as the cultural collision, transformation and fusion from its settlement. Since Dong minority has no written language but only an oral one, the material culture, by contrast, has been flourishingly developed, of which the most important is the architecture. Dong minority’s architecture presents the distinguished characteristics of ethnic culture: Firstly, the different typologies of architecture; Secondly, the distinct regional history and culture among the aspects of landscape, environment setting, and spiritual space.

Among the clusters of traditional Dong settlements, the Drum Tower is the most crucial public building and the landmark venue. Dong people identify strongly with the Drum Tower and regard it as the center of the settlement structure within Dong society. The Drum Tower has many important social functions. As a symbol of the clan, it is a place of both assemblies and where the negotiations on public affairs take place. It is also the place for holding sacrificial ceremonies, weddings and other rituals as well as a space for entertainment among villagers.

Ruan outlines the fundamental relationship between architecture and the identity of the Dong community (Ruan, 2006).

It is architecture that “speaks” to them, and it is an architecture that is primarily for its inhabitants. The built world indeed is the extension of their body and mind; their experience with architecture is figurative, and their understanding of the built world is allegorical.

In 2006, 27 Dong villages applied for UNESCO world heritage status, and the following Dong villages were inscribed on the UNESCO world heritage tentative list, Shudong, Dali Zadang, Zengchong, Tang’an, Xiage, Gaoqian, Zhanli, Ma’antun, Pingyan, Pingzhai, Pingyan, Yanzhai, Pingyan, Gaoxiu, Gaoyou, Gaoshang, Kezhong, Gaosheng, Yanglan, Pingtan, Hengling, Yutou, Shangbao¹, which are under the jurisdiction of Liping, Rongjiang and Congjiang County in Guizhou Province, Sanjiang Dong Autonomous County in Guangxi Zhuang Autonomous Region, Tongdao Dong Autonomous County and Suining County in Hunan Province. The report states:

Dong Villages are a perfect integration of humanity and nature, and they reflect the Dong peoples’ principle of adapting themselves to nature for survival and development. The Dong Villages are not only an organically evolving landscape but also a continuing landscape. It has retained its positive social role in the contemporary society connecting with a traditional lifestyle and is a testimony to the evolution and development history of the Dong Nationality.

Overall, the Dong settlement and architecture are retaining their original indigenous characteristics to an exceptional degree. Moreover, Dong Drum Tower in particular, presents the historical, cultural, social development of vernacular architecture in China and it is of great value for studying the architectonics, evolution and tradition thinking. As a consequence, the preservation issue of Dong settlements and architecture has become a key objective. However, it has been increasingly recognized that the current challenge is how to preserve the tradition value under the present Chinese society while meeting the requirements of local villagers, which is

¹ Refer to the website: <http://whc.unesco.org/en/tentativelists/5813>.

defined as a long-term problem in need of continuous effort from generation to generation.

Within the Dong architectural studies, Drum Tower still takes a very essential and significant role. Nevertheless, this PhD thesis is the first study that combines knowledge with preservation issue.

This PhD thesis is divided into two parts, part I is knowledge of Dong Minority Drum Tower, part II is preservation of Dong Minority Drum Tower.

Part I includes two chapters, chapter 1 offers an in-depth description of the knowledge of Drum Tower with extensive materials and documents based on in-situ survey. Thus, the main content offers a narration of socio-culture and ethnic significance, typology of structural systems and joints, traditional carpentry as well as geographical difference throughout the Dong area in different periods and its key cause.

Chapter 2 displays an overview of Chinese legislation context of Dong Drum Towers based on the previous exploration of Chinese vernacular architecture. Not only a detailed description of safeguard system of Drum Tower is narrated, but also the critical views on the current problems are pointed out.

Part II also includes two chapters. Chapter 3 develops a first research in the subject of problems and modifications of Drum Towers, ranging from fire risk to alteration, defect, deterioration, mechanical failures of elements; and bad maintenance interventions. Moreover, it is analyzed the actual situation of intervention through two cases studies. In the last section, a first and interesting comparison is developed between the protected level and the quality of intervention of 19 investigated Drum Towers with a critical point of view.

Chapter 4 starts from the Scandinavian experience of the Stave Church Program, aiming to inspire and enlighten the preservation of Drum Towers. Secondly, it is recalled that a well-organized knowledge activity is fundamental and indispensable for any preservation action. Thirdly, Dong traditions of fire prevention are addressed, which involves the local taboos on fire and the local customs on fire prevention, aiming to regain the accumulated experience and traditions of fire prevention. Fourthly, it explains that multi-risks prevention in the Drum Tower is a huge project that

integrates policies, regulations, technologies, engineering, local culture and other measures. It relies on a widely-involved and coordinated government support system and a local support system. Finally, recommendations are proposed with the purpose of controlling the most fatal risks, ranging from fire, insect and fungi risks, with operable acceptance by local people and authorities.

II Research motivation and objectives

Over the last two decades, the first stage of Dong building's studies has been carried out focusing on the typology of the buildings, such as Drum Tower, Wind-Rain Bridge, dwellings, etc. While analyzing the common and distinct characteristics enclosed in each type belonging to diverse geographical areas, despite of some limitations, rich achievements in the research of individual type of architecture, especially the Drum Tower, have been acknowledged. However,

- i. A synthesis of the study of Dong Drum Tower, which an in-depth knowledge study is still insufficient.
- ii. The current safeguard system concerning Dong Drum Tower is complicated which requires re-organization and critical evaluation.
- iii. The subject of preservation of the Dong Drum Tower has rarely gained academic attention.
- iv. Since the Dong area is an "isolated world" from the "modern world", the local villagers have insufficient financial support and knowledge for the preservation and maintenance actions of Drum Towers although some of the them have recognized the current problems.

Concerning Drum Tower studies, since the dominant parameters of any given architectural tradition are both historic and cultural, the research was firstly driven by the need to access the preservation of architectural heritage issue via a critical point of view. The Drum Tower, in particular, is the most crucial public building, serving as the main carrier of the traditional settings as well as the witness to social development. Through a long-term social and economic development, conversely, Dong community

has remained almost undeveloped, which has resulted in abundant tradition and heritage, ranging from tangible to intangible one.

However, through the field survey, it has been found that the preservation status of Drum Towers is in a poor condition, even for the ones protected at national or provincial level. Not only physical deterioration was revealed, but also the institutional, technical and financial deficiency.

Accordingly, this PhD thesis aims to answer the following questions:

- i. What is the Drum Tower and why is it important?
- ii. What is the current safeguard system of Drum Towers?
- iii. What are current risks of Drum Towers?
- iv. What are the recommendations for the preservation of Drum Towers?

Finally, an in-depth study on the knowledge and recommendations for preservation of Drum Towers would unveil the actual and urgent situation of Drum Towers to the villagers and local authorities, what is more, to raise their awareness and promote actions.

III Research methodology

Due to limited and insufficient historical archives and documentation about the Dong minority and Drum Tower, the general approach according to this study is based on field survey with a massive description of Drum Tower.

- i. Field survey

This had the purpose of collecting the first-material, including in-situ sketch of the frame structure, and carpentry works, and also the obtainable technical drawings, like AutoCAD, 3D models, and the photograph or other pictorial data. These data could offer the study with an accurate understanding of the Drum tower. Before conducting the field survey, a detailed plan and the related documents had been prepared. Therefore, it is necessary to bring the questions while observing the Drum Towers.

- ii. Interview

Dong minority has no written language but oral one, which means no written archives.

Therefore, the interview to the local villagers (village leaders, the elders, craftsmen, etc.) was indispensable, the content includes the history, carpentry knowledge as well as the custom, social organization, ritual, etc. On the other hand, the author has contacted the local scholars, particularly in the Dong minority ethnic and culture field, who also provided many crucial information to the study.

iii. Information management

Information was normally processed by a text-based and, occasionally, oral record. As said, today's record is tomorrow's documentation, the record should be systematically collected and archived to ensure their availability for future reference and use. Author has visited the local authority of Tongdao, Sanjiang, Rongjiang and Congjiang county several times. Despite difficulties, a lot of important data have been collected.

IV Literature review

It's essential to track and re-organize the previous literature works since Song dynasty (A.D. 960-1279), aiming to build a general and intact frame about the research process and to recognize their contributions to the following study. Despite resources are mostly the description-based traveling notes, they still allowed for a first understanding of Dong minority and their living environment.

The earliest description of the ancestor of Dong people and their living environment that seemingly were based on first-hand discovery dated back to the late Song dynasty, such as *Collected tales of barbarians of the Southwest* (Fu, 2003), *A Categorical Narration of the Region Beyond the Passes* (Zhou, 1178).

Approaching to the Qing dynasty (A.D. 1644-1911), the literature before 20th century incorporate much richer amount of descriptions of ancestors of Dong and its people. Like *Book of Guizhou* (Tian, 1690), *A Handbook of Guizhou* (Tan, 1700s), *Brief Records of Dong in the Chu Kingdom* (Wu, 1700s). *Recording of Guizhou* (Li, 1813) etc. Additionally, there are some first-hand English version documents that offer the basic and general description dating back to late Qing dynasty, including, *Three Years in Western China: A Narrative of Three Journeys in Ssu-Chuan, Kuei-Chow and*

Yun-Nan (Hosie, 1897) and, *Among the Tribes in South-West China* (Clarke, 1900).

It was a turbulent period from the beginning of 20th century to the establishment of the People's Republic of China in 1949, and few contributions were carried out, except Chen who published his work in 1942 as the title as *Dong Drum Towers* (Chen, 1973), which describes the natural connection between the Dong Drum Tower and its surrounding natural environment.

In 1950s, the new communist central government sent a group of working teams to the Dong minority area to perform a field survey and research. However, the research was suspended due to the Cultural Revolution, since the late 1970s following the political reform, the research on Dong minority society restarted, unfortunately, limited research about Dong minority architecture has been done. In the following years, an increasing number of publications were developed on different topics, of great importance, and the Dong architecture became an independent subject, as documented by the books, *Folk Architecture in Northern Guangxi* (Li, 1990); *The Characteristics of the Drum Tower, Cultural Connotation* (Du, 1996). The contents included records about construction material, structure, technique, function and form of buildings.

The study of Dong buildings was commenced since 1990s in China, basically it is a young subject in the research area. Despite plenty of contributions of preservation of historical architecture, little discussion and study focus on the topic of preservation of Dong architectural heritage. the main achievements in the field of preservation of architectural heritage could be classified into the following aspects:

i. The definition of architectural heritage

The Chinese and international charters or regulations mainly indicate the concept of preservation of historical and cultural heritage. The definition states from *cultural relics* to *historical buildings*, as much as spreading to *historical building complex*, *historical urban area*, *vernacular heritage*, etc. The objective of preservation concentrated not solely on the aesthetic value but also the whole cultural setting. Therefore, both the cultural heritage and natural heritage, tangible heritage and intangible heritage were highlighted.

ii. Interventions on architectural heritage

As the representative of principle of “Architectural Authenticity”, Irwin, J. Krick brought the concept into the subject of architectural preservation (Krick, 2003).

iii. Preservation and management system

This topic is closely related to the current legislation system, finance resource system, education and academic research system.

Since Dong minority culture was approached overseas and spread abroad, like in France, Japan, etc. the book, *Revelation of 100 Worldwide Settlements* (Hiroshi, 2003), written by a Japanese architect, presented the Dong society in Liping, Guizhou, demonstrating the harmonious and inherent link between architecture and society. The book *Littératures enchantées des Dong* (Curien, 2000) written by a French scholar, describe the Dong inherent spiritual world and their extraordinary culture. On the basis of a rich field work in southern China, the Austrian scholar, Klaus Zwerger published two books concerning the Dong building traditional value and their sophisticated construction skills, *Vanishing Tradition: Architecture and Carpentry of Dong minority in China* (Zwerger, 2006), *Wood and Wood Joints: Building traditions in Europe, Japan and China* (Zwerger, 2015).

V Previous contributions on Drum Tower

The literature review concerning Drum Towers is listed below.

Table 1. Main previous contributions concerning Drum Towers

Contributions	Contribution Contents
Mei Y. <i>Research of Dong Drum Tower in Dong Village</i> . 1985	Different ancient names of Drum Towers which are corresponding to their morphology or function
Huang C. <i>Research of Dong Drum Towers</i> . Guiyang. Guizhou People Press. 1985	Recognizing Dong Drum Tower is different from the Han Chinese towers.
Yang X., <i>Exploration to Dong Drum</i>	Aesthetic value of Drum Tower

<p><i>Tower's Aesthetics.</i> Guizhou Ethnic Studies. 1989[3]. P37-41.</p>	
<p>Wu S., <i>The Exploration Study on Drum Tower.</i> Guangxi Cultural Relics. 1990(4). P70-72.</p>	<p>The origin of Drum Tower and its historic essence.</p>
<p>Du Q. <i>The Characteristics of the Drum Tower, Cultural Connotation.</i> Journal of the Central Minzu University. 1996(1).</p>	<p>Features and cultural significance of Drum Tower</p>
<p>Yu W. <i>Walk into the Drum Tower, Dong South Community Culture Oral History.</i> Guiyang. Guizhou People Press. 2001.</p>	<p>Cultural significance of Drum Tower through oral history in Southern Dong area</p>
<p>Ruan X., <i>Allegorical architecture: living myth and architectonics in southern China.</i> Honolulu University of Hawai'i Press, 2006.</p>	<p>Forms and spatial disposition of Drum Tower in a social context</p>
<p>Cai L., <i>Traditional Villages and Architecture of Dong Nationality's Habitation Region.</i> China Architecture & Building Press. 2007</p>	<p>Framed in an architecture-village-culture multi-layer, it's a detailed culture-architecture study with the architectural, social and cultural point of view.</p>
<p>Yang Y., Wu K., <i>Chinese Dong minority's Drum Tower.</i> Nanning. Guangxi Publishing House of Minority Nationalities. 2008.</p>	<p>Social function of Drum Tower, the relationship between Drum Tower and other public buildings.</p>
<p>Cai L., Deng Y., <i>Structural Types of Dong Nationality's Drum-tower and Its Geographical Distributing Pattern.</i> Building Science. 2009, (04): 20-25</p>	<p>The geographical distributing pattern of Drum Towers based on two structural types</p>
<p>Yang Y., Huang X., <i>The Dong Folks treasure: Dong Wooden Construction Skills.</i> Guangxi Nationalities Publishing</p>	<p>General construction skills for wooden frame of Drum Tower</p>

House. 2012.	
Ou J., <i>Mathematic knowledge of the Dong Drum Tower</i> . Journal of Kaili University. Vol.26. 2008 (03). P8-11.	Mathematical disposition of Drum Tower
Cai L., <i>Construction Technology of Centro-column Drum Towers of Dong Nationality</i> . Advanced Materials Research. Vols. 450-451: 870-876. 2012	Construction technology research through one case: single column
Hu B., <i>Hunan Dong Drum Tower Construction Technology</i> . Master dissertation of Hunan University. 2011.	Materials and construction techniques
Chen H., <i>Study on the Constructing Technique and Culture of the Dongs' Drum-tower in the Southeast of Guizhou Province</i> . Master dissertation of Chongqing University. 2012.	Cultural features from the architectural space as well as from the construction technics of Drum Tower in Guizhou
Liu F., <i>The Construction skills of Drum Tower and Cultural influence</i> . Master dissertation of Chinese National Academy of Arts.2012.	General construction procedure and structural joints of Drum Tower
Wang S. <i>Research on Dong Minority's Traditional Villages and Drum-towers in Pingtan River Basin, Tongdao County of Hunan Province</i> . Master dissertation of Guangzhou University. 2016.	Drum Tower study in Hunan area and their difference to other areas

The studies related to this aspect are abundant, and contributed in a multi-disciplinary way: architecture, ethnology, anthropology, history, sociology, etc. Utilizing literature review and analysis, field investigation, etc. as research methodologies to collect and

organize data and documents, the narration stands from a multi-disciplinary perspective.

On the one hand, as for the perspective of Architecture, with reference to the subdivision into the provinces of Hunan, Guizhou and Guangxi. Hu Bizhu researched the materials and construction techniques of Drum Tower in Hunan region (Hu, 2001), while Li Miao takes the traditional architectural features in Tongdao county, Hunan as research aim, narrating from the perspective of conservation and inherit of architectural traditions, Li develops some innovative strategies for economic development and renovation suggestion on improving dwelling facilities based on the social and economic problems in Dong community (Li, 2011). Xiao Hua presents a comparison study, showing that due to the cultural influence of Han nationality, the Northern and Southern Dong area develop a diversity of village layout and architectural features (Xiao, 2011). Zhao Xiaomei takes Yanglan Village in Hunan as an example to explore its particular settlement and architecture space (Zhao, 2012). Zhao Xiaomei, Chen Hongxiang, and Tian Zesen analyze the cultural features from the point of view of both the architectural space and the construction technics of Drum Tower in Guizhou (Zhao, 2012; Chen, 2012, Tian, 2014). Wang Xiaoxue, Ma Kekao discuss the architectural features, including in the analysis the Drum Tower, Wind-rain bridge in Sanjiang county, Guangxi province. The former one starts to define the architectural vocabularies to narrate the cultural significance (Wang, 2012), the later one also takes the architecture in Sanjiang county as an example, with special reference to the Wind-Rain bridge, which is one of the important public buildings in Dong community (Ma, 2010).

On the other hand, an architectural classification can be done, ranging from public buildings to residential buildings with the public buildings including Drum Tower, Wind-Rain bridge, Village Gate, etc. and the residential buildings. Undoubtedly, the Drum Tower, as the most cultural and traditional building, has plenty of contributions, mainly with reference to the background history and the aesthetic value (Feng, 2011). Liu Fangyu and Yang Yonghe refer the construction procedures of Drum Tower and its construction skills (Liu, 2012; Yang, 2012). Yang Xiulv studies the artistic and

aesthetic value of Drum Tower (Yang, 1989). In addition, also the mathematical issue on Drum Tower was studied (Luo, 2008). In addition, this author has studied the Dong Minority Drum Tower along the Pingtan river, in the Tongdao region of Hunan, providing an integrated database. Furthermore, the thesis indicates the cultural differences and their main causes among different Dong minority regions (Wang, 2016). Rich achievements in the study of individual Dong minority inhabitant province as well as the traditional architectural typologies have been considered as the first step.

Unlike the *official architecture*² in China, Dong minority has no written archives for their architectural history, but the oral story or music passed down from generation to generation. Even at present, actually no systematical and comprehensive publications could demonstrate Dong architectural history. Therefore, an in-depth field survey is the only approach.

A lot of international scholars focus on Dong minority buildings, such as prof. Klaus Zwerger, who has worked on the subject of Dong minority's traditional building and culture for a long time. He discussed the historical development of Dong architectural traditions, including the construction skills related to the structural joints and wooden material (Zwerger, 2006).

With respect to the previous contributions, the main contributions in this PhD thesis can be listed as following:

- i. A more comprehensive and detailed field survey, not only focusing on the architectural knowledge of Drum Tower, but also on the historical information, intervention, wood species, structural instabilities, decay phenomenon.
- ii. A more comprehensive explanation of the traditional hand-tools
- iii. A more detailed explanation of the construction procedures of Drum Tower.
- iv. A clear description of the three typologies of repeatable Chuan-dou frame
- v. The first developed typology of Pai-lou of Drum Tower.

² Official architecture is relative to folk architecture, often referred to as palace-style buildings, including imperial palaces, bureaucratic buildings, etc., which are often used in some Buddhist temples and Taoist temples.

- vi. Re-organization of current safeguard system of Drum Tower with critical views.
- vii. A first comparison between the protected level and intervention quality of Drum Towers based on field survey.
- viii. Analyzing previous and current conditions of Gaochuan and Rongfu Drum Tower
- ix. Intervention analysis through five restoration projects of Drum Tower that are regarded as a first-hand resource beyond academic contributions.
- x. Mapping the distribution of alteration, defect and deterioration on Zengying and Yashang Drum Tower.
- xi. Mapping interventions on every wooden element of Lusheng and Mapang Drum Tower.
- xii. Collected and re-organized response of the local authorities' and villagers' response to the fire risk
- xiii. Proposing recommendations concerning institutional and financial aspects.
- xiv. First developed general recommendations for preservation of Drum Tower which are simple, economic and easy to implement with respect to the actual Drum Tower conditions.

VI Research area

i. Natural conditions

Dong settlements are mainly located at 108th to 110th meridian east, between 25th and 31st parallel north, 360 kilometers from east to west, and 580 kilometers from north to south, within an area of 200,000 km², settled principally in the nexus of Hunan, Guizhou and Guangxi province. The Dong settlement is an area across provinces and administrative jurisdictions. It is also an area with outstanding characteristics. First of all, the climate of the Dong settlement is warm and humid, with an annual rainfall of about 1,200mm, the annual average temperature is around 16 °C. There is less frost in spring, less heat in summer, no heavy rain in autumn, and no chilly winter. It belongs to the humid climate of the mid-subtropical mountain. In such a condition, it is perfect for the production model of “forestry and crops”. Dong area is a strikingly

picturesque world. It is located in the slope of the transition from the Miaoling Mountain Range to the low hills of Xianggui in the southeastern margin of the Yunnan-Guizhou Plateau, there are several surrounding mountain ranges. On the north is Wuling Mountain and Folding Mountain; On the south is Yuecheng Ridge and the Jiuwan Mountain; On the east is Xuefeng Mountain and on the west is Nanling Branch. Leigong Mountain stretches the Dong settlements from northwest to southeast also being the watershed of the two major river systems of the Yangtze River and the Pearl River. On the north side of the Leigong Mountain, there are the main streams of Qingshui River which in the upper part reaches of the Yuan River and Qu River. In the south of the mountain, the Liujiang River and the Xun River are the two tributaries of the Pearl River.

Due to the natural obstacles of the geographical space, the Dong area is regarded as an isolated region from the outside world, with insufficient communication and poor transportation from outside the region. Therefore, the cultural development is basically an autonomous process. Despite relatively slow development, and poor economic status, Dong people still do a lot, clearly, to obtain their cultural identity, not only as the splendid Dong Drum Tower, but also their vivid social life.

ii. Dialects and subgroups

The population of the Dong minority reached 2.88 million in 2010, of which Guizhou is mainly distributed in Rongjiang, Congjiang, Liping, Zhenyuan, Tianzhu, Jinping, Sansui, Jianhe and Yuping counties; Hunan is mainly distributed in the Tongdao, Xinhuang, Huitong, Qijiang and Jingzhou counties; Guangxi is mainly distributed in Sanjiang and Longsheng counties (Fig.2). In addition, there are small areas of Dong settlement in Enshi, Hubei province. Tongdao County of Hunan Province, Sanjiang County of Guangxi Zhuang Autonomous Region, Liping, Congjiang, Rongjiang Counties of Guizhou Province are the primary Dong settlements in which the Dong people makes up more than 70%; in Xinhuang and Lijiang counties of Hunan province, Jinping, Zhenyuan and in the Tianzhu counties of Guizhou province, Longsheng county of Guangxi province the Dong people reach more than 50%. It is a multi-ethnic area with a large Dong minority population. The traditional Dong villages and

architecture remain in a well-preserved condition. The research area concerning this study is mainly based on the above-mentioned counties of Hunan, Guizhou and Guangxi.



Fig.2 Dong area in the southwest of China (Draw by author)

Dialects are defined as one of the most meaningful reference points to characterize the Dong cultural division, it has been discussed that language (dialect) is

approximately synonymous with cultural identity, from the point of view of topographical division, the Dong dialect could be divided into two major subdivisions, Southern Dong and Northern Dong, in which Southern Dong includes Rongjiang, Congjiang counties of Guizhou, Sanjiang and Longsheng counties of Guangxi, and Tongdao county of Hunan, while Northern Dong includes Tianzhu, Jianhe, Zhenyuan, Jinping counties of Guizhou, Xinhuan, Jinzhou counties of Hunan. Due to mainly flat soil conditions and convenient communication ways, Northern Dong displays a greater influence of Han Chinese, going beyond the language impact, the Dong cultural identity goes weaker, thus, the symbolic Drum Tower could be hardly seen in Northern Dong area (Fig.3). Conversely, Southern Dong tends to be more conservative, majorly due to the geographical limitation, with an isolated world, which is inconveniently connected to Han nationality area. (beyond the geographical obstacles, historical and cultural causes had a progressive impact on a long-term development) Therefore, indigenous cultural heritage is well preserved, the cultural identity of Dong people as well. Every village has at least one Drum Tower (Fig.4). Thus, the research area in this study is mainly focused on Southern Dong.



Fig. 3 Gaoyi village, Hunan, Northern Dong area (Photograph by Ling Cai, 2003)



Fig.4 Zengchong village, Guizhou, Southern Dong area (Photograph by author, 2018)

VII Field survey

The field survey is conducted in Southern Dong area, that is, Tongdao in Hunan, Sanjiang in Guangxi, Rongjiang and Congjiang in Guizhou. It aims to collect the first-hand material to complement the research data. The field survey route covers the main villages and Drum Towers among Dong area (Fig.5), and the collected data by author is listed in Table.2. The geometrical measurements, photographs, video recordings, interviews to the locals are intended to record and document information about³:

- i. Form and dimensions of the building;
- ii. The interior and exterior characteristics;
- iii. Materials, constituent parts and construction, decoration, ornament or inscriptions;
- iv. Cultural, topographical and natural features of the site;
- v. The traditional and modern technology and skills used in construction and maintenance;
- vi. Evidence to establish the subsequent history of its uses, associated events, structural or decorative alterations, and the impact of human or natural external

³ Refer to ICOMOS Principles for the recording of monuments, groups of buildings and sites (1996). P51.

- forces;
- vii. The history of management, maintenance and repairs;
 - viii. Representative elements or samples of construction or site materials;
 - ix. An assessment of the current condition of the heritage;
 - x. An assessment of the conflicts and risks from human or natural causes.

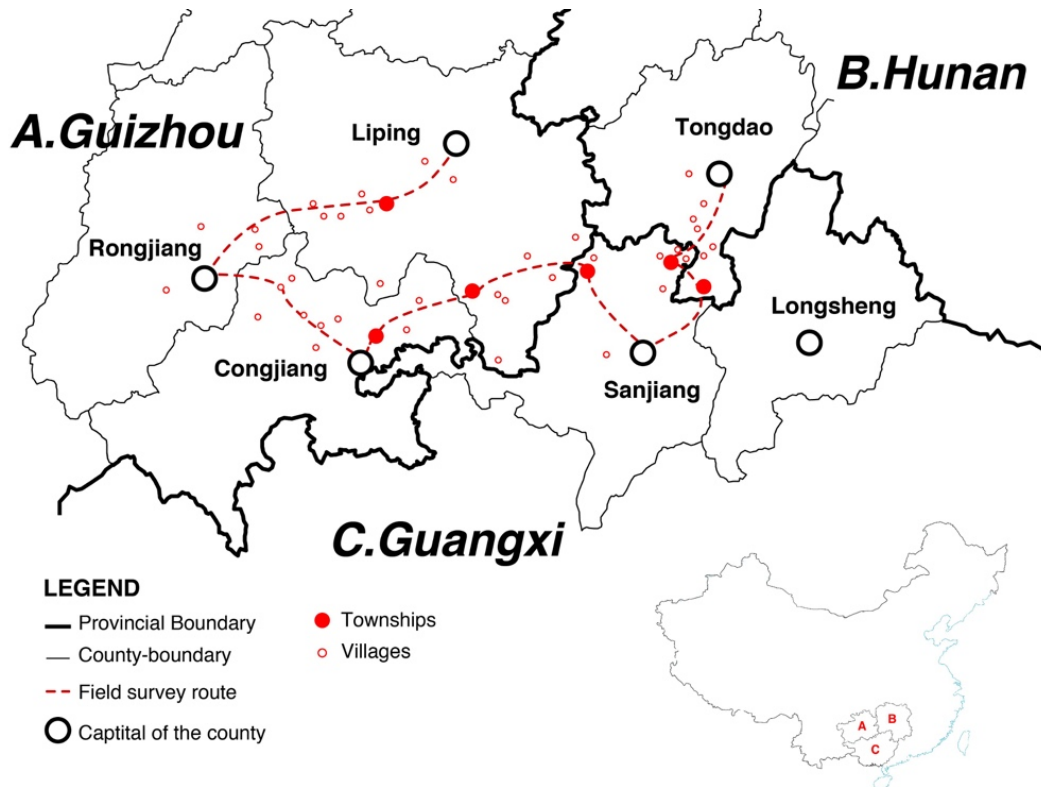


Fig.5 The route of field survey (Draw by author)

Table.2 The collected data of villages and Drum Towers during field survey

Province	County	Village	Drum Tower	In-situ sketch	AutoCAD drawing	3D model
Hunan	Tongdao	Yutou	Longshi	X	X	
			Yashang	X	X	
			Tianzhong	X	X	
			Lusheng	X	X	

		Hengling	Hengling	X	X	
			Xiaozhai	X	X	
			Neizhai	X	X	
			Shangyan	X	X	
		Pingtan	Pingtang	X	X	
			jiulongzhai	X	X	X
			jizhongyin	X	X	
			Wushi	X	X	
		Pingri	Gaoping	X	X	
			Baoxin	X	X	
			Gaopan	X	X	
		Yanglan	Yanglan	X	X	X
			Central	X	X	
		Gaotuan	Gaotuan	X	X	
		Gaobu	Gaosheng	X	X	X
			Longxing	X	X	X
			Heshang	X	X	X
			Yanzhai	X	X	
			Shangzhai	X	X	
			Yangtian	X	X	
		Pingyang	Matian	X		
Guizhou	Congjiang	Zhanli	Zhanli			
		Pingqiu	Pingqiu			
		Xiaohuang	Xiaohuang			
			Gaohuang			
		Bapa	Bapa			
		Yintan	Shangzhai	X		
			Central	X		
			Xiazhai	X		

		Zengchong	Zengchong	X	X	
		Zengying	Zengying	X	X	
			Jingou	X	X	
		Chaoli	Gaocai	X		
			Gaoshang	X		
			Lanshua	X		
			Paiguan	X		
		Zeli	Zeli	X	X	
		Gaoqian	Gaoqian	X		
		Zai'e	Zai'e	X		
		Gaochuan	Gaochuan	X		
		Jitang	Shangzhai	X		
			Xiazhai	X		
	Rongjiang	Dali	Dali			
		Zaidang	Zaidang			
			Chejiang			
Guangxi	Sanjiang	Mapang	Mapang	X	X	

Part I Knowledge of Dong minority Drum Tower

Chapter 1 Traditional Dong Drum Tower: Meaning and Characteristics

The overall objectives of this Chapter tend to offer an in-depth and comprehensive knowledge of Dong minority's traditional Drum Tower, ranging from the socio-culture feature to structural typology, carpentry and construction process as well as geographical differences during its development among Dong areas and their cause. In a relatively pristine community, like Dong minority settlement, a public building, such as a "commission board" or in its fullest elaboration, the Drum Tower, represents what local people define the village heart or center, where they conduct and organize the social and cultural life. It serves, first and foremost, as a "home" of rural community. Given that the Dong minority has long been subject to the outsiders (generally Han Chinese) from Tang dynasty, a "home", in an emotional as well as spiritual sense, is an essential fabrication, or shelter for Dong people to feel the warmth and security. Therefore, the Drum Tower is honored in the community, not only because it looks like a dominant construction in the village, but rather as it stems from the process of the attitude of Dong people themselves to inhabit and create. The Drum Tower, therefore, is widely referred to as home and identity both physically and spiritually, it plays a worship icon, a symbol of consanguinity and also the social and cultural seat.

Experts and scholars in the field of Dong minority traditional architecture, professor Ling Cai in particular (Cai, 2007), have devoted more than a decade to the research of Dong minority traditional village and its architecture, identifying the structural typology of the Drum Tower, which would be classified as alternatively-distinguished, the crossed definition being avoided: firstly, the Tai-liang (post-beam structure); secondly the Chuan-dou (column-tie structure). The differences between the two kinds of structural systems are given by the beams or ties crossing the columns or short

columns. Different structural systems reflect different roof morphologies of Drum Tower, such as gable roof, gable-and-hip roof or a pyramid roof. The different indigenous construction techniques the carpenters hold, have resulted in a diversity of interior spaces, outer façades as well as several special wood joints.

As afore-mentioned in section V “Previous contributions on Drum Tower and other Dong buildings”, which have discussed the distinct architectural and aesthetic value of Drum Tower, recognizing a rich contribution. Nevertheless, lacking of an in-depth knowledge in the following questions: what are the characteristics of Dong carpentry? How do the local carpenters process the components with hand tools? How exactly is the Drum Tower erected step by step from zero to a dominant and honored public building? The following sections in this chapter will explain this clearly via the author’s field survey and interviews to local elders and, most important, Mark-ink carpenters⁴. The answers to these questions will not only be explained in a “scientific” way but also in a “ritual” way, as they are closely connected to the ethnic culture.

As aforementioned, the Dong identity goes weaker in northern Dong than in southern Dong, as it is evident from the traditional public buildings and, specifically the Drum Tower. However, among the southern Dong areas, according to the field survey, it is still easy to find out the differences both in the aspect of architectural morphology and in structural typologies. Most of the Dong Drum Towers were built from middle and late period of Qing dynasty (18th-19th century) to the period of the Republic of China (the first half of 20th century). The selection of structural typologies by carpenters has gradually changed during the evolution of Drum Towers. It also reflects in the geographical pattern. Explicitly, there is an east-west diversity within the research area: Drum Towers in Hunan are more similar to the Han Chinese building both in morphology and structural typology, while the Drum Towers in Guangxi and especially in Guizhou, tend to be more towering and more “Dong-like”. Besides, the “Han-like” Drum Towers are much less than the “Dong-like” ones, and solely exist in Hunan.

⁴ Mark-ink carpenter, the master carpenter who is the key man in the control of the construction. The construction does not require the construction drawings but the remembered marks and past experience.

Moreover, even the “Dong-like” Drum Towers display a big difference among the different Dong areas. The following sections will firstly analyze geographical difference and the behind cause.

1.1 The socio-cultural significance of Drum Tower

1.1.1 History of Dong minority and its Drum Tower

According to Dong elders, the Dong began as a people with no clothes, who were driven to where they live now by invaders. The Gao-miao site occupied by the Dong at Qian-yang on the middle of the Yuan-jiang River was the home of a paddy rice culture that flourished 7,000 years ago. Pottery pieces found here contain images of suns, birds, flowers and trees. There was also legend based tale promoted by the generations. Traced by the documented history, the Dong people, are a branch of the Rau people⁵ that splintered off from the Baiyue⁶ people during the Southern and Northern Dynasties period (A.D. 420-588). The Yue people, whose most famous leader, according to legend, was the Great Yu, are believed to be the forefathers of the Han Chinese people. It was during the Tang Dynasty (A.D. 618-907) and Song Dynasty (A.D. 960-1279) that the Rau people divided into further subgroups, one of which are the Dong⁷. The Yue tribe that would produce the Rau and eventually the Dong ethnic group are related to the Tai⁸ ethnic group that inhabit present-day Thailand and elsewhere in Southeast Asia and in the South Pacific region.⁹

The original documents on the Dong Drum Tower are since Ming Dynasty (A.D.

⁵ Rau, or Liao (Chinese: 僚人), is an ethnic cluster covering Zhuang, Buyei, Tay-Nung, and other northern Tai language-speaking peoples.

⁶ Baiyue, or hundred yue (Chinese: 百越), were various indigenous non-Chinese peoples who inhabited the region stretching along the coastal area from Shandong to southeast China between the first millennium BC and the first millennium AD.

⁷ Dong people usually call themselves Kam, though they pronounce it more like "Gam".

⁸ Alternatively, *Dai* (Chinese: 傣).

⁹ Refer to the website: <https://www.chinatravel.com/facts/grand-song-of-the-dong-ethnic-group.htm>

1368-1644), they call it in several different ways, Chiya recorded (Kuang, 1368-1644):

Ground a large log, making into a Dujiao-lou (unicorn-like building), with hundred feet high, covered with colorful tiles, looks like the splendid fish scale, men singing and drinking inside, sleep there when the nights coming, taking as an honor.

Chang-min-ce-shi states (Sui, 1575):

Calling for hundreds, or seventies, or thirties families, build a High-building, set a Drum on the top floor, convene all villagers when beat-sound on.

Guangxi Local Annual (Guangxi office, 2017) recorded:

Dong people, who live along the rivers or in the mountains... when spring comes, set a huge log ground, and build as a high tower, people sing over nights inside, it is so called Luohan-lou (the building where gathers numerous people).

Yuping County Annal (Yuping office, 1757) recorded:

Nanming-lou, thus Drum Tower, was built in the Yongle emperor period, Ming dynasty... set the original site as foundation, build with a huge column, over three-storey.

Guizhou Records (Li, 1796-1820) recorded:

Several villages construct a building on the hilltop, named Jutang (gathering hall), set a bamboo stick alongside the drum, when important issue comes, beat the drum.

Jutang, the place gathered with lots of people, is similar to Tangka, Tangwa in Dong language. In the Dong folk history, there are various names as well, such as Bai, which means the shed stacking in woods; or Lou, which refers to the songs for ancestor worship, the loanword from Han Chinese; as mentioned Tangka, Tangwa is

the place for gathering people and for negotiating public issues.

Apparently, the names for Dong Drum Tower, both in history records and folk tales, are including two meanings, on the one hand, it comes from the building morphology, like Bai, Lou, Dujiao-lou, etc. on the other hand, it comes from the utilization purpose, like Luohan-lou, Jutang, Tangka, Tangwa, Drum Tower, etc. Despite the lack of historical archives and evidences to prove the origin of Drum Tower, as mentioned previously, the Drum Tower is indeed a production derived from the social life, as well the morphology has a close relationship with the development of the construction technique and even the function requirement.

1.1.2 Shan-mu (Chinese fir) as an analogy

In the Dong minority community where the customs of primitive society have been preserved, the Shan-mu (Chinese fir) is deemed as a kind of sacred tree which can provide shelter for people as a giant “umbrella” (Ruan, 2006) (Fig.1-1). In Dong minority villages, there exists a saying: *building a tower before building a village*, where a fir tree, as an analogy, is erected in the center of a level ground on the hillside. In a region without a Drum Tower, if there is a singing and dancing activity during the Spring Festival, a fir tree is erected in the center of level ground as a “Drum Tower”, around which people sing and dance (Yu, 1989). All the above indicate that the central column of Drum Tower and the fir tree exist in the relationship of primitive worship. The fir tree represents the social activity center of the villages, as well as a miniature cosmos axis, which has the extraordinary power to shelter the villages underneath the giant “umbrella”. Similarly, the central gods of villages are also common seen in other minorities located in southwest of China (Chen, 1987) and the De’ang and Bulang minority in Yunan province build a holy column at the center of the village; usually the base is carved as an analogy for specific gender characteristics. In a similar manner to Dai, Laku, A’chang minority, also has a central column, which is considered as a protector god for the locals. Therefore, it has to be carefully kept by villagers.



Fig. 1-1 The “umbrella” symbol in the ritual (Source: Cai L., *Traditional Villagers and Architecture of Dong Nationality’s Habitation Region*, P238)

Moreover, this form of central column also embodies ancestor worship and reproduction worship (Feng, 1999). Such song links the “tower” with the earth worship of Sabing. Regardless of Sa-bing, Sa-sis or Sa-man, etc. all refer to the Grandmother in Dong language. The name is somehow different among different Dong areas. She is considered as a historical goddess, who dedicated her life for the freedom of Dong a thousand years ago (Deng, 1990). Like Dong Drum Tower, almost every village has a Sa-altar or a shrine (Fig.1-2, 1-3), which reflects Dong minority people’s female worship as the symbol of maternity. An annual worship ceremony in Sa-altar is performed in the first month of the Chinese new year. Meat, vegetables and fruit are offered to Sa. Prior to the ceremony, the elder people gather in front of the Sa-altar to share the offerings and sing praise to Sa. Although there are no ancestors’ memorial tablets in the Drum Tower, the erection of “Drum Tower” analogizes the male life symbol. In most of cultures during various periods, the central position often visually

represents extraordinary power or other divine powers (Arnheim, 2009). Sense of direction, of security, of identity and of belonging that the center contains are formally demonstrated with the help of specific objects, through which the control role on the site is presented visually and behaviorally.



Fig. 1-2 Sa-Altar in Yutou village (Photograph by Ling Cai, 2014)



Fig. 1-3 Sa-Altar in Tang'an village (Photograph by Ling Cai 2014)

1.1.3 Symbol of consanguinity

The smallest unit of Dong minority rural society organization network is family, in which the father is the highest patriarch. The male characters (father and son) are collectively called Bula. The clan, also called Dou, generally shares a common ancestor. Dong minority village is composed of Dou, a unit with blood relationship. A relatively big village is composed of 3 or 5 Dous, each having its own Drum Tower. Generally speaking, a Drum Tower suggests a Dou's family name. The number of Drum Towers in a village signifies the number of Dou groups within settlements. For example, in Zhanoxin village, Congjiang county of Guizhou, five Drum Towers suggest that five Dou groups live there (Fig.1-4).



Fig. 1-4 Five Dous in Zhaoxing village (Photograph by Ling Cai, 2015)

The “tower”, being the product of the reproduction worship, naturally becomes the symbol of consanguinity, as well as the sign of social organization. The Drum Tower is the symbol of status in the family or village. There are Laka village and Lageng village in the Dong minority region. Laka refers to those who had settled down in a place at the earliest, while Lageng refer to those who move or seek refuge into the Laka village, are admitted and relieved by Laka without compensation, fulfill various obligations, present gifts to Laka each year, and respect Laka as eldership. According to *Guizhou Records* (Li, 1796-1820),

“In Guzhou...‘Yetou’ (alternatively Laka) lives in the big village, while ‘Dongzai’ (alternatively Lageng) lives in the small village; Dongzai is entirely subject to Yetou.”

According to *Guizhou Miscellanies* (Lin, 1795-1820),

“The small village, also called Dongzai, is affiliated to the big village without independent right, and respects the big village as Yetou. The big village undertakes local official affairs, while the small village, like an ancient dependency, isn’t given notice and dispatched any task.”

In Laka and Lageng, explicit subordination and affiliation relations exist in the social

life, with certain hierarchical differences. The Drum Tower, as the symbol of family, highlights such hierarchical relation in the form of materialization. In the village with the status of Lageng, the Drum Tower is restricted in size, tier and degree of decoration (Shi, 2001). For example, Yaxian village in Congjiang, Guizhou was previously a Lageng village of Xindi village; Yaxian Drum Tower has hexagonal nine-floor eaves and pavilion roof, with roof-corner at each tier having no flying rafter or other decoration. However, Xindi Drum Tower has octagonal thirteen-tier eaves, pavilion roof, flying rafter and rake angle.

1.1.4 Cultural identity

Dong minority village, as a small group society, under the influence of primitive worship, in the process of generation and development of consanguinity and clan concept, has formed a common lifestyle and spontaneous culture norms. Under the superficial life phenomena, there is a potentially collective sense of identity made up of the villagers' common values and interlinked individual feelings. Such collective sense of identity, for the connotation of the Drum Tower, is an interactive process.

The sense of identity that the individual belongs to the village firstly begins with the naming ritual of the individual, that is, an important life ritual of the newborn. The newborn, upon completion of his or her first month of life, is given a pet name in the first naming ritual held in the Drum Tower. When growing up to 11 or 13 years old, he (she) is given a second name, also called "Drum Tower name", in front of all the Dou people in the Drum Tower. The name which is not given in the Drum Tower is not admitted by all the Dou people. Moreover, another naming place is never admitted. The naming ritual in the Drum Tower, like an "adult ritual", manifests that he (she) has been admitted by the society officially. The social and individual identities also can be reflected in the funeral ritual. According to Dong minority customs, the naturally-died elders above the age of 60 or the prestigious naturally-died persons below the age of 60 can enjoy the treatment to place their coffins in the Drum Tower forever and hold the solemn funeral in the Drum Tower or its front plaza.

The status of building is symbolically converted through the ritual into the individual's social status. Moreover, a load-bearing column as major component of the building is marked with the villagers' honor or disgrace, with attachments and ornaments on a load-bearing column and central column becoming a kind of symbol. The horns of victorious fighting water buffalo are hung onto the one of the load-bearing columns, expressing the mood of enjoyment and pride (Fig.1-5). The horns of failed fighting water buffalo are also hung onto the column, symbolizing misery and humiliation. Nailing a big iron nail into the load-bearing column indicates that an important thing between Dous and villagers has been determined without regret.



Fig. 1-5 Buffalo's horns tie in Yintan-xia Drum Tower, Guizhou (Photograph by author, 2018)

In this way, the rituals held in the Drum Tower express such collective sense of identity to individuals. Moreover, space and place for such rituals, i.e. Drum Tower, also becomes an energetic well-functioned organism to inherit the collective sense of identity. Hence, the custom culture phenomena conducted in the Drum Tower make it the living space for the village to inherit customs.

1.1.5 Social custom

Dong inhabitants live as a cluster. Due to its evolution from clan society to Kuan society, the symbolic meaning of “tower” at the spiritual level is gradually retreated to the depth of historic culture. Due to its increasing actual functions, the “tower” has become the crucial public building in the villages.

According to historical records, the meaning of Jutang (gathering hall) is close to that of Dangc wacg (Dong language) (Dong office, 1985), referring to a place for the people to talk and discuss. The earlier Drum Tower mainly reflected the two essential social functions: discussing public issues and providing an entertainment venue for local people. Then, the social and cultural functions of the Drum Tower were expanded into all the aspects of Dong minority people’s life. Firstly, the Drum Tower is a place for the political activities, for example, announcing village regulations and provisions, implementing regulations and agreements, handling disputes. Secondly, the Drum Tower is a place to discuss economic activities of Dong village. For example, date schedule for holding the ritual of transplanting seedlings, building water conservancy project, hunting and fishing, etc., and economic issues concerning collective interests, such as negotiating commodity price, controlling grains. Thirdly, the Drum Tower is a military activity center. Fourthly, the Drum Tower is a place for social activities, for example, singing in antiphonal style, chatting between the elders, greeting and seeing off guests, singing and dancing among neighbor villages for the purpose of friendship.

Out of these activities, Dos yeeh ritual is a kind of special Drum Tower activity, which essentially highlights the dominant role of Drum Tower in the Dong minority society. The status of the Drum Tower is converted through such ritual into the force to “communicate” daily life. Lu You, a poet from South Song dynasty (A.D 1127-1279), well-known for his poems as well as the extensive travelling records, had several observations on southern minority groups in his *Jottings From An Old Study Shed*,

“During the slack farming seasons, one to two hundreds of people gather

together, hand in hand, to sing and dance, with local musical masters blowing 'Lu-sheng' (a Chinese mouth-blown free reed instrument) in front of the others."

indicating that Yeeh is a kind of ancient folk song and dance, and Dos-yeeh ritual is held during Sa-sui sacrifice, commemorative activity and festival ceremony(Fig.1-6). Accompanied by Lu-sheng, drum and flute music, the well-dressed people gather together on the square of Drum Tower, and sit in a circle, hand in hand, to enjoy songs and dances.



Fig.1-6 Dos-yeeh ritual in front of Drum Tower, Xiaohuang village(Photograph by author, 2014)

All these political, economic, military and cultural activities are linked with the spirit to enhance ethnic centripetal force and intensify ethnic awareness of internal cohesion. Dong minority people, through participating in the activities held in the Drum Tower, have developed both a cultural spirit and a value system based on the ethnic characteristics.

So far, the Drum Tower in Dong language has different names, such as "Tower", *Bai*,

Dangc wagx, Dang kah, without the implication of “drum”. Therefore, it is uncertain to make a conclusion that there is a drum within the tower.

Both “drum” and “tower” firstly have been seen in *Chang Min Ce Shi* (Sui, 1575). The combined name (Drum Tower) of “drum” and “tower” has been seen in the literature during the later periods, especially during the periods of the Qing dynasty and the Republic of China. In *Yuanzhou Ting Annal* (Zhang,1903) :

*“Yizhi has preserved some Drum Towers, magnificent and towering,
founded in the Hongzhi period, of which most have collapsed.”*

Hence, placing the “drum” in the “tower”, that is, adding a long drum based on *Jutang*, has caused the evolution of Drum Tower into current version. Moreover, the Drum Tower has added a new social function: beating drums as a signal (Fig.1-7), although the drum is rarely beaten nowadays to solicit awareness for villagers. The most crucial function of Drum Tower is still a gathering place, not only for festivals, rituals and other public issues but also to listen to elders’ past stories and create new songs. Therefore, the Drum Towers without a drum still widely exist among Dong areas.



Fig.1-7 An ancient drum hangs at the top of Zengchong Drum Tower (Photograph by Ling Cai, 2014)

1.2 Typology of structural system

Two different structural systems are employed in Drum Tower, the main one is Chuan-dou, a column-tie structure. Some specific areas like Hunan, are also using another structural system, Tai-liang, a post-beam structure, as official Han building does. However, the Tai-liang employed in Drum Tower in Dong area always combines with Chuan-dou, the special structural system, named Tai-liang. The second one was generally built much earlier, mostly in Qing Dynasty, with combination of village gate; the main structure and morphology of Drum Tower is similar to the wooden hall-style building adopted by Han Chinese in the south part of China. Chuan-dou Drum Towers were usually built a little later from Qing Dynasty to contemporary era, most of them are towering with dense multi-eaves roof. Wood joints would be analyzed and described in details in the following part, only a few previous contributions have focused on the nodes at the connection of elements. In this thesis, the different kinds of special wood joints applied in Dong Drum Tower and their structural function are well-recognized.

1.2.1 Chuan-dou typology

In this kind of structural system, the entire skeleton of Drum Tower consists of columns, purlins, struts, tie-beams and architraves. (Fig.1-8) The purlins are located on the top of the columns or struts, which are connected and crossed by the horizontal tie-beams and architraves. The plans of the Chuan-dou Drum Towers are often a regular polygon, there is a central column (touching the ground), or a king-post (suspended above the ground) being located in the geometric center of a regular polygonal plan, rising up to the top of the Drum Tower. Using this kind of structure, the roof morphology of Drum Tower is a dense multi-eave roof, which makes the Drum Tower look high and straight.

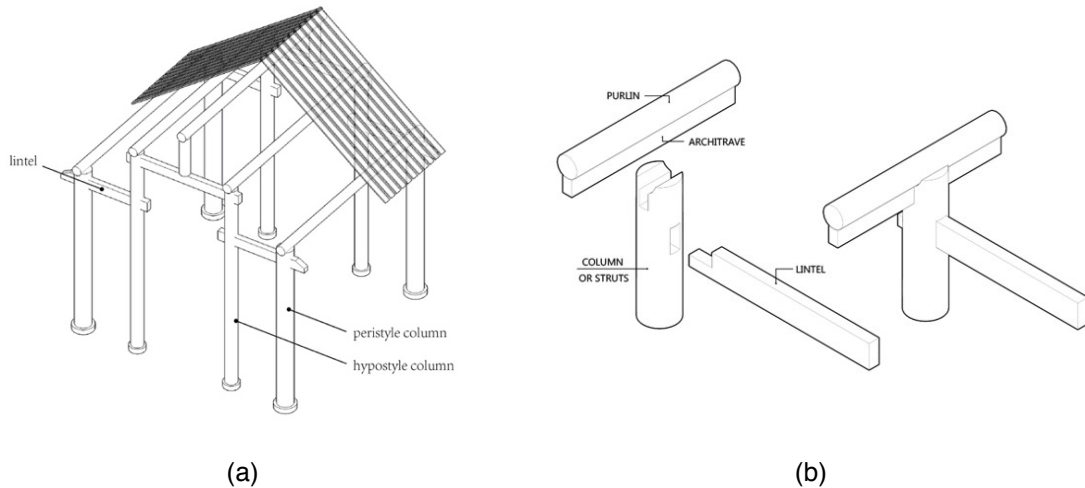


Fig.1-8 Chuan-dou typology (Draw by author)

(a). Structural frame of Chuan-dou; (b). Connection of elements

Among the traditional buildings of the Han nationality and other minorities, the Chuan-dou structure is only applied in constructing dwelling houses with no more than three floors. The Chuan-dou Drum Towers of Dong minority, are generally more than five stories or eaves. The Drum Towers take full advantage of this type of structure by expressing the creativeness and development of the traditional timber structure of China. Whether using the central-post or king-post, the Chuan-dou Drum Tower can be classified into two types: single load-bearing column and bundle load-bearing columns.

The single load-bearing column Drum Tower stems from a Dong legend story, in the past, the Dong people planted a huge Chinese fir tree at the center of the village, acting as a giant umbrella, which could protect the villagers under its shade. The strong analogy of Chinese fir, nonetheless, still exists in the Dong area. Local people are convinced that their village had a giant fir previously, covering the whole settlement inside, the fir died after many years, but the spirit lingers on, people attempt to imitate the shape of fir and construct a large “umbrella”. This is how single load-bearing column Drum Towers appeared.

Only one single load-bearing column Drum Tower survived among the Dong areas, which is found in Shudong village, Liping county of Guizhou (Fig.1-9). Shudong Drum

Tower is a seven-story one, was originally built in 1922, located at the top of the hill, and it is called by local villagers as Lou Lat Dungh, alternatively single load-bearing column Drum Tower. Once, according to the elder villagers, there were other two Drum Towers that appeared similar to the existing one. However, they were destroyed, after being for a long neglected and without any restoration. As to the interior space, has only one column supporting the whole structure, right at the center, balanced with the surrounding eight peripheral columns, which are crossing with the central column with eight tie-beams.



(a)



(b)

Fig.1-9 Shudong Drum Tower, Guizhou (Photograph by Xiaotie Chen, 2013)

(a). External view; (b). Interior view

Because of the particular central column, the fire place has to be, inevitably, off the center and arranged near the central column, therefore, the “spatial cohesion” is lost with the occupancy of central place (Fig.1-10). People can only gather around the fire place at the corner of the ground floor. Besides, with the increasing request for the

space function, the *single load-bearing column* Drum Tower cannot meet the requests. Hence, the transformation of the structure is strongly requested, i.e. suspension of the central column and expansion of space. The *bundle load-bearing columns* Drum Tower is emerging.

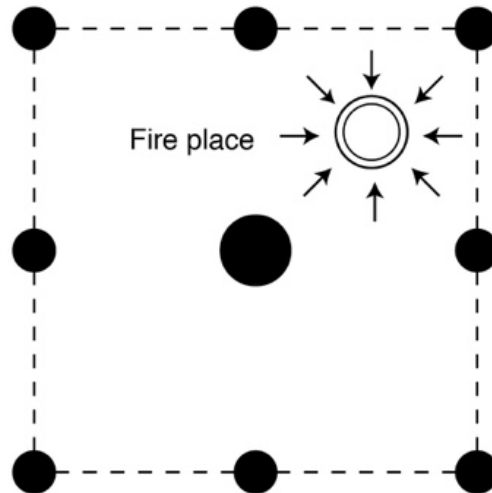


Fig.1-10 Fire place off the center, Shudong Drum Tower (Draw by author)

The bundle load-bearing columns Drum Tower stems from the single load-bearing column Drum Tower, being the transformation or second type of the later one. Occasionally, the square, hexagon or octagon is used for the plan, with two bundles of columns (Fig.1-11), the ground-touching central column transformed the king-post after being elevated. Therefore, the modification make it possible to promote the height of the Drum Tower, which was previously limited by the height of the central column (usually it depends on the height of the fir tree).

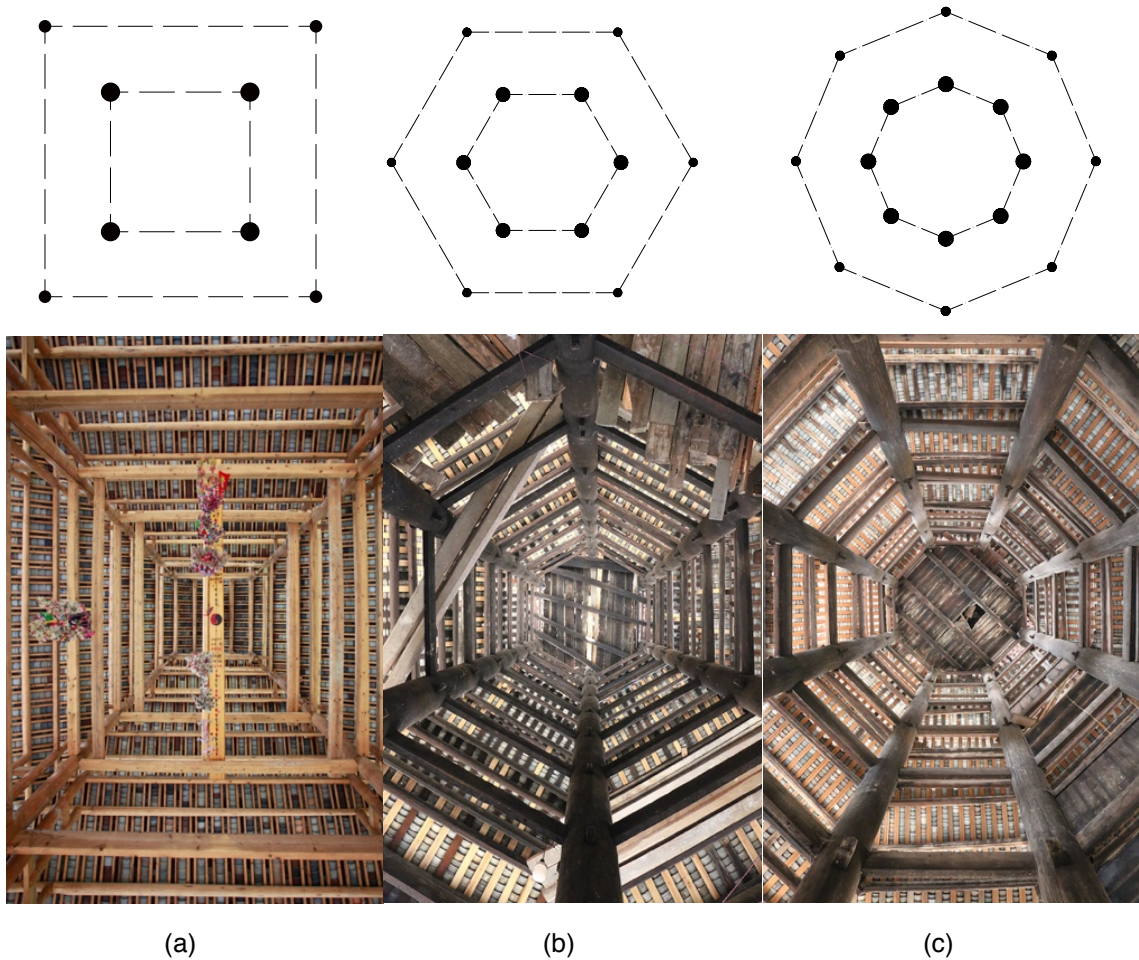


Fig.1-11 The bundle load-bearing columns Drum Towers (Photograph and Draw by author)

(a). a quadrangular bundle; (b). a hexagonal bundle; (c). an octagonal bundle

There is a repeatable frame within the bundle load-bearing columns Drum Tower (Fig.1-12), the peripheral columns and inside columns are crossed by several horizontal tie-beams. The first-tier tie-beams support the short columns as well as the first-tier eave-purlins. The short columns and the inside columns are connected by the second-tier tie-beams, which support the short columns and the second-tier eave purlins. This kind of logic-repeated connections occurs until the short columns nearly attach the king-post. In this way, the height of the Drum Tower will not be limited by the height of the inside column. As aforementioned, the inside columns, connected to each other by horizontal tie-beams, are supplemented by a peripheral bundle of columns. The umbrella-like frame ends of these peripheral columns bear purlins that

support the lowermost mono-pitched tier of roof.

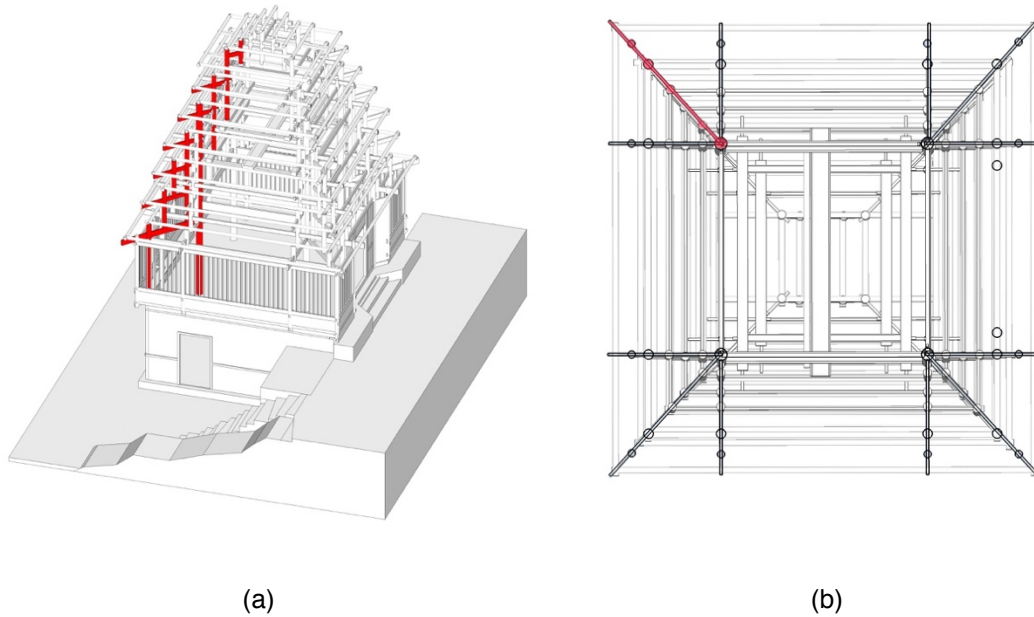


Fig.1-12 A repeatable frame (mark in red), Jiulong-zhai Drum Tower (Draw by author)

(a). 3D model; (b). upward view

From the structural point of view, this kind of logic of construction cannot accommodate a roof that would extend far enough to effectively protect the columns. For this reason, a series of stepped tiers of mono-pitched roofs was chosen: it affords optimum protection for the timber members by shielding against driving rain and allowing wind pass between the tiers of roofs, reducing the level of moisture in the wood, caused by extreme humidity during the monsoon period, to a tolerable level (Zwerger, 2015).

According to the field survey, it is concluded that three main different repeatable frames which use different connection approach among peripheral column, inside column, short column and tie-beam can be identified as Type A, Type B and Type C: In Type A, the horizontal tie-beams are used to cross the inside column at every eave, meanwhile, bearing the short columns(Fig.1-13). With this kind of frame, the tie-beam bears only one short column at each tier roof. It is the most common roof frame in Chuan-dou Drum Tower. For example, Gaocai Drum Tower in Guizhou;

In the repeatable unit of Type B as we can see, the inside columns and peripheral columns are connected by the tie-beams at first tier roof, bearing two short columns, which are crossed by the tie beams at second tier roof without expanding to attach the inside columns (Fig.1-14). Using this kind of frame usually can enlarge the distance between peripheral and inside columns, which results in a “thicker waist” of Drum Tower from the morphology point of view. For example, Liujia Drum Tower in Guizhou. In order to enhance the stability of the structure, Type C appears a special construction method where the inclined inside column is similar to standing straddle legs. They are connected by horizontal tie-beams at first-tier roof, bearing two short columns, which are crossed by the tie beams at second-tier roof without expanding to attach the inside columns. Meanwhile, the tie-beams at second tier bear other short columns upward to the third-tier roof (Fig.1-15). For example, Yintan-xia Drum Tower in Guizhou.

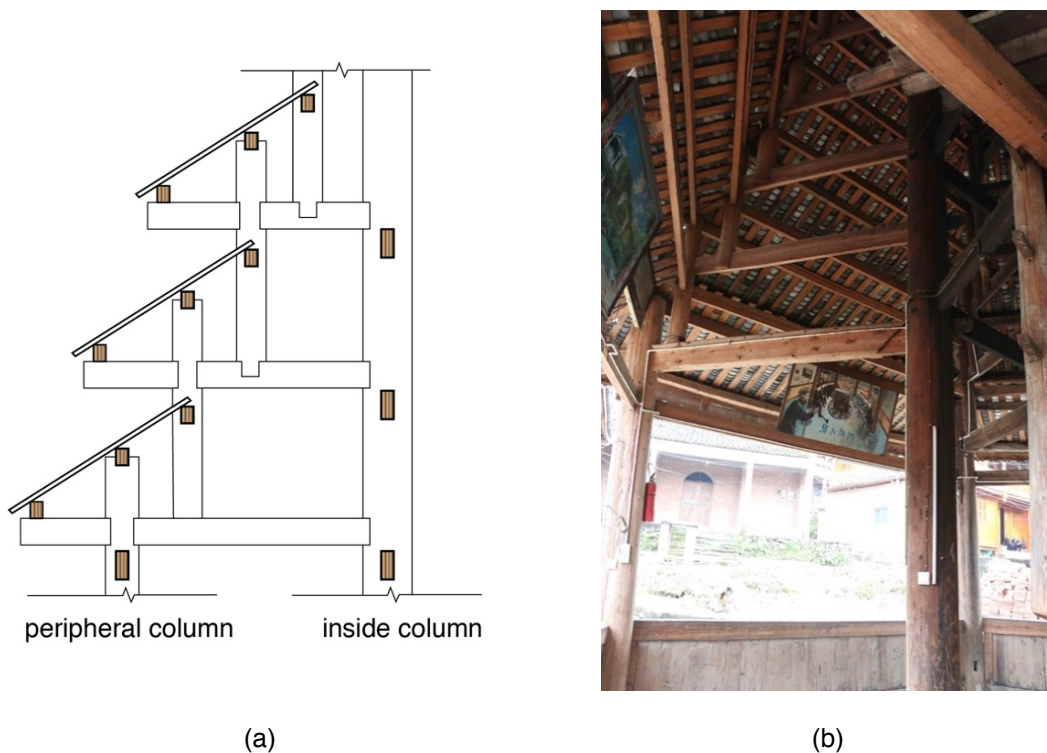
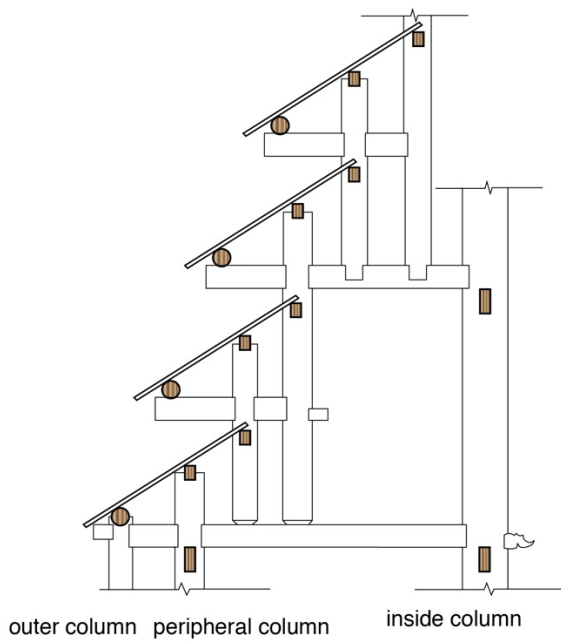


Fig.1-13 Type A roof fame (Photograph and draw by author, 2018)

(a). Diagram of a partial roof frame; (b). Interior view of Gaocai Drum Tower



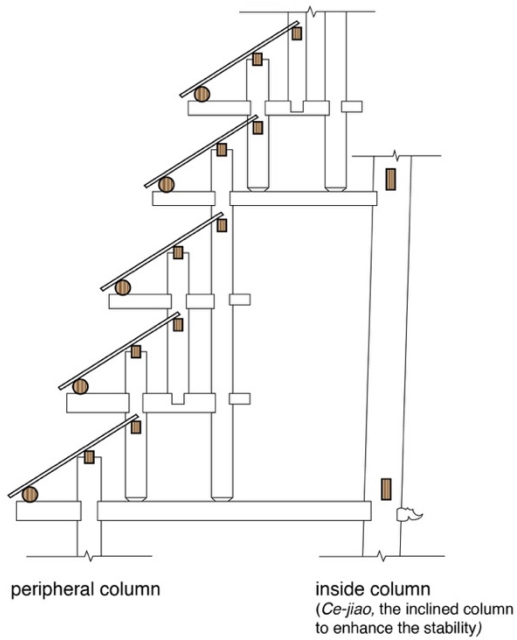
(a)



(b)

Fig.1-14 Type B roof fame (Photograph and draw by author, 2018)

(a). Diagram of a partial roof frame; (b). Interior view of Liujia Drum Tower



(a)



(b)

Fig.1-15 Type C roof fame (Photograph and draw by author, 2018)

(a). Diagram of a partial roof frame; (b). Interior view of Yintan-xia Drum Tower Drum Tower

Different types of roof frames create diversified morphologies of Chuan-dou Drum Tower due to the intelligent local carpentry. All the interior of Chuan-dou Drum Tower is an open space, without ceiling and all the elements are exposed. It also echoes the free and open character of Dong people as well as the collective atmosphere within Dong settlement.

The simple logic of the interior structure is often adjusted to meet a functional and morphological request by the following two different method, additional short columns and removable inside columns.

i Additional short columns

The common method which has been adopted in Drum Towers, in particular among Dong area in Hunan, is to add the number of supporting short columns, that is, the upper roof of the Drum Tower transforms from a lowermost quadrangular hipped roof into an octagonal or a hexagonal pyramidal roof by using additional short columns and corresponding bearing tie-beams(Fig.1-16).

The method A can be seen in the Lusheng Drum Tower, Tongdao, Hunan. Dragon head-like tie beams cross the four inside columns, bearing four additional short columns, other four additional short columns are supported by the crossing tie-beam which also bear the king-post. Method B can be seen in Zhaoxin Drum Tower, Liping, Guizhou. Four additional short beams stand on the tie-beams at first tier roof, and the additional short beams bear four additional short columns, using the existing four inside columns, producing the octagonal shape. Method C is present in Gaosheng Drum Tower, Tongdao, Hunan. The eight additional columns stand on the tie beams at first tier roof, in which four additional tie-beams are set in the middle of two inside columns and parallel to the tie beams which are connected to inside columns and peripheral columns. Method D is similar to the first one. However, the difference is that the additional short beams are crossed at 60 °. In this way, the transformation presents a hexagonal tier roof. For example, the Jizongyin Drum Tower, Tongdao, Hunan.

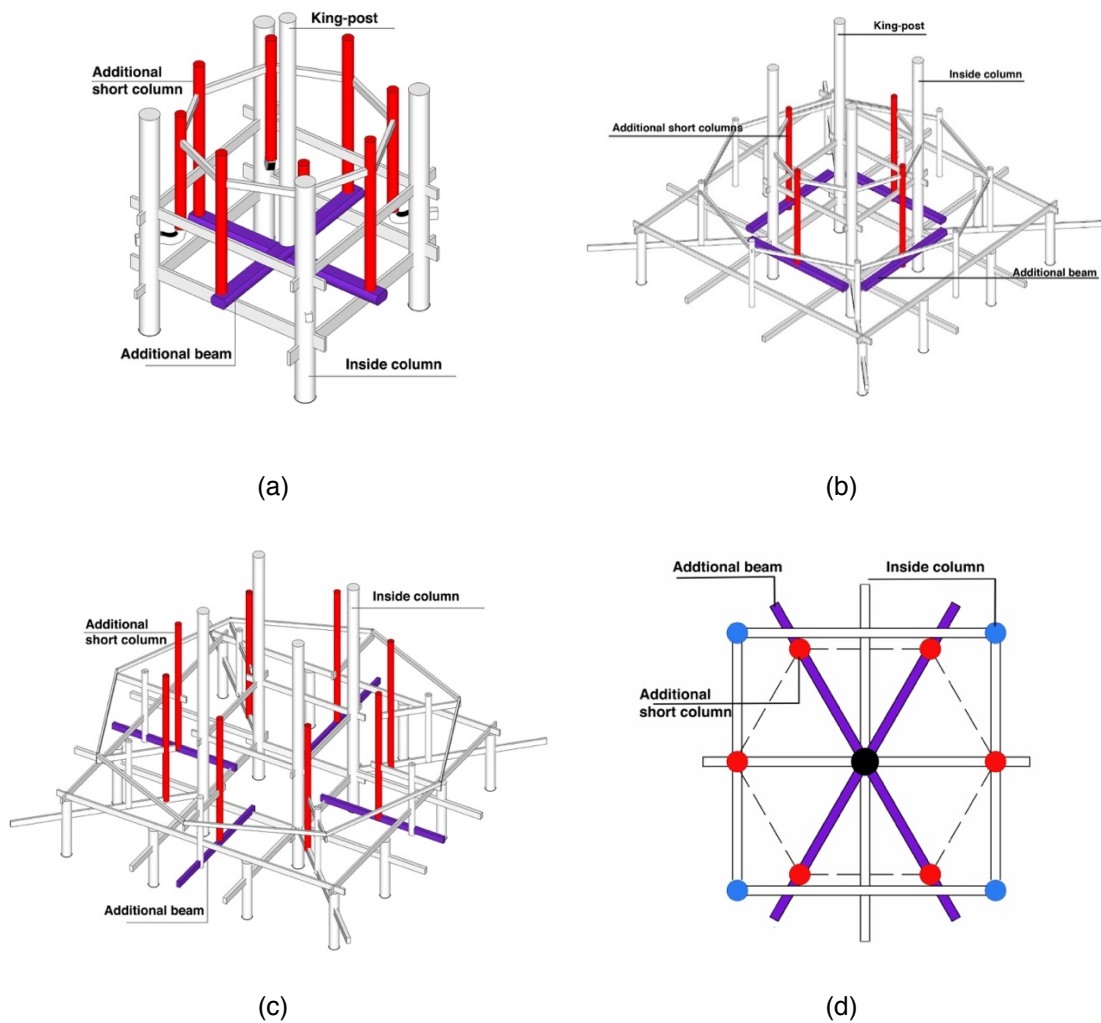


Fig.1-16 Four methods of “additional short columns” (Draw by author)

- (a). Method A, Lusheng Drum Tower; (b).Method B, Zhaoxing Drum Tower; (c). Method C, Gaosheng Drum Tower; (d). Method D, Jizongyin Drum Tower

ii Removable inside columns

The method is to remove four of the eight inside columns, making the inner bundle of columns into square, while the outer bundle is still an octagon. This is the case, for instance, of the Zaidang Drum Tower, Rongjiang, Guizhou. The outer bundle is composed of eight peripheral columns while the inner bundle is to four columns (Fig.1-17). In this case, two forms of roof frame appear. The roof frame B is totally the same as an ordinary bundle load-bearing Drum Tower, connecting the peripheral column and to the inside column. After removing the four inside columns, the roof

frame A is directly supported by the tie-beams which connect with the two close inside columns. Hence, this kind of structure is characterized by high value of the shear stress on the main tie-beams.

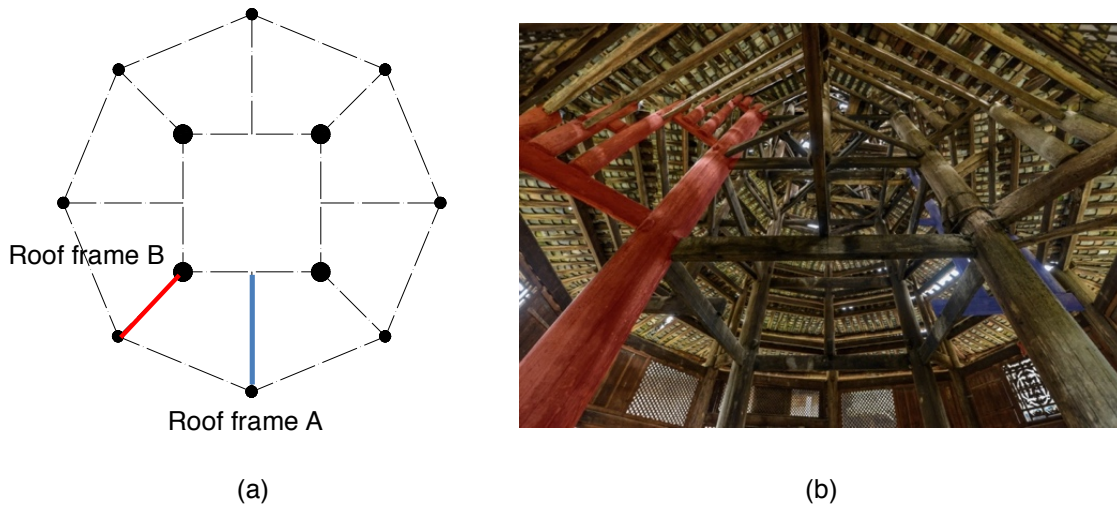


Fig.1-17 “Removable inside columns” (Draw and photograph by author, 2015)

(a). Diagram of “Removable inside columns”; (b). Interior view of Zaidang Drum Tower (roof frame A marked in blue, roof frame B marked in red)

Besides this, the concept of “remove” is applied also to the suspended central column, i.e. the central column does not touch the ground, as while the lower part is removed and supported by the cross-beams. This is the case, for instance, of the Jitang Drum Tower (Fig.1-18), where being located in a limited place, the request for an expanding ground floor is inevitable. Using a main beam to bear the suspended central column is a particular method that is not suitable for every occasion. Because of the limited span, the crossing beam can bear the central column and the whole structure. However, if the span of Drum Tower expands to a particular extent and the main beam is not capable to bear the load, the “suspended central column” is not an appropriate solution.



(a)

(b)

Fig.1-18 Suspended central column, Jitang Drum Tower (Photograph by Xiaotie Chen, 2013)

(a). External view; (b). Interior view

1.2.2 Tai-liang typology

Tai-liang Drum Tower is very similar to the Han nationality main hall. Tai-liang means there is a big beam between two peripheral columns, or two inside columns, which are loaded by two short columns supporting the 3 or 5 purlin beams(Fig.1-19). The purlins-horizontal members that support the rafters are positioned along the stepped shoulders of the skeleton. In the Dong Drum Tower, the big beam between the peripheral columns and inside columns behaves more like tie-beam, while bearing the short columns. Therefore, the lower part between the columns is Chuan-dou, the upper part between short columns and beams is Tai-liang. Therefore, Tai-liang Drum Tower involves more than a pure Tai-liang typology as Han main hall does. A surviving example of the three-purlin beam is the Longshi Drum Tower (Fig.1-20) in Yutou village, Tongdao County of Hunan. Another example of a five-purlin beam is the Yashang Drum Tower (Fig.1-21) in the same village. The Tai-liang structure can form a wider space between the two peripheral columns or two inside columns, which depend on the length of the big beam. These kinds of Drum Towers often have some

common characteristics: firstly, by having a rectangular shape; the second, by having roof styles that often include an overhanging gable roof and a gable-and-hip roof, or even a composite roof style. Sometimes, huge columns are used to support the ground floor of the Drum Tower in order to adapt to any distinctive topography.

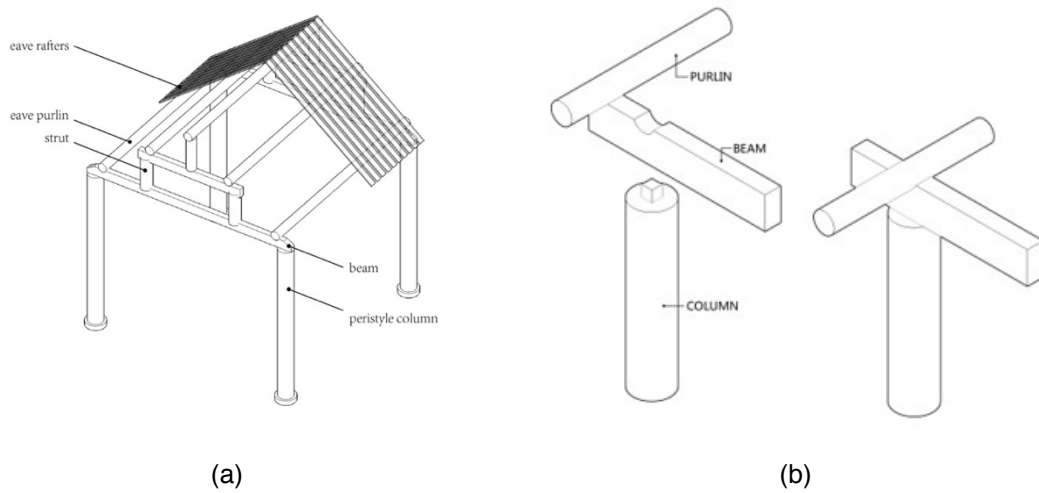


Fig.1-19 Tai-liang typology (Draw by author)

(a). Structural frame of Tai-liang; (b). Connection of elements

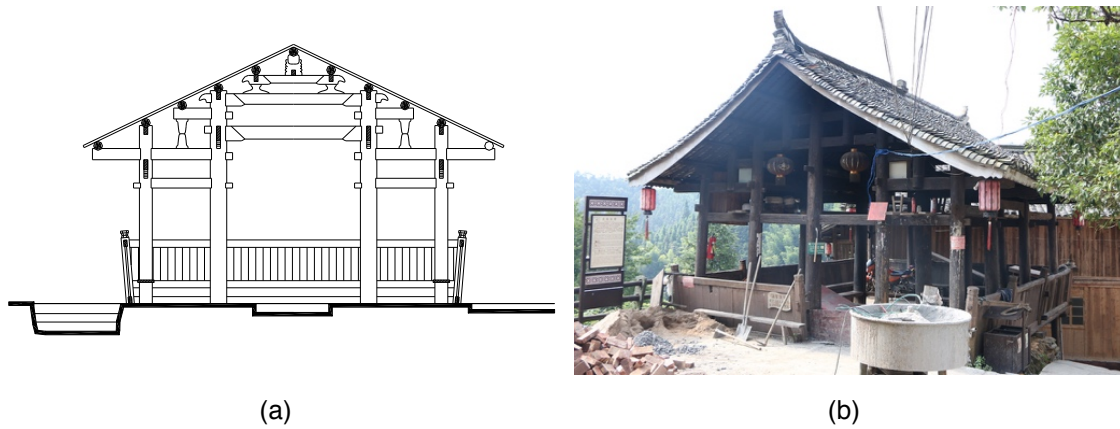


Fig.1-20 Longshi Drum Tower (Draw by Ling Cai; Photograph by author, 2018)

(a). Section; (b). External view

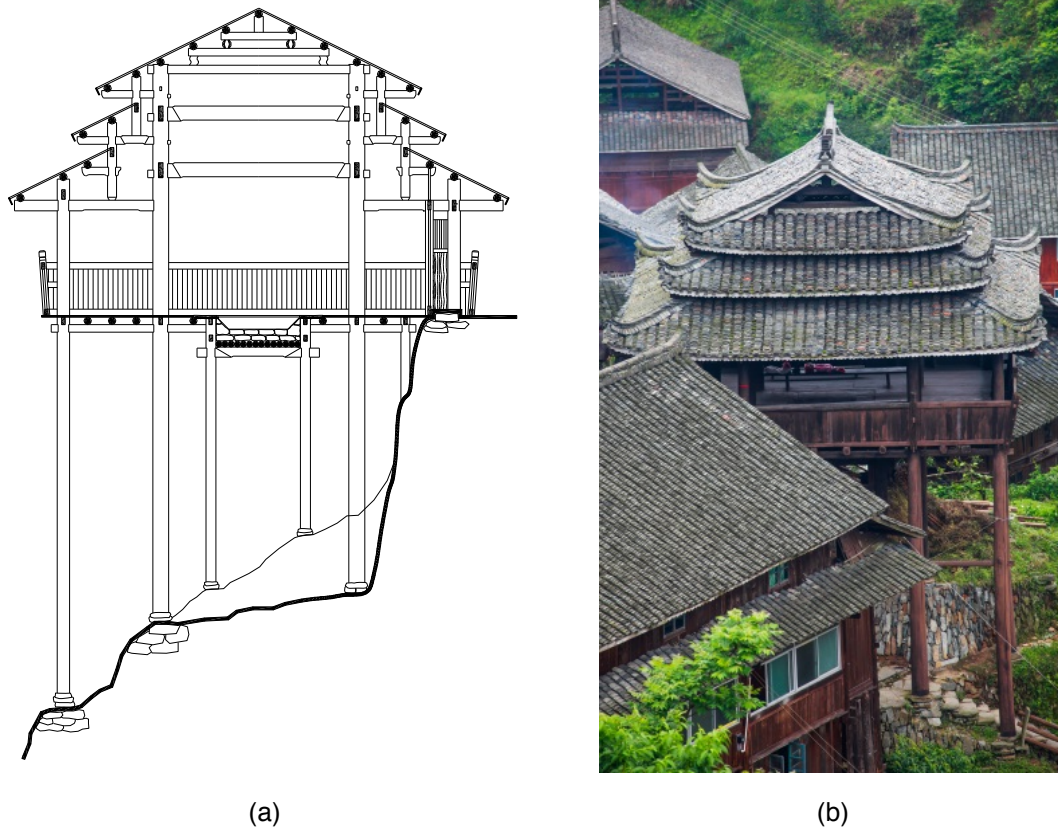
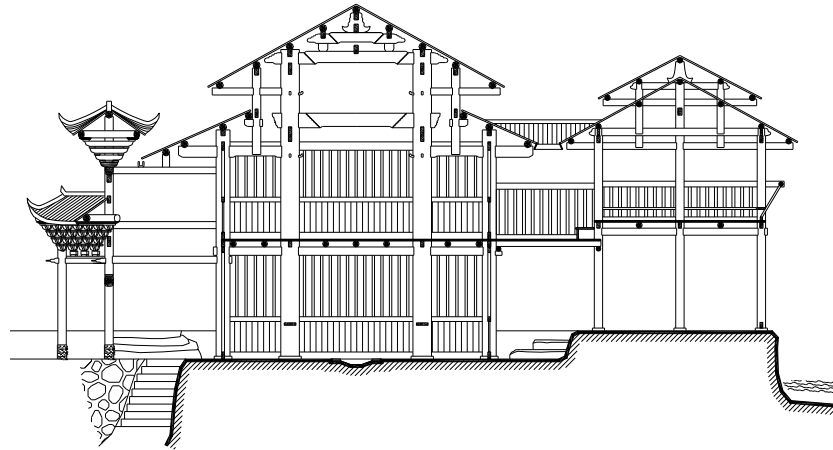


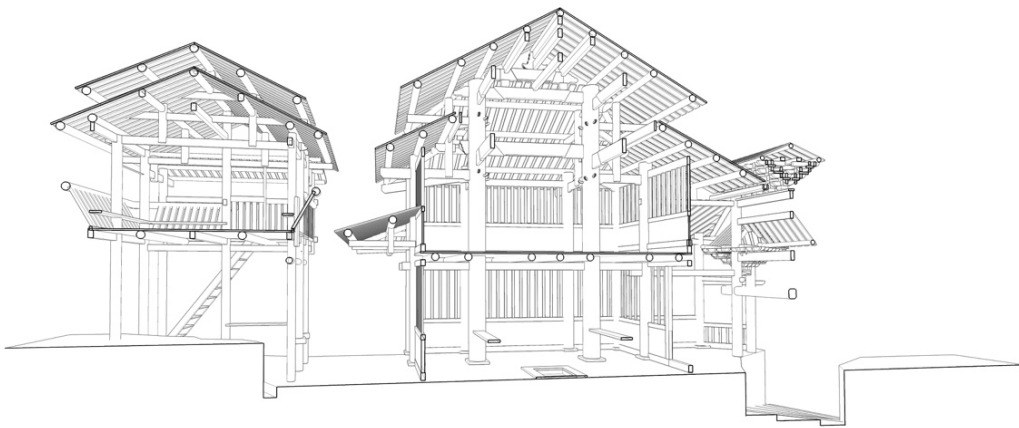
Fig.1-21 Yashang Drum Tower (Draw by Ling Cai; Photograph by author, 2014)

(a). Section; (b). External view

The structure and modeling of the Tai-liang Drum Tower is simple and clear. It is often combined with other kinds of buildings such as the village gate, the temple, an auxiliary building, thus forming a complex with special morphologies along with a variable public space within the villages. Two examples of a Drum Tower complex which consists of a village gate, a Drum Tower and an auxiliary building are given by the Yanglan Drum Tower, Tongdao county, Hunan (Fig.1-22), and the Xia-chentuan, Tongdao, Hunan Drum Tower (Fig.1-23). The Hengling Drum Tower, Tongdao, Hunan (Fig.1-24) complex consists of one Drum Tower and two village gates, which were built in three different eras of the Qing Dynasty. Another Drum Tower complex, Pingtan Drum Tower is composed of two single buildings, which are Drum Tower and Nanyue Temple (Fig.1-25). The grey brick walls on both sides of Nayue Temple, raise up out of roofs in order to stop spreading of fire if in case of accidental fire.



(a)



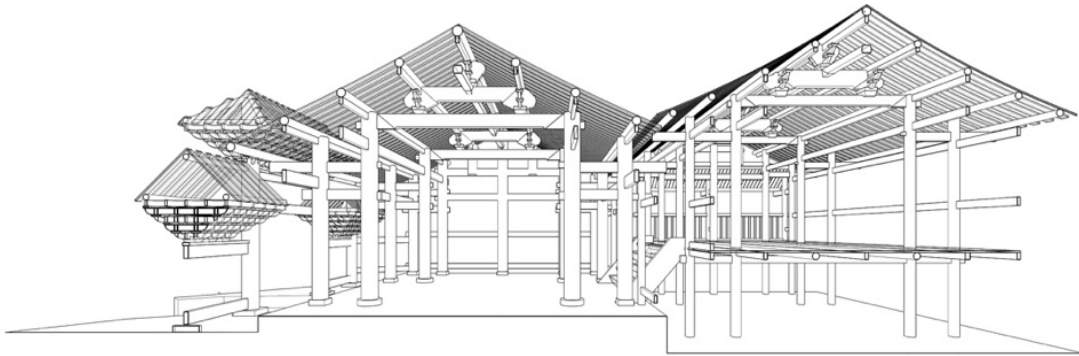
(b)



(c)

Fig.1-22 Yanglan Drum Tower (Draw by author, photograph by Xiaotie Chen, 2013)

(a). Section; (b). 3D model; (c). External view



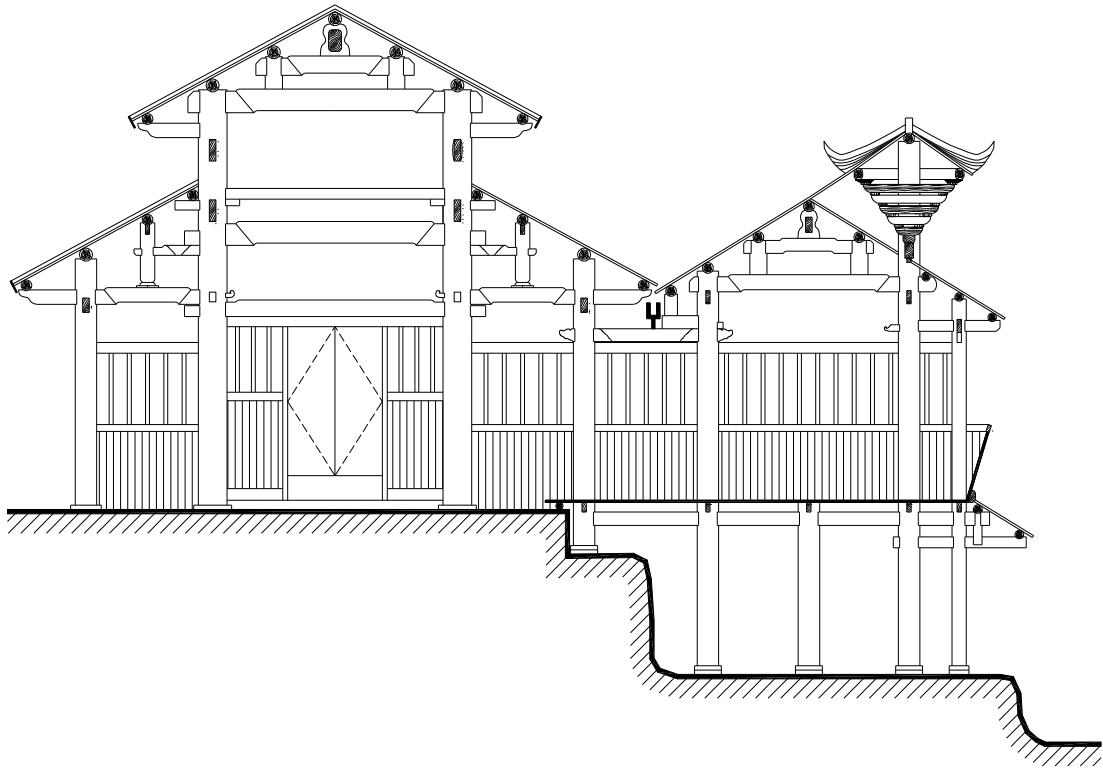
(a)



(b)

Fig.1-23 Xia-chentuan Drum Tower (Draw by Zhoujie Chen, photograph by author, 2014)

(a). 3D model; (b). External view



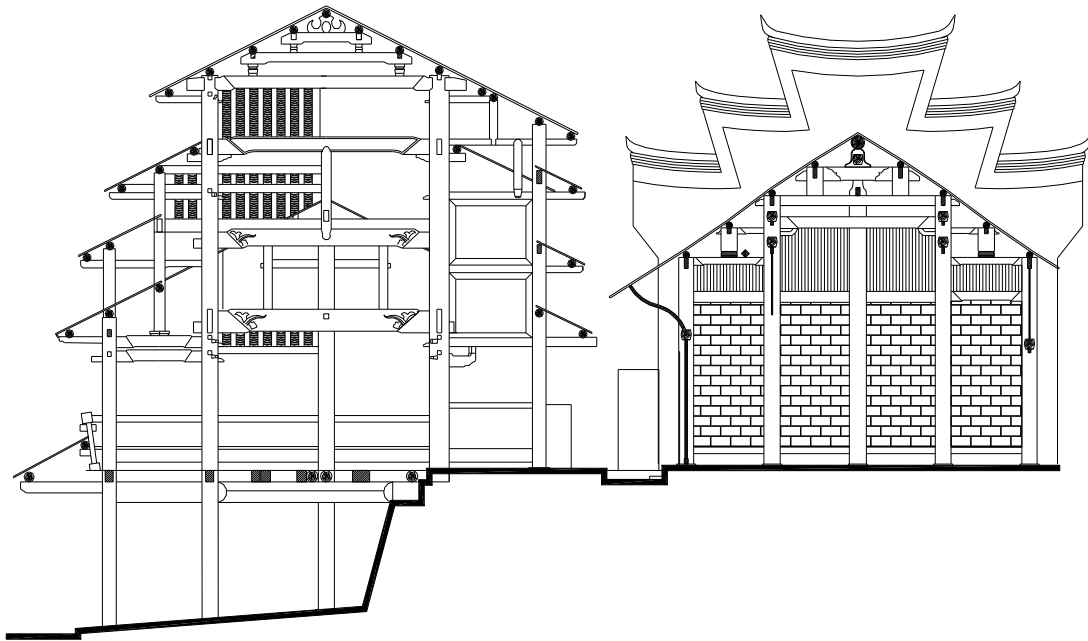
(a)



(b)

Fig.1-24 Hengling Drum Tower (Draw and photograph by Ling Cai, 2013)

(a). Section; (b). External view



(a)



(b)

Fig.1-25 Pingtan Drum Tower (Draw by Ziyao Xiao, photograph by Ling Cai, 2013)

(a). Section; (b). External view

1.2.3 Connection of elements

Chinese traditional mortise and tenon are applied also in Dong Drum Tower. However, the specific solution adopted for the joint tends to be more adaptable to the particular logical structural system and more simplified and flexible compared to the official Han nationality architecture.

i Hua-sun (slip tenon).

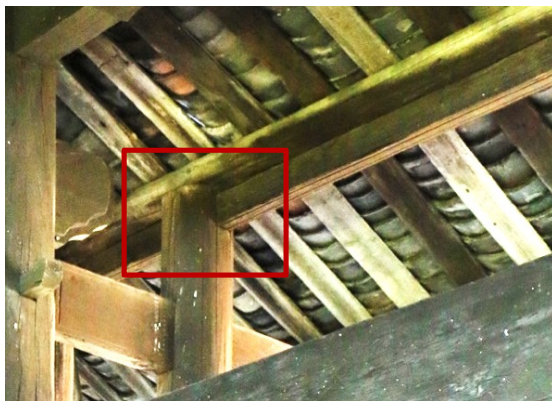
Hua-sun is one of the most prevalent connection typologies in Drum Tower, applied between columns and tie-beams. The tenon-head is straight and plane, holding an extraordinary effectiveness on horizontal binding; it usually acts overhanging the column, and the cross section gets smaller after slip into the column, and ends up with a diversified shape tenon-tail, acting as an anchor for the tie-beam. In this way, columns are connected to one another by tie-beams to form a truss. Ideally, various anchor tie-beams slip through one column, so that the column is connected via reversed forked tenon joints to horizontal anchor tie beams arranged at different heights(Fig.1-26) This kind of simple but effective method not only reduces the cross area due to the presence of several wood elements at same position, but also serving a more stable structural binding effectiveness.



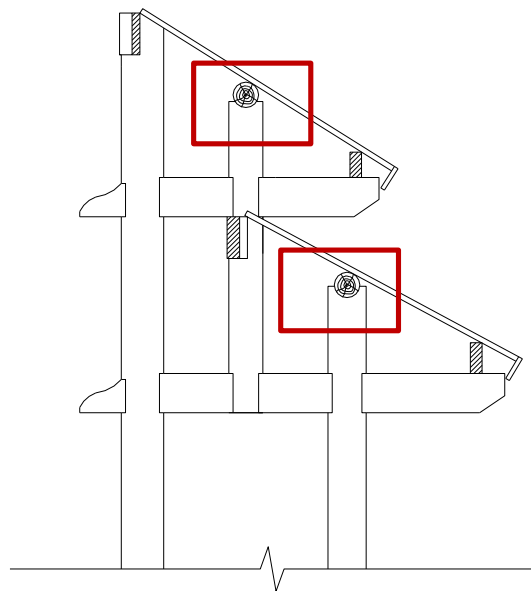
Fig.1-26 Tie beams arranged at different heights (Photograph by author, 2018)

ii Ao-cao (groove).

Ao-cao refers to the sunk mortise at the column-top, that is carved to host the upper cylindrical purlin (Fig.1-27). Rather than putting the purlin directly on the column without any connection, Ao-cao allows for a firmer connection within the whole structure. The height of Ao-cao is basically the half of the purlin, the depth is around 50mm. When the Ao-cao bears more than one purlin, like in the octagonal roof shapes with two crossing purlins at an angle of 135° , the corresponding Ao-cao would match the crossing angle as well. Apparently, Ao-cao serves as a strengthening joint to connect columns with purlins in a more tighter and steady way.



(a)



(b)

Fig.1-27 Ao-cao between column and purlin (Draw and Photograph by author)

(a). Detailed view; (b). Diagram

iii Pai-lou (Dong wood bracket).

A Dong version of wood bracket, considered as similar in the function by Han nationality Dou-gong, is used to support the overhanging of the top eave and also has a strong decorative effect on the Drum Towers (Fig.1-28). Currently, the carpenters call them in two languages, Han Chinese and Dong language. In Han Chinese, they

are called Pai-lou. Local carpenters explained that Pai-lou is created to communicate in the context of Han Chinese with the non-Dong language speakers. “Pai” means to assemble components to form several plane clusters; “Lou” refers to the stacking morphology of several plane clusters from bottom to top. The carpenters from various villages call them as Dou, Dou gang-ling or Jiong-ling in Dong language, signifying the “honey-comb” in Han Chinese. Apparently, these names are derived from the description of morphology of Pai-lou. It appears in form of the component clusters, which are based on the connection of sub-components in longitudinal, transverse and oblique directions. In terms of morphology, Pai-lou appears as the continuous duplication of units consisting of two or three sub-components in the horizontal direction, and the stagger of units on the upper and lower floors in the vertical direction. Such compact mode of construction, with regular duplication and stagger of units, combines the components into a firm, structural and decorative plane system, and finally forms a honey-comb like network.



Fig.1-28 Pai-lou in Zengchong Drum Tower (Photograph by Ling Cai, 2014)

According to author's field survey, Dong minority Pai-lou is a collective term for the component clusters under the eaves. As for sub-components of Pai-lou, Dong carpenters cannot give a specific term, and have no concept of naming the sub-components (Cai, 2018). Its construction logic, as the local carpenters explain Pai-lou, is to determine the joint dimension of each unit based on pre-set number of vertical layers, and then conduct the processing and assembling of components. After a firm plane floor is completed, a Pai-lou set is formed through overlaying four or five layers from bottom to top. For the sake of illustration, the Han Chinese names of sub-components of Dou-gong are used to name that of Pai-lou (Fig.1-29): externally overhanging sub-component is Hua-gong, sub-component perpendicular to Hua-gong is Heng-gong, obliquely overhanging sub-component is Xie-gong, the component arranged at the lowermost part of Pai-lou is Big-dou, and there is a Small-dou or a layer of transitional sub-plate between the upper and lower floors.

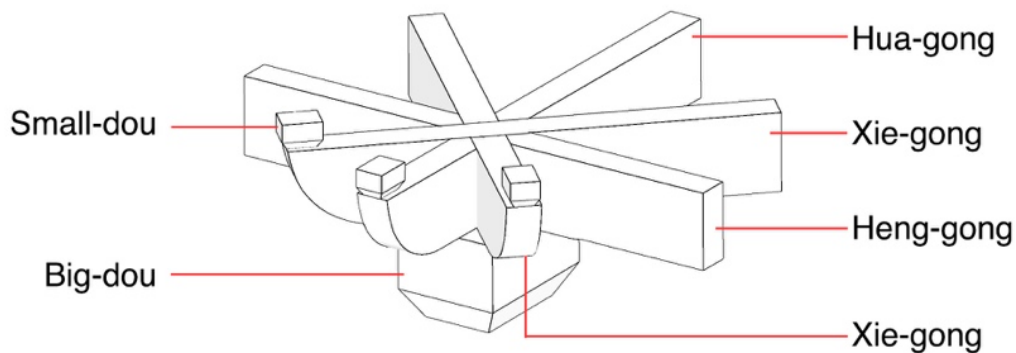


Fig.1-29 Components of a unit of Pai-lou (Draw by author)

On the lowermost floor, Pai-lou, Hua-gong, Xie-gong and Heng-gong are arranged on the several lined Big-dou, and strung into an integral whole. The difference lies in the assembly sequence of gong sub-components, which results in the difference of mortise and tenon processing. There are three kinds of assembly sequences of gong sub-components(Fig.1-30): Method A: overlaying intersecting 45° Xie-gong onto orthogonal Hua-gong and Heng-gong; Method B: overlaying orthogonal Hua-gong

and Heng-gong onto intersecting 45° Xie-gong; Method C: overlaying intersecting 45° Xie-gong onto Hua-gong and placing Heng-gong on the top.

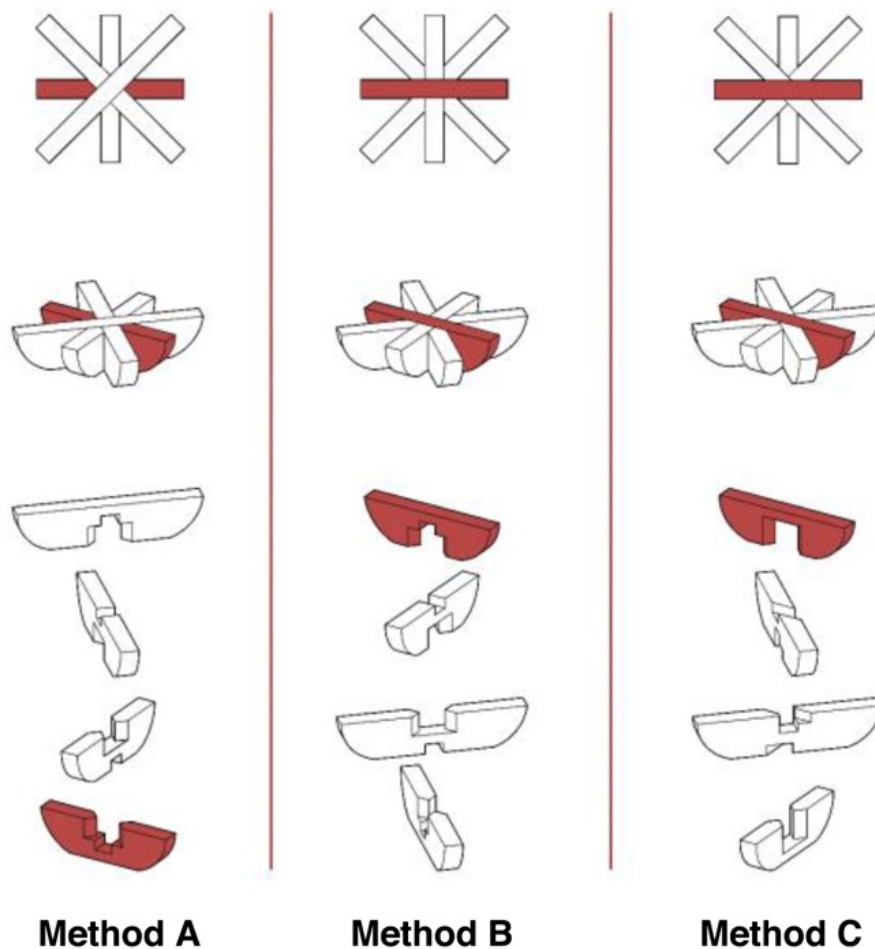


Fig.1-30 Three different assembling methods of Pai-lou, Heng-gong marks in red (Draw by Haomin Wu)

Method A and Method B have the same practice in the processing of mortise and tenon, and have the opposite sequence of overlapping Hua-gong, Heng-gong and Xie-gong, but the two kinds of opposite overlapping sequences can bring Pai-lou to different structural performance. If only small-dou is used to support between Pai-lou's upper and lower floors, the space between the floors is hollow. Therefore, the longbow-like gong is easily cracked due to overloaded bending moment. Method B can solve the above problem through overlaying the traverse and long Heng-gong as

a final step, so the carpenters can make it prop up the gong components on the upper floor through heightening Heng-gong. Heng-gong of Pai-lou of some Drum Towers is relatively a bit high, and is used as a rabbet embedded into the gong components on the upper floor (Fig.1-31). Method A is to overlay a Xie-gong as a final step. If the Heng-gong arranged on the bottom is heightened in the same way, at the intersection of components a notch is present. Its structural performance is far lower than that of Method B; for this circumstance, the carpenters can insert the wood blocks into the upper and lower floors to enlarge the stress surface, which can make up for such deficiency. Method C, just like a panino, is to sandwich left and right Xie-gong by Hua-gong and Heng-gong.

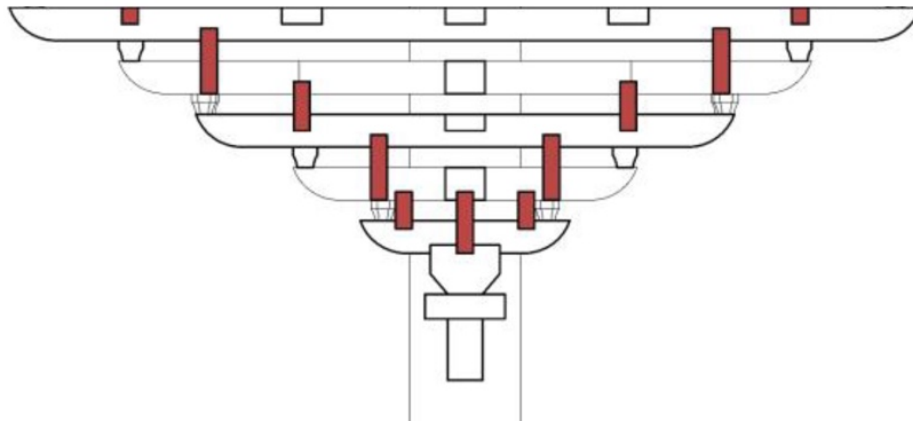


Fig.1-31 Section of Pai-lou in Method B, Heng-gong marked in red (Draw by Haoming Wu)

Different Drum Towers, for the tier of Pai-lou, have different planar organization modes, that is, methods of pai (Fig.1-32). Method I: all the components are extended bow-like components, which are mutually interwoven into the plane floor, for example, Zengchong Drum Tower, Congjiang of Guizhou; Method II: only Xie-gong at one side is an extended component, which is intersected with Heng-gong and overhang a part. For example, Zeli Drum Tower, Congjiang of Guizhou. Method III: all the Xie-gongs are extended components, which are mutually interwoven, and even some of Drum Towers remove *Hua-gong* components. For example, Liujia Drum Tower, Congjiang of Guizhou.

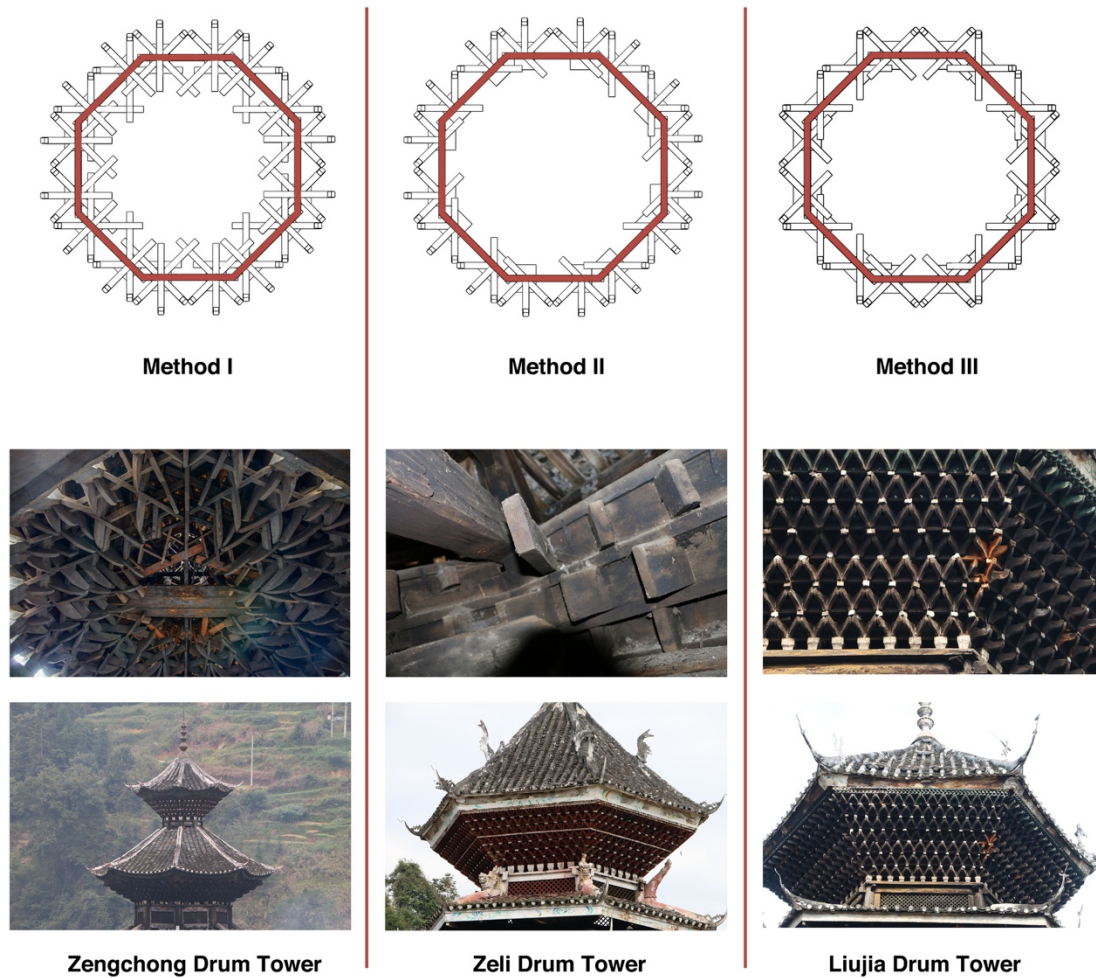


Fig.1-32 Three different planar organization methods of Pai-lou, Heng-gongs marked in red
(Draw and photograph by author)

Above all, Method I can ensure the firmness of mortise and tenon on each floor, but it has an extremely high requirement for the carpenters' processing skill. Each sub-component is overlapped with one another for many times, even completed the assembly with the double or treble cross pattern, so that a gong component needs several rabbets, which needs very accurate production. The big deviation of sub-components in the production process certainly influences the assembly. Moreover, each sub-component is an extended component, which results in high material utilization amount. Method II and Method III can effectively relieve the

above-mentioned defects, such as complex sub-component production and high material utilization amount, thereby ensuring the firmness of structure.

Apart from the method of removing Hua-gong in Method III, regardless of whether assembly sequence or planar organization mode, their appearances are basically the same, that is, one Hua-gong and two Xie-gong constitute a symmetrical unit centered by Hua-gong. Such unit is connected by Heng-gong to form regular duplication of three gong sections along the outermost fringe of Pai-lou in the horizontal direction; in the altitude direction, the units on the upper and lower floors are exactly staggered a half of the opening and closing size of a unit, that is, the Hua-gong on the upper floor unit is arranged at the intersection of two Xie-gong of the adjacent units. As a result, the “lattice” or “honey-comb” like shape comes into being.

The components assembly or planar organization methods of Pai-lou indicate that the carpenters have their own construction logic and construction approach to solve some actual problems, which tend to be diversified.

For the purpose of avoiding the high moisture and the insect attack (mainly the Himenopteran) from the ground, usually, a base is used for resting the columns. In Dong Drum Tower, the column base is usually made of drum-like stone with decorative sculpture (Fig.1-33). In some cases, the completion date of the Drum Tower is inscribed on the base (Fig.1-34). It is speculated that the inscription on stone is not as easily destroyed as that on timber components.



Fig.1-33 Column base with decoration (Photograph by author, 2018)

(a). A waist-like base; (b). A drum-like base



Fig.1-34 Column base with construction date in lunar calendar (Photograph by author, 2018)

(a). Mar 6th, 1924; (b). Feb 7th, 1873

1.3 Dong carpentry and construction process

As for this part, a few previous contributions were analyzed and discussed in detail, ranging from construction material, various kinds of processing traditional tools as well as the construction process of Drum Tower, the construction technique of local Mark-ink carpenter.

1.3.1 Construction material

Dong Drum Towers have gone through hundreds of years, Shan-mu (Chinese fir) (Fig.1-35) has been used as the main material of building structure, without need of nail and rivet, and the basic wooden structure system of the Drum Tower is linked with the mortise and tenon structure between column and tie-beam.

Chinese fir (Fig.1-36), as *cunninghamia lanceolate*(Lamb.) Hook. (Taxodiaceae) (Jiang, 2013). Tree and distribution: evergreen trees, characteristic species of China. Height about 40m, diameter up to more than 2m. Distributed in areas south to Huaihe River, and Yangtze River valley, especially in Sichuan, Guizhou, Guangxi, Hunan, Jiangxi, Guangdong, Fujian province.



Fig.1-35 Shan-mu (Chinese fir) (Source: <https://www.flickr.com/photos/uscapitol/9367941008/>)

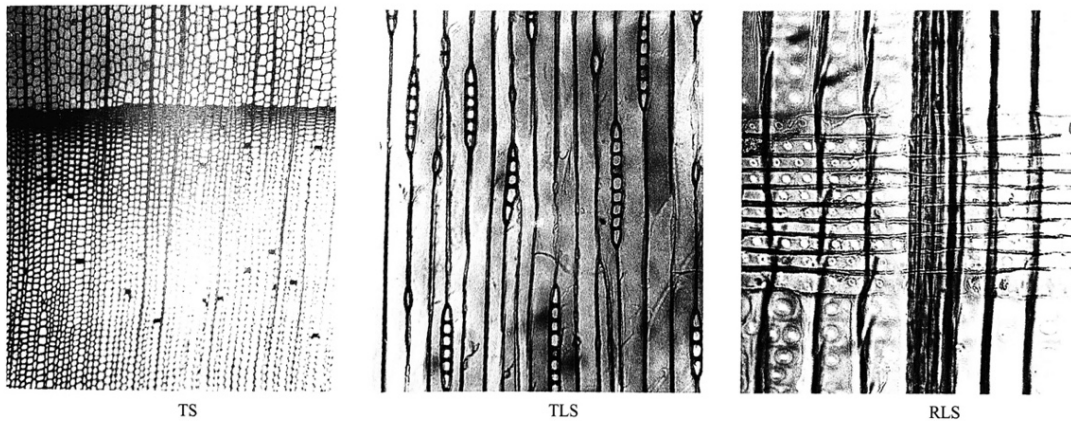


Fig.1-36 Microscopic structure of *Shan-mu* (Chinese fir)¹⁰

Wood characteristics: Bark thickness medium to thick, soft, easy to remove, gray brown to orange, longitudinally fissured, strips shed, with white resin on cross section, with pine resinous odor. Color difference between sapwood and heartwood distinct or indistinct, sapwood pale yellow brown or yellow white, mostly width 2-3 cm or more,

¹⁰ TS=Transverse section; TLS= Tangential longitudinal section; RLS=Radial longitudinal section

heartwood yellow brown or gray red brown. Wood glossy, with pine odor, without characteristic taste; texture medium, grain straight and uniform. Growth ring boundaries distinct, narrow or very wide, sometimes width up to 2 cm or more, non-uniform or little uniform, occasionally discontinuous growth rings present, false growth rings generally present; early wood zone very wide, accounts for most of the ring, early or late wood transition gradual, latewood zone dark, narrow. Axial parenchyma abundant, diffuse or occasionally in short banded, longitudinal plane, rays few to medium, very narrow, obvious with a magnifying glass, markings visible on radial section, resin canals absent. It is characterized by fast growth, straight trunk, uniform texture and no warpage and splitting. Moreover, fir resin in the Chinese fir can prevent insects and decay at some extent. Therefore, the Chinese fir is widely applied to such sectors as building, furniture, utensil, ship-making, etc.

Anatomical features: Tangential diameter of tracheid $50\mu\text{m}$ or more, average $37\mu\text{m}$; spiral thickenings absent, bordered pits uniseriate on radial wall in earlywood. Axial parenchyma cell numerous, diffuse and short banded. Rays 3-6 per millimeter, mostly uniseriate. Cross-field pitting taxodioid, 1-6 (mostly 2-4) per cross field, 1-2 (occasionally 3) horizontally rank.

Wood Properties: splitting rate small to medium, light and soft, impact bending strong. Wood drying without warp, few splits; natural durability good, easy cutting, but surface fuzzy, gluing good, brightness poor after painting, nail-holding capacity poor. The physical and mechanical properties are listed in Table.1-2. Chinese fir's rift grain has maximum compressive strength of 358 kg/cm^2 and maximum static bending strength of 661 kg/cm^2 , so Chinese fir is characterized by moderate strength, lightness and toughness

Table.1-1 Wood properties of *Shan-mu* (Chinese fir)¹¹

Species	MC%	Density/(g/cm ³)		SR(GA)/%		CS/MPa	MOR/MPa	MOE/MPa	Hardness/N	
		BD	AD	R	T				S	E
C.lanceolata (Jianghua, Hunan)	15.0		0.37	2.08	4.65	37.0	62.5	9.4	1480	2479
C.lanceolata(Yuexi, Anhui)	15.0	0.3	0.36	2.25	4.95	31.4	59.5	9.1	1382	2803
Class			II	II	III	II	II	III	I	II

Notes: BD=basic density (Total dry-out wood weight divided by the volume of wood when saturated with water); AD=air-dry density (The ratio of the weight of the air-dried wood to the volume of the air-dried wood after the wood is dry); SR=shrinkage rate; CS=compressive strength parallel to grain; MOR=bending strength; MOE=modulus of elasticity; SS=shear strength parallel to grain; EH=end hardness; GA=green to air-dry; GO=green to oven dry; R=radial; T=tangential.

Environment requirements: Chinese fir is relatively photophilous, and has high requirements for soil, such as fertility, looseness and good drainage. The optimum climate for the Chinese fir is annual average temperature of 16~9°C and annual precipitation of 1300~1800mm. Therefore, Chinese fir is mainly distributed in the Southwest China, which can provide bulk stock for Dong minority's building materials. According to the local carpenters, three kind of Chinese fir are normally used for Dong building construction, the white fir, red fir and you fir. Usually the white fir grows in the foot of the mountain, it takes eight years to be used as construction material; red fir grows in the middle of the mountain, it takes at least ten years to be used as construction material; oil fir, which grows on the top of the mountain, it takes eighteen years to be used as construction material. Among the three types, the oil fir is in the best quality, which has stronger capacity of load-bearing, more dense growth ring, less possible to be cracked and decayed. However, nowadays, the oil fir is decreasing

¹¹ the data refers to Jiang Z., *Wood Properties of the Global Important Tree Species*. Science Press. Beijing, 2013. P34.

in Dong area, only the most crucial building, that is, Drum Tower, in which the main columns come from oil fir, other buildings are made of white or red fir. There are also some other species which are used for the structural elements, like pine or beech. In the Lusheng Drum Tower, as the only investigated case that uses the beech. Author has been informed by local carpenters and the elders that the short columns and beams are made of a local type of beech (Fig.1-37) (*Castanopsis chinensis*), other elements are made of Chinese fir.



Fig.1-37 Dong beech in Yutou village, Hunan (Photograph by author, 2018)

Besides, sandalwood and camphorwood, are widely used in making windows and doors or decorative components. The structural performance of these timbers are inferior to that of Chinese fir. However, its brown color and easy processing characteristics are favored by carpenters. Therefore, they are widely applied to the production of structural accessories except for the structural components, and can frequently be seen in the Drum Towers. Moreover, the Drum Tower has many special auxiliary materials which are frequently used by Dong carpenters. For example,

adhesive synthesized with boiled water of kiwi fruit vine and lime can be used in pasting the grey tiles on the roof, and plaster can be used in creating clay figurines for upturned roof-corner.

As for the selection of timber, according to the interview to the local carpenters, they prefer the timber with lots of knots (Fig.1-38), as from their perspective, the more knots the timber has, the stiffer and better structural behavior it has. Apparently, the conclusion from their years long experience is totally opposite to the knowledge of timber engineering, according to which the knots would weaken the structural properties of wood. Author considers that it may depend on the type of stress conditions. The prevalence of compressive and shear stresses could even take advantage of knots. Besides, considering knots would make the processing harder, therefore, they usually select the timber with small knots.



Fig.1-38 Knots in the processing of a tie-beam (Photograph by author, 2018)

Texture of timber is another key factor for the selection. As it has been told by the carpenter, the grain prevalent direction in the cross-section of a tie-beam should follow the direction of stress, that make the timber less possible to break down, while on the other side, the texture line should follow the long direction of the tie-beam, and parallel to the stress direction (Fig.1-39). For the circumstance that the timber texture is not regular, carpenters consider that the dense part is stiffer than another other part,

and it is less possible to wrap. Moreover, the direction of convex texture¹² should back against the load direction (Fig.1-40). Usually the curved texture shows better structural performance than the straight one, as the former one can support larger load than the latter one. However, the convex direction should, face the load one, otherwise, it is much weaker than the straight texture, and it gets easily broken. These are personal experience of carpenters which requires more scientific explanation. However, this “experience” did make the Drum Tower stands firmly over time.

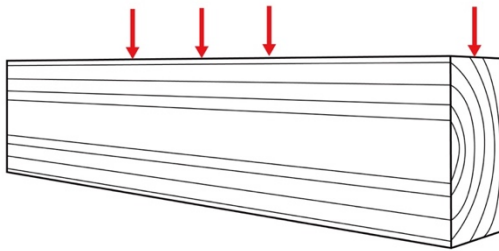


Fig.1-39 A tie-beam and its stress direction
(Draw by author)

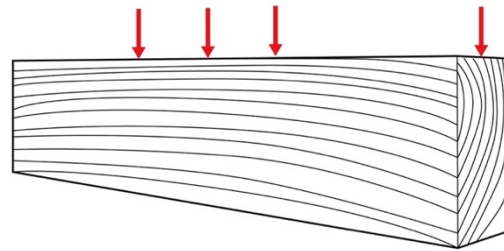


Fig.1-40 A convex texture tie-beam and its stress direction (Draw by author)

1.3.2 Traditional hand-tools

Historically speaking, Dong woodworking tools and technique knowledge have been inherited and succeed from Han Chinese, and the migration brought them to localize into Dong community. According to Luo’s study Dong people adopted the woodworking tools and techniques of Han Chinese much earlier than other neighbor minority ethnic people (Luo, 2008). The woodworking tools that Dong carpenters use currently are dominated by traditional tools. Although, there are some newly-increased modern tools used as auxiliary tools, such as electric plane, electric saw, etc. These traditional tools and techniques are almost the same as one hundred years ago. In order to understand and research the construction techniques of Dong minority’s Drum Tower, it is necessary to understand the Drum Tower carpenters’

¹² It is sort of "arch" effect of the growth rings in wood.

traditional hand-tools and techniques. Most of Dong minority's carpenters use self-made tools. How are these tools produced? How are they classified and operated?

Saw is a kind of frequently-used woodworking tool, which is mainly used in woodworking operations, for example, sawing off log. Common saws include frame saw, fret saw and knack saw. Legend goes that the saw was invented by Luban who was inspired by the grass blade scratching his hand. If so, the saw came into being 2500 years ago. *Along the River During the Qingming Festival*, is a painting by a famous Song dynasty artist, Zeduan Zhang (A.D.1085–1145), who depicted the woodworking process, in which the saw was almost the same as that used by modern carpenters(Fig.1-41). The saws used by Dong carpenters are dominated by the frame saw, with its structure consisting of four parts: H-shaped saw frame, twisted rod, twisted rope and saw blade (Fig.1-42). The frame saw can be divided by size and width into big saw, medium saw and small saw. The timber is placed on the two (or one) Ma-deng (log-holder) upon woodworking, and cut off through pushing and pulling back and forth to control the saw blade. The log-holder is frequently seen on Dong carpenters' woodworking sites, consisting of two X-shaped crossing timbers (narrow in the upper part and wide in the lower part) and a wooden strip skewed through the intersection to form a floor-type triangular support(Fig.1-43). Upon woodworking, the carpenters place the timber between the two log holders, and make use of the log holder to support the timber-operating.

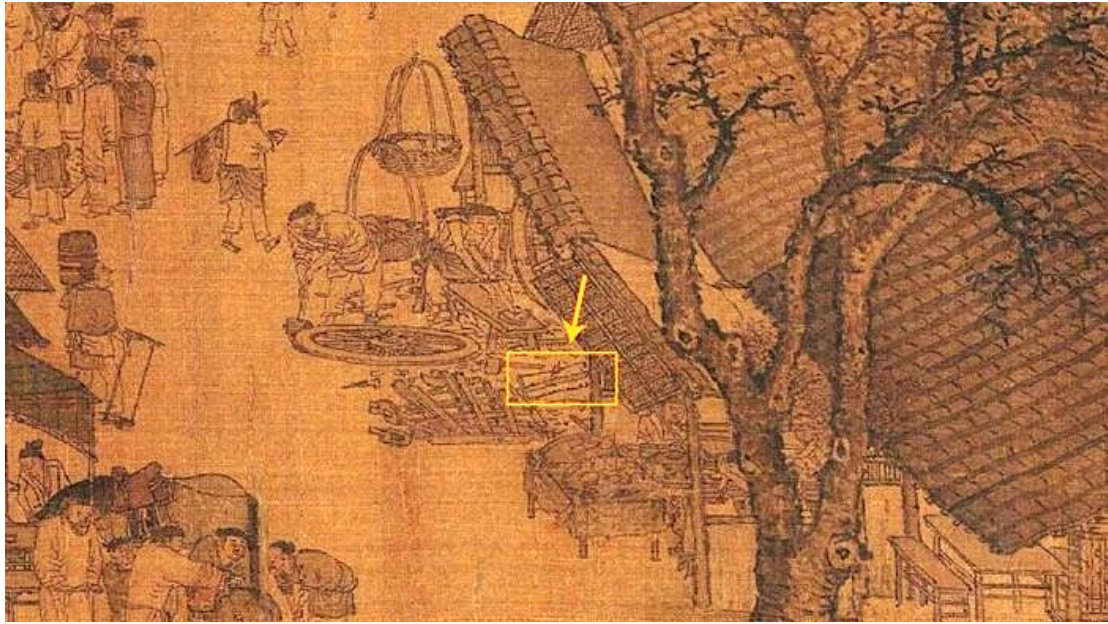


Fig.1-41 Woodworking depicted in *Along the River During the Qingming Festival* (Source: <http://wap.art.ifeng.com/?app=system&controller=artmobile&action=content&contentid=3415889>)



Fig.1-42 Saw for Dong carpenters (Photograph by author, 2018)



Fig.1-43 Woodworking on Ma-deng (log-holder) (Photograph by author, 2017)

Axes used by modern carpenters are derived from original forms. Relatively-common axes include broad axe, short axe, and others which have been used as weapons, such as fishtail-like axe, big axe, etc. In the woodworking process, the axe can be used in cutting timber based on the leverage principle, and also can be used as the striking tool upon assembling components and chiseling tenon (Fig.1-44).



Fig.1-44 Axes for Dong carpenters (Photograph by author, 2018)

Plane is mainly used to plane the timber flatly, smoothly, straightly and thinly, and consists of plane body, plane blade, plane handle, wooden wedge, etc. By shape, function and dimensions, the plane can be divided into: long plane, medium plane, short plane, finish plane, bend plane, flat plane, rebate plane, linear plane, etc. The flat plane is the most common(Fig.1-45). Upon woodworking, the angle between the plane cutter and the plane body is $40^{\circ}\text{C}\sim 45^{\circ}\text{C}$, and the wide seam in the middle of the plane cutter is used to discharge the wood chips. The plane can polish the timber tidily.



Fig.1-45 Flat planes for Dong carpenters (Photograph by author, 2018)

Chisel came into being in the late part of the Palaeolithic Age and in the early part of the Neolithic Age. The existence of chisel is related to the development of mortise and tenon structures. Because the chisel is mainly used to slot and open pores, the mortise in the mortise and tenon structure is completed by chisel and axe. The chisel can be divided by shape of blade into: flat chisel, skew chisel, round chisel, diamond

chisel, etc. The chisel used by Dong carpenters are dominated by the flat chisel (Fig.1-46), which is mainly used to chisel or renovate square holes; other types of chisels, such as round chisel and diamond chisel, are mainly used for precision work, such as carving. The chisel consists of a chisel cutter and a chisel handle. Upon chiseling, the carpenter holds the chisel handle with one hand and the axe with another, shakes the chisel from side to side to prevent the chisel body from being unstable.



Fig.1-46 Flat chisel for Dong carpenters (Photograph by author, 2018)

Dong carpenters use various measurement tools. Common rulers include try square, Luban ruler, etc., which are widely applied in the woodworking process. These tools are mainly used to measure and record dimension of timber, or inspect the surface flatness of timber, or match the ink marker to make the ink lines such as vertical line, parallel line, etc. The try square is a kind of non-equilateral right-angle tool frequently

used by carpenter and fitter, which can be used to inspect if the components such as planed board, tie-beam, etc. are perpendicular, and also can be used in measurement (Fig.1-47). The try square consists of a rod ruler (short board) and handle(long board). The ruler handle is made of a thin wood pole, it can be used as handgrip, and is slightly longer than the ruler rod. The ruler rod is thicker and has calibrations, it can be used in measurement, with different length being 1 chi (a traditional Chinese length unit, equals to 33.33cm), 8 cun (Idem, 1 cun equals to 3.33cm), 6 cun, etc. The try squares have different dimensions and styles, including personal craftsmanship and preference of many Dong carpenters.



Fig.1-47 Try square for Dong carpenters (Photograph by author, 2018)

The Luban ruler which can be frequently seen in the folk woodworking process, is a kind of measuring tool for building houses. Its difference from common ruler tools is that Luban ruler, based on Yin-Yang horoscope, can be used to measure

auspiciousness and disaster of house or door-window components. According to legend, the Luban ruler was invented by Luban, from the Lu State during the Spring and Autumn Period (1042–249 BC), with a length of 1.44 *chi*, it has some measuring scales, as well as some character concerning auspiciousness preference and disaster avoiding. When the Luban ruler is used, scales of components correspond to the words concerning auspiciousness and disaster, which can be limited to match with the auspicious scales for the purpose of avoiding disaster and praying for safety. The Luban ruler is rarely used in current woodworking, but its characteristics and cultural significance is still worshiped by the Dong and other folk community.

The ink marker is frequently used in Dong traditional woodworking (Fig.1-48). It consists of an ink chamber, a reel with rolling ink line, and a wooden pin. Its main functions are as follows: (a). Drawing a long straight line, The method is firstly inserting the pin into the end of timber, then approaching one end of soaked ink-line to another end of timber, pull out the ink-line wound on the reel to another end of timber, tension and fix the ink-line, lift up the middle point of ink-line and then loosen the ink-line. At this time, a straight ink-line appears on the timber; (b). Making a mark, the ink marker has a horn-shaped ink chamber, to store the ink; dip ink stick into it, and then match with the deformable try square to draw a short straight line or make a mark; (c). Drawing a vertical line, Its use is almost the same as that of previous sequences.



Fig.1-48 Ink-maker for Dong carpenters (Photograph by author, 2018)

Jiang-gan (a measurement pole), being Dong carpenters' special bamboo ruler, is to split the whole Mao bamboo into two parts, scrape off the green peel, engrave scales in proportion, and then mark unique symbols of Dong minority buildings. Such symbols are corresponding to that of Drum Tower components. Therefore, when the Drum Tower is built, the locations of components can be determined according to the characters marked on the jiang-gan (Fig.1-49, 1-50). Some of jiang-gan can be inserted into the mortise and tenon components, so that jiang gan prompts that the tenon of component shall be inserted into specific mortise of component. Dong Drum Tower is gradually constructed based on marking and prompting functions of Jiang-gan.



Fig.1-49 *Jiang-gan* with different marks (Photograph by Ling Cai, 2018)



Fig.1-50 The use of *Jiang-gan* (Photograph by Ling Cai, 2018)

1.3.3 Construction process

It is a vital event for all the villagers to build the Drum Tower. If the Drum Tower belongs to the dou people, all the dou people must contribute money, manpower and materials, and related dou people also shall offer help. If the Drum Tower belongs to all the villagers, all the villagers shall contribute. People contribute materials, rich or poor, and donate manpower, more or less. *Sanjiang County Annals* during the period

of the Republic of China (A.D. 1912-1949) recorded:

“Villagers are willing to make contributions. The riches donate silvers up to two to three hundreds, at least tens of silvers. All people, regardless of age and gender, go all out without buck-passing. The enthusiasm in the public welfare is admirable.”

Even today, when the Drum Tower is constructed or restored, Dong village’s villagers will contribute their money and manpower. The village committee will record the name of sponsors or organizations and their corresponding donation amount. Then post them on the wall of Drum Tower(Fig.1-51). In general, the construction of Drum Tower needs the following sequences: “Committee” negotiation of the Drum Tower’s affairs, site positioning, materials preparation, Mark-ink carpenter employment, materials’ dimension determination, auspicious day selecting, base-flattening, components processing, frame erection, tile roofing and decoration, and finally completion. Materials preparation, components processing as well as frame erection are three key steps. The several steps correspond to the material process of construction, and are mixed with some rituals, which highlight the extraordinary significance of Drum Tower in the Dong village.



Fig.1-51 Donation board in Rongfu Drum Tower (Photograph by author, 2018)

i. “Committee” negotiation.

Before the construction of Drum Tower, a “ Drum Tower construction committee” will be set up by the elder villagers to arrange and organize the whole plan, The main task for the “committee” includes site positioning, material preparation, arrange the work of craftsmen and their salary, of the most importance, hire a suitable and capable Mark-ink carpenter to lead the construction team.

After the final agreement is made, with taking the suggestion of Mark-ink carpenter and Feng-shui master, the “committee” will assign several people to make the working schedule, including amount of requested material and its budget, arrangement of carpenters and their salary, food allowance, safety issues, and working provisions, etc. Finally, the “committee” will announce the schedule to all villagers.

ii. Site positioning and orientation.

The primary factor that should be considered is the natural condition, the site should avoid natural disasters, like landslide, flood, etc. As the elders in Mapang village, Sanjiang county of Guangxi said, if there is an old tree in the site, that means the site has not suffered from the natural disasters for a long time (Fig.1-52). Therefore, it could be considered as at least a safe site for the construction of Drum Tower. In case there is no old tree, the surrounding dwellings or other buildings are requested, because they could be a “shield” that keep the strong wind or storm away. This is the case of Longxin Dum Tower, Tongdao county of Hunan (Fig.1-53).



Fig.1-52 The old trees and Mapang Drum Tower (Photograph by Shiruo Wang, 2018)



Fig.1-53 Drum Tower and surrounding dwellings (Photograph by author, 2017)

Feng-shui horoscope is part the safety consideration, serving as an essential factor to the site positioning. Pursuit of auspiciousness is the basic principle, Dong people call the mountain ridge as “Dragon vessel”, and the flatting place, where a brook goes through, is called “Dragon head”, the “dragon head” suggests the *yang*, which has to face to the south, to get more sunshine. And the village locates the “dragon head”. “Dragon vessel”, conversely, suggests *yin*, and faces to the north, which it can keep away the cold wind from northern region. As Dong people are convinced, sitting in the “dragon nose” is always under the eyesight of the dragon, which means the “dragon nose” can always absorb the energy and vitality of dragon. Drum Tower is set in the “dragon nose”. When the site is determined, a ritual is going to held under the command of Feng-shui master, pouring the water to the site ground, to wash away the devil or misfortune (Kong, 2016). The ritual is also aimed to ensure the safety of the following construction work.

A single Drum Tower is always located in the geographical center or at the top of the village. In the situation that there are more than one Drum Towers in a village, as aforementioned, different Drum Towers belong to different *dous*, and have their specific area in the village, not isolated from other *dou* areas. All the Drum Towers are connected by a main road to promote the accessibility among different *dous* in the same village. See, for instance, the Huang-gang village, Liping county of Guizhou. Five scatter Drum Towers are connected by a main road, which also separates the villages into two parts (Fig.1-54).

Landscape is another supporting factor to the Drum Tower positioning, as it needs a harmonious relationship between environment settings, accompanied by a hill, a water pool or an expanding plaza. Besides, the water pool offers also the function of fireproofing, when a fire attacks the Drum Tower, the villagers can extinguish the fire immediately. The plaza is usually set in front of the Drum Tower, providing social or festival activities for the villagers.



Fig.1-54 A main road connects five Drum Towers (Photograph by Ling Cai, 2014)

iii. Materials preparation.

The components required by the Drum Tower represent different meanings. In the process of material preparation for the Drum Tower is load-bearing timbers, such as central column and king-post, are donated by prestigious or affluent families inside the Dou or village, and small timbers are shared by all the Dou (village) people. For example, the king-post of Jitang Drum Tower was donated by Xuebin Lu family. This kind of donation means that each member of the village is one of the parts of the Drum Tower, which is a physical assembly of clans.

The timber selection is conducted by the prestigious elders in the village, the trees used for timber should be straight up, thick trunk and the diameter is almost the same from bottom to the top. The trees used for main load-bearing columns should be around 20m height, and the diameter is 30cm to 50cm. Besides, the tree has to be a whole trunk way up, the bifurcated one is not allowed to use as the main load-bearing columns. The king-post is selected out of the three big Chinese firs planted on the hillside 10km away from the village (Cai, 2007). The ritual for logging and erecting the king-post reflects the significance of central column in the Drum Tower. Logging is carried out during late spring, when the bark is easily peeled-off. Before logging, a special ritual should be conducted to pacify the mountain god (Fig.1-55).

After the ritual, the prestigious elders use the axe to cut the tree three times, later the young men will continue the logging until cutting off. Upon logging, the tree must fall

downwards the hillside without touching the ground, with limbs supporting the tree, then the young men deliver the logs on their shoulders (Fig.1-56), way back from the hill to the village, without stopping or replacing any people on the way, because the Dong people are convinced that it may bring bad luck to their family or even the whole village. When the logs arrive at the village, people cut off the branches and leaves and lift it up to the log holder on the Drum Tower ground. Upon erecting, the column is covered with a piece of Dong cloth.



Fig.1-55 Pacify the mountain god before logging
(Source: Yang T., *The Chinese Dong Drum Tower*.
P31.)



Fig.1-56 Delivering the log
(Source: Kong. *The Dong Oral
Architecture*. P264.)

Apart from the timber, other materials should be prepared at the same time. Tung oil, is obtained by pressing the seeds from the Tung tree, it is used to resist the worms and termites, and also it serves as fire-proofing at some extent. Clay is used for the tiles-firing, but also the making the flying roof corner for decoration. Kiwi fruit vine and lime mixture is used for the decoration sculpture in the roof. Overall, the materials used for construction are natural materials, Dong people prefer to obtain the materials from nature and local sources.

iv. Timber processing and ink-drawing

Before embarking the construction work, it is necessary to explain the “project” to the

“committee” via a model or a draft drawing by the Mark-ink carpenter. The model keeps the same structural frame as the real one but in a smaller scale (Fig.1-57), this step previews the construction sequence and the joints connection which have all been kept in mind by the carpenters as a reference that would accelerate the following construction work.



Fig.1-57 Carpenter Linsheng Yang and his prototype (Photograph by Ling Cai, 2018)

Components processing is to determine location and dimension of mortise and tenon with ink-line by the Mark-ink carpenter, and then complete the production of components by the other carpenters. The Mark-ink carpenter training started with building wooden residential buildings, eventually developed into a higher-level Drum Tower. The “Mark-ink carpenter” refers to head of carpenters who takes charge of Mark-ink without need of design drawings in the early days. The wooden components of Drum Tower are connected with mortise and tenon. As previously mentioned, the “Mark-ink” skill of “Mark-ink carpenter” is extremely important. The carpenters process

mortise and tenon according to the ink-marking of the Mark-ink carpenters. Therefore, the most critical work in the components processing is the ink-marking. The Mark-ink carpenter's each ink-line is regarded as the relations to auspiciousness or disaster of all the Dou or village people. Before the Mark-ink carpenter snaps the first ink-line on the central column, people conduct a special ritual to worship the god for blessing. Jiang-gan is actually the Mark-ink carpenters' "design drawing" and "construction scheme". The components of Drum Tower have their own names in the Dong language, for example, central column is Dong-huo, king-post is Dong-weifu (Shi, 2002), etc. For the sake of marking, the Mark-ink carpenters create some unique architecture symbols so as to mark on the Jiang-gan. Every Mark-ink carpenter hold his own marks, written in Luban characters to define different timber elements, the various dimension of Jiang-gans are accompanied with corresponding mark to recognize which timber element belongs to, and the marks signify the different name of timber elements, as well as their position(Fig.1-58, 1-59), Because there is no shared written language in Dong community, and each carpenter learned from a different Mark-ink master, the marks are created by their own experience or working habit, even though, according to author's field survey, Dong carpentry industry shares a similar mark-creating method.



Fig.1-58 Jiang-gan of Carpenter Yang (Photograph by Ling Cai, 2018)



Fig.1-59 Jiang-gan accompanies with corresponding component (Photograph by Ling Cai, 2018)

v. Frame erection.

It consists in the erection of central columns and connection of the tie-beams. The following procedures, from bottom to top, layer by layer, are to erect short column, overhang eaves, tie beams, and erect top king-post till the whole Drum Tower framework is completed (Fig.1-60). To prevent the case of missing components or making a wrong match to the positions, the precisely code-marking, right positions and directions as well as the assembly sequences should be perfectly-guaranteed, otherwise the stability and safety of the Drum Tower would in danger (Hao, 2006).



Fig.1-60 The procedure of frame erection (Photograph by Derong Kong, 2015)

According to the interviews to the local carpenters in Jitang village, all the workers are divided into four teams, team one is in charge of pulling ropes; team two lift up the central columns; team three adjust the position of hanging central columns on the scaffolding; team four support and control the direction of columns. When the step of erecting a frame is started, all the participants must make no noise, and fully obey the

Mark-ink carpenter's gesture commands. When the columns have been erected, the tie-beams should be connected to the corresponding columns from lowermost roof to the top, then the installation of short columns generally keeps the same method until the whole structural skeleton is completed. Besides, erecting a frame for the Drum Tower must comply with many strict taboos. Upon erecting a frame, the workers must meet certain conditions, for example, parents are still alive, there is no unnatural death within the family members.

After the skeleton of Drum Tower is erected, the installation of the main beam is the most crucial procedure. Feng-shui master select an auspicious day from the Chinese lunar calendar, the Mark-ink carpenter host the "main column ritual" with some sacrificial offerings and burning the joss sticks, lifting up the main beam till the top between the central columns. Next, the fire-place are offered to make the atmosphere into a thrilled and prosperous version. Occasionally, the accomplished data information would be written on the main beam, it is recognizable when people look up the Drum Tower (Fig.1-61).



Fig.1-61 A main beam with the accomplished data (Photograph by author, 2018)

vi. Tile roofing and decoration.

It is the final process, which includes placing tiles on the roof, installing the wooden doors, windows, decorative sculpture on the roof corner, and putting on the paintings.

The decorations are about the Dong legendary story people's everyday life, or admiring the nature, with no limitation on the topic; they are a good wish for the people and village(Fig.1-62). All this presents a lively, relaxing and positive atmosphere.

The decorative painting usually is drawn on the roof eave, or on the wooden board underneath the roof tier (Fig.1-63). the decorative sculpture is usually placed on the roof corner or the top roof, is made of clay and mashed kiwi fruit vine. The topic of the sculpture is about auspicious animals(Fig.1-64), like tigers, dragons, monkeys, buffaloes, elephants, etc. or about the Dong heroes, who usually were set in a pair (Fig.1-65). For instance, two fighting warriors with crossing weapons. Regardless of the animals or heroes, they both present the pursuit of good luck and bright expectation for the village and villagers.



Fig.1-62 Decorations in Drum Towers
(Photograph by author, 2015)



Fig.1-63 Paintings on wood board
(Photograph by author, 2018)



Fig.1-64 A buffalo sculpture on the roof corner (Photograph by author, 2018)



Fig.1-65 A pair of decorative Dong heroes (Photograph by author, 2018)

After the Drum Tower is completed, all the villagers, together with people from neighboring villagers, celebrate in the three consecutive days, and the village elders organize solemn singing and dancing ritual. A traditional musical instrument, like Lusheng, will be played. In these activities, Dong minority people are able to experience special and irreplaceable significance of the Drum Tower. Finally, the construction of Drum Tower is totally completed.

Drum Tower, being a continuous and dynamic cultural heritage, which keeps hundreds-year of tradition alive until today, represents not only the tradition of construction techniques but also customs and rituals, which have been inherited in a flourish way. Therefore, Drum Tower is both an “old” and “young” cultural heritage.

1.4 Evolution and geographical difference of structural typologies

According to the definition of structural system, Chuan-dou and Tai-liang are both serving as a standard in the construction history of Drum Tower from Qing dynasty to nowadays. In the author’s field survey, it has resulted to be organized on the basis of

timeline of construction. The data information of the particular Drum Tower are traced back to the original construction year. Besides, as confirmed by the local villagers and existing history documentaries, the following interventions have not changed the structural system during the evolution development, i.e. the structural system of Drum Tower stays unchanged along the history (Table.1-2).

Table.1-2 Construction date and system information of Drum Towers

Name	Date	Province	Construction	Name	Date	location	Construction
Zengying	1665	Guizhou	Chuan-dou	Jitang	1813	Guizhou	Chuan-dou
Matian	1661	Hunan	Chuan-dou	Lusheng	1829	Hunan	Chuan-dou
Zeli	1664	Guizhou	Chuan-dou	Hengling	1855	Hunan	Tai-liang
Zengchong	1672	Guizhou	Chuan-dou	Gaocai	1873	Guizhou	Chuan-dou
Gaoqian	1723	Guizhou	Chuan-dou	Jingou	1884	Guizhou	Chuan-dou
Zai'e	1735	Guizhou	Chuan-dou	Rongfu	1915	Guizhou	Chuan-dou
Dali	1740	Gzuizhou	Chuan-dou	Yaxian	1924	Guizhou	Chuan-dou
Longshi	1787	Hunan	Tai-liang	Mapang	1928	Guangxi	Chuan-dou
Yanglan	1787	Hunan	Tai-liang	Gaochuan	1980s	Guizhou	Chuan-dou
Yashang	1789	Hunan	Tai-liang	Yintan	1997	Guizhou	Chuan-dou

1.4.1 Geographical distribution pattern: Between Chuan-dou and Tai-liang Drum Towers

The evolution development in the timeline (Fig.1-66) and their geographical distribution(Fig.1-67) can be divided into three phases, as follows. The first phase is from the early Qing dynasty to 1911(the end of Qing dynasty), Chuan-dou and Tai-liang Drum Towers demonstrate a relatively centralization and independence, Tai-liang Drum Towers were mainly built in this period. The second phase is 1912-1980, in which the period of 1966-1980 is a vacancy, because of the Culture

Revolution, Drum Tower was destroyed as the “Four olds”¹³. Therefore, the new construction of Drum Tower was not even possible. Tai-liang Drum Towers in the second phase were dramatically decreased and their construction totally disappeared after 1949, so the Tai-liang were built mainly during late Qing dynasty before the period of Republic of China; the third phase is 1981 till the present, the Tai-liang Drum Towers were rarely constructed, conversely, the Chuan-dou towers came to be the main type selected in this period.

¹³ In Chinese, “四旧” is a particular item used during Cultural Revolution (1966-1976), refer to the attempts of Communists to destroy elements of Chinese culture pre-communism. The Four Olds were: Old Customs, Old Culture, Old Habits, and Old Ideas.

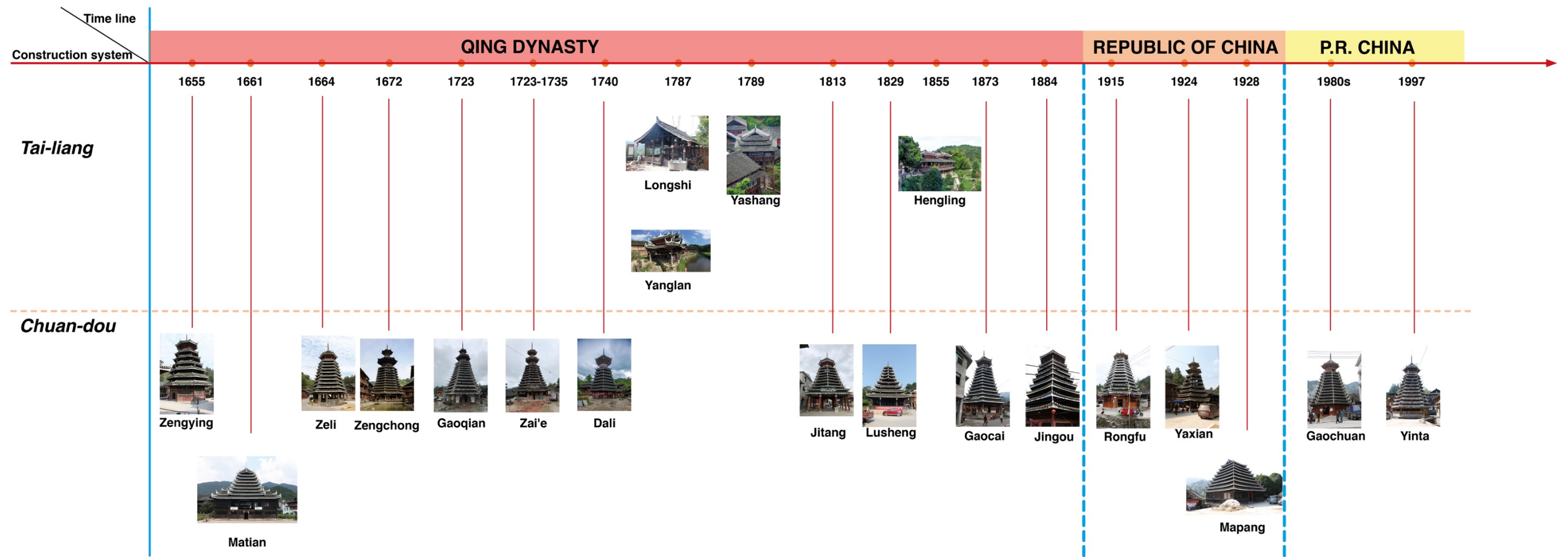


Fig.1-66 The evolution of Drum Towers over timeline (Draw by author)

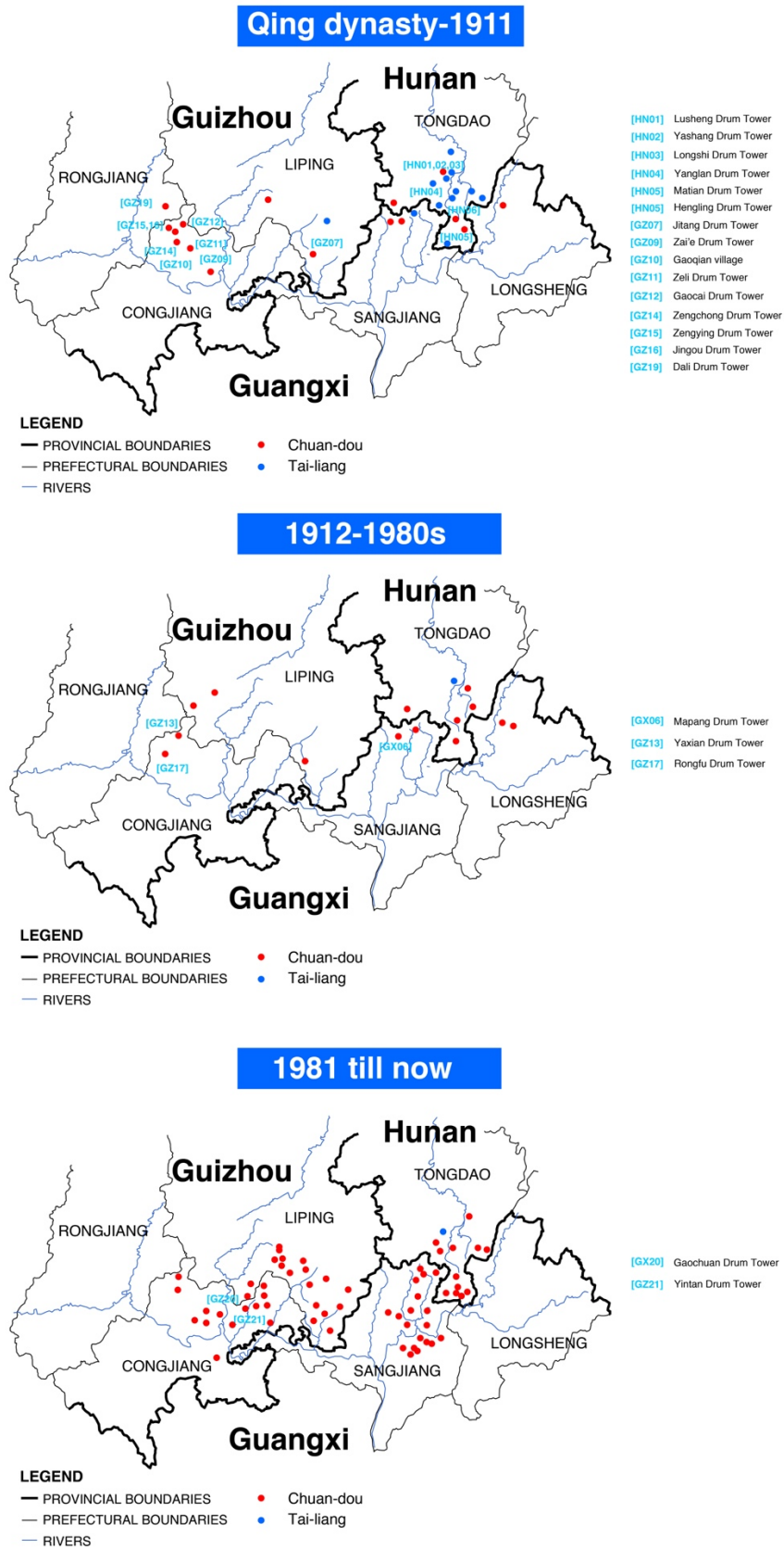


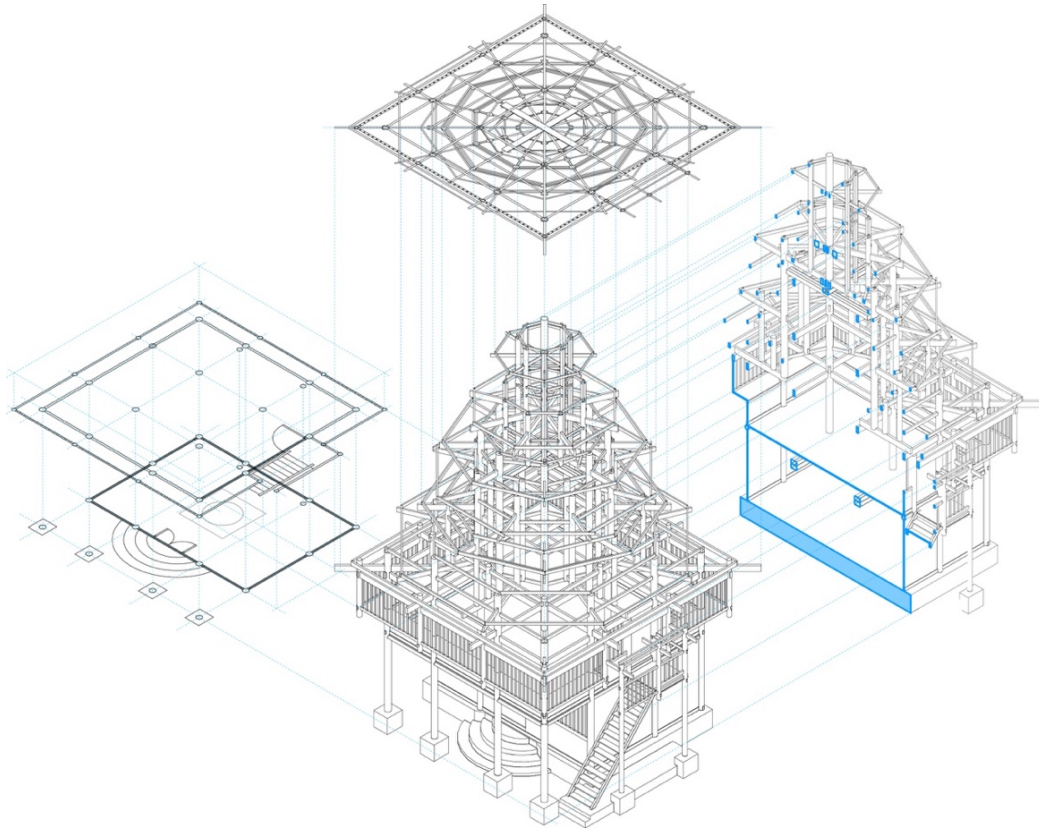
Fig.1-67 The geographical distribution of Drum Towers along the timeline (Draw by author)

These three distribution diagrams also reveal a phenomenon that begins in 1665, when the earliest existing Drum Tower was built, and has continued until now, the geographic distribution of Chuan-dou Drum Towers has been continuing to expand. There are no Tai-liang Drum Towers in Guizhou; while in Hunan, two types of Drum Towers coexist in the Qing dynasty. However, the Tai-liang Drum Tower, which was used to overwhelm the Chuan-dou ones by numbers in the Hunan province, has gradually been abandoned during the later stages of the development process. And the Chuan-dou Drum Towers evolved to become the only choice to be built. This kind of situation was more remarkable after the 1980s. This is exactly because of the development trend of construction technology for Drum Towers.

While having various types of complexity, the Tai-liang Drum Towers are limited in height. Although the Chuan-dou ones are limited to the regular polygon on the plane, carpenters had been attempting to achieve certain structure innovations to enhance the possibility of developing additional height and transforming the façade with fascinating contour shapes as well as having a flexible façade. See, for instance, the Longxin Drum Tower in Gaobu village, Tongdao of Hunan, where the roof rotates 22.5° every other tier (Fig.1-68). The Chuan-dou Drum Towers have advantages over the Tai-liang ones in their symbolic significance, and also the Chuan-dou Drum Tower tends to be a more Dong culture-preserved one, while the Tai-liang Drum Tower explicitly demonstrates the blending of Dong and Han nationality's culture.



(a)



(b)

Fig.1-68 Longxing Drum Tower (Photograph by author, Draw by Ziwei Liu)

(a). External view; (b). Diagram of 3D model






The gradual disappearance of the Tai-liang Drum Towers in modern times, as well as the development of the Chuan-dou ones on the façade with their continuing expansion in the geographic space, all reflect the Dong people's choice. It means that selection of the characteristics within the Drum Tower is culturally and symbolically significant. The towering Chuan-dou Drum Towers, with complicated and flexible façades, are considered as the most representative buildings of the Dong minority.

1.4.2 Geographical difference: Within Chuan-dou Drum Towers

As discussed in the last section, the two types of structural system display a great difference in geographical pattern between Chuan-dou and Tai-liang Drum Towers. According to author's field survey, the Chuan-dou Drum Towers among different Dong areas even can be visually distinguished from appearance morphology. Therefore, it is also interesting to find out the differences within the Chuan-dou Drum Towers among Dong areas.

Generally, two plane shapes of bundle columns are performed in Guizhou, a hexagon one and an octagon one, and the "removable inside columns" method is also adopted to make the outside bundle as octagon, while inside bundle is a square. A rectangle bundle column is preferred by the carpenters in Guangxi. The Drum Towers in Hunan, in particular, adopt a more complicated method, i.e. flexible alteration from rectangle to octagon roof tier via additional short columns and tie beams. The following table shows the difference (Table.1-3). Different adoption of construction techniques reflects the choice of carpenters among different Dong areas.

Table.1-3 Different adoption of construction techniques of Chuan-dou among Dong areas

Province	Chuan-dou Drum Tower	Adoption of construction techniques				
						
Guizhou	Chaoli	X				
	Gaoshang	X				
	Lanshua	X				
	Paiguan	X				
	Gaocai	X				
	Zengchong			X		
	Zengyin		X			
	Jingou	X				
	Dali	X				
	Zaidang			X		
	Zeli	X				
	Gaoqian	X				
	Zai'e		X			
	Gaochuan		X			
	Jitang			X		
	Yaxian-shang	X				
	Yintan-shang	X				
Hunan	Lusheng				X	
	Baoxinlou				X	
	Neizhai				X	
	Gaosheng				X	
	Longxing				X	
	Heshang				X	

	Yanzhai				X	
	Shangzhai				X	
	Yangtian				X	
Guangxi	Mapang					X
	Baxie					X
	Badou					X
	Gaoding					X
	Batuan					X
	Yanzhai					X

The façade configuration of Drum Towers also displays the differences among Dong areas:

- i. The Drum Towers in Guizhou are more towering and higher than in Hunan, where the minimum is seven-storey, and the maximum is thirteen-storey (Fig.1-69). On the other hand, the Drum Towers in Hunan are no more than nine-storey, but are generally five or seven-stories(Fig.1-70).



(a)



(b)

Fig.1-69 Drum towers in Guizhou (Photograph by author, 2018)

(a). Gaoqian Drum Tower; (b) Gaochuan Drum Tower



(a)

(b)

Fig.1-70 Drum towers in Hunan (Photograph by author, 2014)

(a). Kezhong Drum Tower; (b) Yanzhai Drum Tower

- ii. As for the roof style, the pyramid roof is dominating in Guizhou, yet there are not only pyramid roof Drum Towers but also the gable and hip roof ones in Hunan and Guangxi, which tends to be more diversified in the roof style.
- iii. There are some distinctive and regional joints, like “neck of tower” and *Pai-lou*. When the roof structure is upward and narrowing to the top, the cornice is uplifting and overhanging, that is “neck of tower” (Fig.1-71). Almost all the Drum Towers in Guizhou adopted these joint works. However, a few cases in Hunan and Guangxi adopt these particular joints.



Fig.1-71 “Neck of Drum Tower” , Jingou Drum Tower (Photograph by author, 2018)

iv. As for the decoration on the ridge, cornice, neck of tower, top roof, etc. are they adopt a more delicate and distinctive decoration work, that is, sculpture, painting in Guizhou (Fig.1-72), which embodies a higher aesthetic significance than that in Hunan, which tends to be more simplified.



(a)



(b)

Fig.1-72 Decorations in Drum Tower of Guizhou (Photograph by author, 2018)

(a). Painting on roof eave; (b). Sculpture on roof ridge

1.4.3 Han culture transmission

By reviewing corresponding geographic regions of Tai-liang and Chuan-dou Drum Towers based on the evolutionary trend of the structure, we may find that the diversity of culture within the architecture is closely connected with the difference of the social culture in various geographic regions.

i. Border Areas Development

The governance and time period in which the central dynasties governed the Dong regions are significantly different. It is important to explain the cultural differences in the Dong minority's habitation regions. The development of border areas by the central government stretched from the northeast Dong residential areas to the southwest hinterland. The northern area of the Dong minority's habitation regions has been included in the jurisdiction and scope of the central government as early as the Tang dynasty. Differently, for counties such as Liping, Rongjiang and Congjiang inhabited by the Dong minority in Guizhou province, the system of the central government appointing officials for the direct management has been implemented since the Song dynasty and really established during the Qing Emperor Yongzheng reign.

The development of border areas directly caused the influx of a large number of Han nationality immigrants. The Han went into the Dong minority habitation regions by acting as officials, defending soldiers and by spontaneous immigration. The most prosperous period for immigration was during the Ming and the Qing dynasties. The army and the people were going into the Dong minority habitation regions for cultivation and were mostly the Han people from Jiangxi and Hunan provinces. The immigration direction from east to west has helped to determine the direction for cultural transmission of the Han(Fig.1-73). Therefore, the immigration at the Ming and Qing dynasties is an important cause for the distinguishing of the east-west architectural culture in the Dong minority habitation regions.

In the Dong minority habitation regions of the Hunan and Guizhou provinces, Hunan

is closer to the habitation regions of the Han from a geographic perspective and the Tai-liang structure is therefore affected by the hall-type buildings of the adjacent Southern Han nationality. Accordingly, the Chuan-dou Drum Towers appear mainly in Guizhou, which is relatively more remote. Because of this, the more indigenous structural techniques of the minority are maintained in this area.



Fig.1-73 Han Culture transmission spreads Dong area (Draw by author)

ii. Cultural Revitalization Movement

Why did the geographical distribution space for specific types of structural technology of the Drum Tower change as time goes by? In other words, why did the Chuan-dou Drum Tower replace the Tai-liang Drum Tower and become the only choice when building a Drum Tower now?

In the past, conditions that limited travel resulted in a limited ability to communicate any kind of change, helped to ensure that there was a herd mentality among those building Drum Towers. The carpentry methods stayed primarily similar to the carpenters from neighborhood villages. After 1980, though, the Drum Tower experienced a process of “renaissance”, which is relative to the *Cultural Revitalization Movement* of rediscovering, rearranging and carrying forward the national culture at that time. A large number of previously neglected rural minority villages were discovered.

The Chuan-dou Drum Towers in Guizhou have been widely reported by the modern media as a symbol of Dong minority architecture or even the culture of Dong. Gradually, values have been formed that this type of Drum Tower represents the culture of Dong. Pointedly, the Chuan-dou Drum Tower in the village of Zhao Xing in Liping county of Guizhou frequently has appeared in many physical media pieces. This kind of Drum Tower strengthens the belief that it represents the Dong minority through the cultural transmission. Once formed, values become a kind of mind-set and the belief is cemented that all Drum Towers should be built like this. According to the statistics of the 1992 edition of Sanjiang Dong Minority Autonomous Annals, the number of the Chuan-dou Drum Towers increased from 2 in the late Qing dynasty to 6 during the period of the Republic of China and 28 after 1949 (foundation of People’s Republic of China), 20 of which were built after 1980.

Of additional interest, the local carpenters have played the role of communicators. The construction methods of the Drum Tower have inevitably been affected by those of other regions because of improved travel abilities and the shared communication among the carpenters from different places. This can be proved from the construction

process of specific Drum Towers. According to the carpenter Shi Yinxiu, after being invited to repair the Diping bridge in Guizhou in 1981, he built the Baxie Drum Tower in 1985 in Guangxi and followed the technique of the Drum Tower used in Guizhou. He used the Pai-lou to support the top roof of the building. The carpenter then went to Guizhou to learn the techniques used in the Drum Towers before he built the Drum Tower of the Pingpu village in Guangxi in 2000. According to author's interview with the villagers and carpenters in the Dong villages in Tongdao county, Hunan, they generally have preferred the Chuan-dou Drum Tower because of its supreme height and magnificent look. Furthermore, this perception will influence the activities of reconstructing and expanding the Drum Tower. According to the survey of Dr. Ling Cai in Liping county, Guizhou in 2003, architect Lu Wenli was invited to expand the old Drum Tower by the Zhuping village. He retained the bundle columns of the old one, but added more short columns and purlins to make the "new" Drum Tower have more roof tiers and Pai-lou after his expansion.

The Chuan-dou Drum Tower became a cultural representation of the Dong minority through the national Cultural Revitalization movement and was promoted by the modern media. At first it may have been looked upon as just a technique used and expressed in the regional art. However, it has gradually been formed to a more accurate standard in the whole habilitation area of the Dong. The role of the identification standard also adapts to the demand of the tourism business in the remote Dong area. Due to the popular aesthetic preference of the Chuan-dou Drum Tower, it has been used in many tourist or governmental projects, such as folk custom villages, natural scenic areas and even the ethnic style buildings in the squares of many a city. Therefore, this accepted type has played a guiding role in the technique transmission and development of the Drum Towers.

Chapter 2 Safeguard of Dong Drum Tower

Before discussing the safeguard of Dong minority's traditional buildings and Drum Tower, it is indispensable to mention the Chinese vernacular architecture. Because it is in no way call into question that the fact a whole series of architectural phenomena in Dong vernacular architecture are drawn from the Chinese vernacular architecture as well as its traditional village.

Historically, China has long based on a rural community, with land use being predominantly agricultural. Traditional village developed along the evolution of agricultural civilization, as Fei indicated, the village emerged as a settlement where people inhabit together (Fei, 2006). Firstly, because the limited cultivated farmland makes people live close to each other with short distance to no matter residence house or the farmland. Secondly, For the sake of security, people choose to live together. Thirdly, under the rules of equally-partible inheritance, the property, the farmland in most occasion, would be equivalently passed down to every male heir. Eventually, after a few generations, the village has been arisen to a pretty big scale. Hence, the formation of Chinese village, in any case, ties closely with the geographical or natural environment, rural society and economy and the particular way of family inheritance.

Undoubtedly, vernacular architecture is one of the most vital compositions of a village, acknowledged by more than a century of sociological, historical and ethnographical findings, vernacular architecture, intrinsically, is the "root culture" of Chinese traditional architectural culture. What is more, it has been commonly recognized among the most culturally and traditionally meaningful architecture forms, whereas, the vernacular architecture formed without any intentionally connection with particular culture or tradition. Conversely, current architecture is always designed with abundant cultural traditions and meanings.

Some part of the villages had been involved as an expanding urban area under the process of urbanization since modern period. Inferentially, some of the villages

remained the indigenous culture at maximum extent, ranging from architectural phenomena, environmental setting, social life, etc. that is what we called, the traditional village. Following the perspective, traditional villages not only include the ones that have been already legally listed into a national, provincial or municipal level, but also the un-listed or un-recognized traditional villages with full valued historical and cultural significance.

Chapter 2 develops from three parts to explain the safeguard of Dong Drum Tower: Part one corresponds to the increasing academic attention on vernacular architecture since 1930s, which comprises three main historical phases: from 1930s to 1950s; From 1980s to the beginning of 21st century; The beginning of 21st century to the present. At a first stage, the academic attention focused on dwellings, as the major architectural type in a traditional village should be, in most circumstance, the dwelling. However, the architectural types within vernacular architecture are more than dwelling, for instance, the Dong minority traditional public buildings, with the continuous dedication throughout several generations on vernacular architecture, having laid a basic theoretical foundation and structure to the following architects or conservators. Part two, of great importance, the description of legislation context on Dong traditional architecture and their problems, ranging from cultural relics protection system; famous historical and cultural town (village), to traditional village and UNESCO “Chinese World Cultural Heritage Tentative List”. Part three corresponds to the questions: how is a Dong Drum Tower inscribed as a specific protected level? Currently, there is no particular assessment system for Dong Drum Tower or even the vernacular architecture. Therefore, the same system in use for cultural relics should be applied for the assessment of protected level for Drum Towers. In this way, lots of problems emerged.

2.1 First attention on vernacular architecture in China

Given to the rich diversity of Chinese architecture types, as varied as hierarchically

organized royal architecture, official architecture, religious architecture, etc. it is remarkable that the vernacular architecture did not attract serious interest until 1980s in China. Prior to that, only a small number of Chinese scholars showed interest and attention in the vernacular one. Like Liang Sicheng and Liu Dunzhen who had to work under hard political circumstances. However, their works during 1940s to 1950s offered a first glance of architecture types previously neglected or considered to have been lost. Over the last three decades, the vision has expanded into an ever more comprehensive picture.

On the other hand, foreign scholars and their travel books have, more or less, recorded some historical information of vernacular architecture from the last half of 19th century to the first half of 20th century, such as *Ansichten aus Japan China und Siam: die preussische Expedition nach Ost-Asien* (Eulenburg, 1864), in which 21 pictures, out of a total of 60, display China (Fig.2-1). 7 in Tientsin (now Tianjin city), 1 in Tungtschau (now Tiangongsi Tower), 8 in Peking (now Beijing), 1 in Hong Kong, 1 in Canton (now Guangzhou) and 3 Macao. The pictures in Tientsin have shown some vernacular architectures, like dwellings and stores (Fig.2-2), and a family temple displayed in Macao (Fig.2-3).



Fig.2-1 Preface of *Ansichten aus Japan China und Siam* (source: <https://new.shuge.org/>)



Fig.2-2 Dwellings near the port in Tientsin
(source: <https://new.shuge.org/>)



Fig.2-3 Family temple in Macao (source:
<https://new.shuge.org/>)

George Ernest Morrison (1862-1940), an Australian journalist, in 1894 began a journey from Shanghai to Rangoon, boating up Yangtze River along 4,800km. Then he turned this journey into a book, *An Australian in China* (Morrison, 1895), which has recorded a vivid picture and narration, ranging from custom, architecture, politics and economics in Southwestern China of late Qing Dynasty (Fig.2-4). Interesting

examples in his narration are given by the dwellings in Tali (Dali) in Yunnan province and theater building in Chung-king (now Chongqing).



(a)



(b)



(c)

Fig.2-4 Travel route and sites in Morrison's book (source: Morrison, *An Australian in China*)

(a). Travel route from Shanghai to Rangoon; (b). Dwellings and snow-clad mountain in Tali, Yunnan; (c). A temple theater in Chung-king

However, in the above travel records, western authors are narrating and photographing in a personal way, with limited concern for China or its vernacular architecture. The descriptive narrations and few photographs produced limited academic value. Nevertheless, they expressed an early interest in Chinese society, custom and even the vernacular architecture.

Hence, only the academic attention on vernacular architecture in China is going to be discussed in the following sections. It could be chronologically divided into three timelines, firstly the discovery and recognition of the value of vernacular architecture from 1930s to 1950s; secondly, classification of the building type and analysis through the field survey from 1980s to the beginning of 21st century; the last, from the beginning of 21st century to the present, the modern adaptation as a response to the present social constraints.

2.1.1 From 1930s to 1950s

A study of cave dwellings has been the first published paper about vernacular architecture in China; this was a contribution of *Society for the Study of Chinese Architecture*, a first folk academic organization in China, and produced specific study on traditional architecture. From July to December, 1940, Liu Dunzhen, a distinguished architectural historian, and his colleague from Society for the Study of Chinese Architecture conducted an in-depth field survey on traditional architecture in Southwest of China via building documentation, they published the paper *A general study of traditional architecture in Southwest of China*, which for the first time catalogued the traditional dwellings as an independent architectural type officially. With the efforts of Liu and his colleagues, a great attention on the significance of vernacular architecture was raised, the book *A general study of Chinese dwellings*, which upgraded the traditional dwelling to a certain level, it is regarded as one of the most significant references on this topic in the following study. During this period, other academic report were published, such as *Huizhou dwellings in Ming Dynasty*, *Suzhou traditional dwellings referred catalogue* (School of architecture, Tongji

University, 1958).

2.1.2 From 1980s to the beginning of 21st century

The academic research from 1960s-1970s, however, due to the Cultural Revolution, has been suspended in general speaking. Approaching to the 1980s, the research of vernacular architecture is processing a prosperous era, on the one hand, inheriting the previous research methodology, that is, emphasizing on the architectonic value and documentation, ranging from plan layout, framework system, construction technique and the decoration study. On the other hand, the “Culture Fever” is quite prevalent throughout the academia, providing a great influence on the knowledge of the architectural forms of vernacular architecture. In 1988, an academic organization was founded, the Chinese Academic Traditional Dwellings Committee. Undoubtedly, it promoted the progress to the research of traditional dwelling and even vernacular architecture. In 1993, the International Conference on Vernacular Architecture in Guangzhou was held, and the submitted papers on the subject of “history and culture”, “space and technique” were more than 1/4 of the proceedings. Shan offers a theoretic as well as practical study on traditional dwellings and settlements (Shan, 2004), what’s more, it mentioned the preservation and update of vernacular architecture. In 2005, the *Suzhou Declaration* was announced, more than 40 restorers and architects were appealing for a general survey as a basic need for the nation-wide survival of vernacular architectural heritage and a targeted preservation plan.

2.1.3 The beginning of 21st century to the present

Over almost over last 20 years, the rural development and preservation of vernacular architecture is one of the major challenges facing the contemporary built environment. In China, the vernacular architecture and settlement has become a new frontier for experiments in this area, and the country is developing it at a speed and scale which is unseen in the West. Drawn by the promise of boundless opportunities, architects,

restorers, artists, scholars as well as capital flow, are converging in rural areas across the nation. Wu liangyong, a most influential Chinese scholar and architect, proposed that the vernacular architecture must meet the request of the contemporary society, and the future should not be the simple imitation of the past (Wu, 1998).

The return to the pastoral life has long been an ideal of Chinese literary tradition. In modern times, living in the vernacular architecture in rural areas typically involves aspects such as policy, capital, infrastructure, and technology. While modernization and technological progress promise a better life with modern living conditions, they also, to some extent, sever the link between rural life and tradition. Facing mass-produced rural housing brought on by urbanization, architects and restorers attempt to find a middle ground between tradition and modernization, taking advantage of modern technology in search of a vernacular connection. The 16th International Architecture Exhibition, La Biennale di Venezia, 2018, Pavilion of China present the topic *Building a future countryside*, depicting the countryside of contemporary China through six episodes: poetic dwellings, local production, cultural practices, agricultural tourism, community reconstruction, and future exploration. The academic but also practical exhibition outlines more than nostalgia for rural lands and vernacular architecture, what's important, we should return to the countryside where Chinese culture originated to recover forgotten value and overlooked possibilities.

2.2 Current safeguard policy and system of Dong Drum Tower

Unlike the most western countries, China practices the designated heritage preservation system. A governmentally-designated heritage preservation agency or department, as per the principles and standards for the heritage evaluation stipulated by the state, selects the qualified tangible or intangible heritages, and determines the preservation level. The designated heritage is managed and preserved by relevant authorities, and provided by the state with the funds and other resource conditions required by maintenance and restoration.

In terms of the status quo of China's architectural heritage preservation, the state-based preservation work is the most reasonable and effective. In order to maximize its efficiency, the architectural cultural heritage preservation work shall be incorporated into the urban and rural planning; therefore, the state is required to make overall and integrated arrangements and management. The highly-authoritative state system can safeguard the real implementation of architectural cultural heritage preservation work.

China's historical and cultural heritage preservation system increasingly improved over the last 20 years. The state system of Dong minority architectural cultural heritage preservation, as aforementioned, has gone through a continuously-improved process of heritage preservation system, from a site protected at local level, a site protected at the corresponding level, a famous historical and cultural town (village), a world cultural heritage, to a traditional village. At the state system level, a heritage registration and preservation system has been built, consisting of cultural relics protection entity, famous historical and cultural town (village), traditional village and "Chinese World Cultural Heritage Tentative List".

2.2.1 Cultural Relics System

Acting as the most fundamental legislation system, the *The Cultural Relics Protection Law of the People's Republic of China* has been revised and updated through many times¹⁴, serving as the core law in the protection of cultural heritage.

¹⁴ On November 19, 1982, the 25th meeting of the Standing Committee of the Fifth National People's Congress passed the first *The Cultural Relics Protection Law of the People's Republic of China*; on June 29, 1991, the Standing Committee of the Seventh National People's Congress Amendments to the 20th Meeting of the Committee on the *Amendment of the Decision of the Protection of Cultural Relics of the People's Republic of China* 《关于修改<中华人民共和国文物保护法>的决定》; the 30th Meeting of the Standing Committee of the Ninth National People's Congress on October 28, 2002; December 29, 2007, *The Decision of the Standing Committee of the National People's Congress on Amending the Law of the People's Republic of China on the Protection of Cultural Relics* 《关于修改<中华人民共和国文物保护法>的决定》 has been released; on June 29, 2013, the Standing Committee of the National People's Congress on the revision of the *The Cultural Relics Protection Law of the People's Republic of China* and

The revision of *The Cultural Relics Protection Law of the People's Republic of China* defines a more comprehensive and rigorous way on culture relics and the typologies, such as the Article 2:

The state shall place under its protection, within the boundaries of the People's Republic of China, the following cultural relics:

(1) Sites of ancient culture, ancient tombs, ancient architectural structures, cave temples, stone carvings and mural paintings that are of historical, artistic or scientific value;

(2) Important historical sites, material objects and typical buildings of modern and contemporary times related to major historical events, revolutionary movements or famous people that are highly memorable or are of great significance for education or for the preservation of historical data;

.....

(5) Typical material objects reflecting the social system, social production or the life of various nationalities in different historical periods.

Cultural relics could be divided into movable and unmovable. Hence, the principle and regulation can be made more strategic and well-defined, such as in the Article 3:

Unmovable cultural relics, such as sites of ancient culture, ancient tombs, ancient architectural structures, cave temples, stone carvings, mural paintings, and important historical sites and typical buildings of modern and contemporary times, etc., may be determined as major historical and cultural sites protected at the national level, historical and cultural sites protected at the province level and historical and cultural sites protected at

other 12 Decision of the law (adopted at the third meeting of the Standing Committee of the 12th National People's Congress on June 29, 2013).

the level of city or county.

Movable cultural relics, such as important material objects, artworks, documents, manuscripts, books and materials, and typical material objects, etc., are divided into valuable cultural relics and ordinary cultural relics; valuable cultural relics are divided into Grade 1 cultural relics, Grade 2 cultural relics and Grade 3 cultural relics.

In July 2018, the State Administration of Cultural Relics has promulgated *Guidelines for Accreditation of Unmovable Cultural Relics(Trial)*. Article 7 has defined what kind of architecture could be listed as unmovable cultural relic, and pays emphasis on the authenticity and integrity of architecture:

“A building with one of the following conditions can be considered as an unmovable cultural relic:

The remains of ancient buildings and structures still exist, or there are independent geographical areas at the new site after the remove;

(2) Representative modern buildings have the characteristics of the times, are typical in a certain area, or in the related social fields, especially in form and style, and the structure is basically complete.

*The ancient buildings still in existence before 1840 **shall** be regarded as unmovable cultural relics; important and representative buildings constructed by traditional building materials and techniques or using modern building materials and techniques from 1840 to 1949 **shall** be recognized as unmovable cultural relic; a particularly important and representative building constructed after 1949 **shall** be considered as an unmovable cultural relic.*

Thanks to evaluations based on historical, aesthetic and scientific points of view, several elements of the Dong traditional architectural heritage have been recognized

and determined as unmovable cultural relics protected at different levels, as it is shown in the Tables.2-1,2-2

Table.2-1 Unmovable cultural relics of Dong buildings protected at national level (Dong buildings)

Province	Name	County	Announce batch(time)
Guizhou	Zengchong Drum Tower	Congjiang	3 rd batch (Jan 1988)
	Diping Wind-Rain Bridge	Liping	5 th batch (May 2001)
	Dali traditional buildings	Rongjiang	7 th batch (May 2013)
	Jinping Feishan Temple	Jinping	7 th batch (May 2013)
	Gaoqian Drum Tower	Congjiang	7 th batch (May 2013)
	Zai'e Drum Tower	Congjiang	7 th batch (May 2013)
	Jingou Wind-Rain Bridge	Congjiang	7 th batch (May 2013)
	Sanmentang traditional buildings	Tianzhu	7 th batch (May 2013)
Hunan	Matian Drum Tower	Tongdao	4 th batch (Nov 1996)
	Yutou traditional buildings	Tongdao	5 th batch (May 2001)
	Pingtang Wind-Rain bridge	Tongdao	6 th batch (May 2006)
	Gaoyi traditional building	Huitong	6 th batch (May 2006)
	Gongcheng Academy	Tongdao	7 th batch (May 2013)
	Binshuge and Wenxing Bridge	Tongdao	7 th batch (May 2013)
	Baiyi temple	Tongdao	7 th batch (May 2013)
Guangxi	Chengyang Yongji Wind-Rain bridge	Sanjiang	2 nd batch (Feb 1982)
	Batuan Wind-Rain bridge	Sanjiang	5 th batch (May 2001)
	Mapang Drum Tower	Sanjiang	6 th batch (May 2006)
	Heli Sanwang Palace	Sanjiang	7 th batch (May 2013)

Table.2-2 Unmovable cultural relics protected at provincial level (Dong buildings)

Province	Name	County	Announce time
Guizhou	Jitang Drum Tower	Liping	Feb 1982
	Xindi Drum Tower	Congjiang	Nov 1985
	Shudong Drum Tower	Liping	Jun 2006
	Dengceng Barns	Liping	Jun 2006
	Gaojing Drama Stages	Liping	Jun 2006
	Liujiia Wind-Rain Bridge	Congjiang	Jun 2006
	Zhaoxing Drum Tower & Wind-Rain bridge	Liping	Jun 2006
	Zeli Drum Tower	Congjiang	May 2015
	Zengying Drum Tower	Congjiang	May 2015
Hunan	Yanglan Drum Tower	Tongdao	1996
	Hengling Drum Tower	Tongdao	May 2002
	Chentuan Village Gate	Tongdao	May 2006
	Pingxi Village Gate	Tongdao	2011
Guangxi	Pingdeng traditional buildings	Longsheng	Jul 1994

In addition to the unmovable cultural relics protected at national level and provincial level, numerous Dong traditional architectures have been granted as the unmovable cultural relics at level of city or county. Taking examples as the Tongdao county Banpo Drum Tower, Gaobu, Pingtan, Jinkeng, Pingzhai, Guantuan traditional buildings, etc. have been listed into the unmovable cultural relics protected at level of county. Apparently, the comprehensive preservation has increasingly taken the place of the single-building preservation.

Chapter two of *The Cultural Relics Protection Law of the People's Republic of China* enriched the content of preservation of cultural relics and implement measures via definition of "the famous cities, streets, villages and towns of historical and cultural value". Article 14 says:

A town, street, or village with an unusual wealth of cultural relics of high

historical value and major revolutionary significance may be a street, village or towns of historical and cultural value, **shall** be subject to the approval and announcement of the people's governments of provinces, autonomous regions, or municipalities directly under the Central Government, and **shall** be reported to the State Council for record.

The local people's governments at and above the county level of the place where the famous cities, streets, villages and towns of historical and cultural value are located **shall** organize the formulation of plans on the protection of those famous cities, streets, villages and towns, and bring that planning into the overall city planning.

Measures for the protection of famous cities, streets, villages and towns of historical and cultural value **shall** be formulated by the State Council.

As for the management, it offers the more rigorous and practical requirements, as Article 15 indicates:

The people's government of the provinces, autonomous regions, and municipalities directly under the Central Government and of cities and counties **shall** delimit the necessary scope of protection, put up signs and notices, and establish records and files for the historical and cultural sites protected at different levels and shall, in the light of different circumstances, establish special organs or assign full-time personnel to be responsible for the administration of these sites. The scope of protection and records and files for the major historical and cultural sites protected at the national level **shall** be reported by the departments of cultural relics administration of the people's governments of provinces, autonomous regions, and municipalities directly under the Central Government to the department of cultural relics administration under the State Council for record.

The departments of cultural relics administration of the local people's

governments at and above the county level shall, according to the demand for protecting different cultural relics, work out specific protective measures for the unmovable cultural relics of the protected historical and cultural sites and those not approved as protected sites, and announce and implement such measures.

Which has strengthened the control of various activities under the buffer zone as well as the preservation area. Article 17 indicates:

No additional construction projects or operations such as explosion, drilling or excavation, etc. may be undertaken within the scope of protection of a protected historical and cultural site. However, if additional construction projects or operations such as explosion, drilling or excavation need to be undertaken within the scope of protection of such a site due to special reasons, the safety of the site must be guaranteed, and approval must be obtained from the people's government which made the original approval and announcement on the designation of the site, with consent first obtained from the department of cultural relics administration of the people's government at the next higher level; If additional construction projects or operations such as explosion, drilling or excavation are to be undertaken within the scope of protection of a major historical and cultural site protected at the national level, approval must be obtained from the people's government of the relevant province, autonomous region, or municipality directly under the Central Government, with consent first obtained from the department of cultural relics administration under the State Council.

It is proposed the conception of comprehensive preservation combined with the unmovable cultural relics and their surrounding environment.

Moreover, a major content supplemented and improved in *The Cultural Relics Protection Law of the People's Republic of China* is that the legal liabilities related to

the cultural relics protection are clarified, in which legal liabilities or penalties arising from kinds of behavior and activities which violate the provisions in *The Cultural Relics Protection Law of the People's Republic of China*, ruin the cultural relics or cause an adverse effect on the cultural relics are stipulated in details.

China's cultural relics protection authority is divided into two levels: national level and local level. As a national-level cultural administration, State Administration of Cultural Heritage should take charge of national cultural relics. The departments of local people's governments at and above the county level should establish a special cultural relics protection authority, in charge of the cultural relics work within their respective administrative jurisdictions. Without the special cultural relics protection authority, local cultural administration should take charge of the cultural relics protection within their respective administrative jurisdictions.

In addition to the national-level law *The Cultural Relics Protection Law of the People's Republic of China*, there are some normative documents related to the cultural relics protection stipulated by the People's Congresses and the Standing Committees of provinces, autonomous regions, municipalities directly under the Central Government, cities where the people's governments at the provincial level are located, and relatively-large cities approved by the State Council, as per *the Constitution of the People's Republic of China*, *The Cultural Relics Protection Law of the People's Republic of China*, relevant laws and regulations, based on the regional actual conditions. *Regulation of Hunan Province on the Protection and Management of Cultural Relics (1997)*, *Regulation of Guangxi Zhuang Autonomous Region on the Protection and Management of Cultural Relics (1997)*, and *Regulation of Hunan Province on the Protection of Cultural Relics (2005)* are all local regulations concerning the preservation of cultural heritages including the preservation of architectural cultural heritage of Dong minority.

The compilation and revision of national and local laws and regulations concerning the cultural relics protection reflect the great progress that China has made in the cultural relics protection and the update and progress in awareness. Its development

and change are very apparent. But it still has problems in some aspects.

Firstly, the definitions for some basic concepts in *The Cultural Relics Protection Law of the People's Republic of China* are not accurate and specific. For example, it has not given definition and explanation to the values of cultural relics' historical value, artistic value, scientific value and historical data value. Moreover, recognizing only *historical, artistic and scientific values* will inevitably exclude the cultural heritage with other values out of the range of cultural relics.

Secondly, in terms of determining the preservation level of unmovable cultural relics, *The Cultural Relics Protection Law of the People's Republic of China* is avoid of a normative, rigorous and referable standard to determine the protection level, merely stipulating in general terms that

...according to their historical, artistic and scientific values, the unmovable cultural relics shall be determined as major historical and cultural sites protected at the national level, at the provincial level, or at the level of city and county

Evaluation standard and evaluation method for the cultural relics at all preservation levels haven't been well-defined, and the value difference of cultural relics at three preservation levels has not been well-explained either, which also lead to certain defects of the evaluation and preservation rating system for the architectural heritage, This suggests that there are not specific well-recognized rules for distinguishing the differences between national, provincial and county-level architectural heritage in China. Nevertheless, the differences do exist. Further information on the grading system on protection level of architectural heritage will be demonstrated in the following section.

Furthermore, China, with long-standing history, has numerous cultural relics and historic sites, among which the cultural and historical sites protected at all levels, within urban and rural areas, in total, less than 100,000. The number of the protected cultural relics does not match with the status of China as an ancient civilized country.

In terms of number and scope of the protected architectural structures, China is far less than the countries with small area and short history which are advanced in the heritage preservation. The reason why China is relatively deficient in the resources for the cultural relics protection is strongly-linked to the lagged development of the measures by which towns/ village are listed into the cultural relics protection. As far as Dong minority architectural heritage is concerned, overall preservation of the villages began with 2001 when the ancient architecture complex of Yutou Dong Village in Tongdao Dong Autonomous County in Hunan Province was announced to be in the fifth batch of major historical and cultural sites protected at the national level. So far, only 4 ancient architecture complexes (Gaoyi Village ancient architecture complex in Huitong Hunan, Dali Village ancient architecture complex in Rongjiang Guizhou, Sanmentang ancient architecture complex in Tianzhu County) have been listed as historical and cultural sites protected at national level.

In addition to the problems of definition, the diction is ambiguous, as the word “shall” is constantly used in the legal documents (In original Chinese version, is noted “keyi”¹⁵). Under the circumstance of law or legal document, a diction of modal verb, or we could say “optional” diction, is not legally imposed in any case. A more “mandatory” diction should be replaced in a legal document. Otherwise, it could result in evasion of legal liability.

In comparison, the Italian national provision, *Codice dei beni culturali e del paesaggio*¹⁶, which is a systematic body of provisions on the subject of cultural heritage, landscape assets, provides a clearer definition of the cultural heritage. For example, the second part, Article 10 defines (The English translation is attached below the original Italian text):

Sono beni culturali le cose immobili e mobili appartenenti allo Stato, alle

¹⁵ In Chinese, “keyi”(可以) translates to shall or could be.

¹⁶ Decreto Legislativo 22 gennaio 2004, n. 42. Codice dei beni culturali e del paesaggio, ai sensi dell'articolo 10 Legge 6 luglio 2002, n. 137.

regioni, agli altri enti pubblici territoriali, nonché ad ogni altro ente ed istituto pubblico e a persone giuridiche private senza fine di lucro, ivi compresi gli enti ecclesiastici civilmente riconosciuti, che presentano interesse artistico, storico, archeologico o etnoantropologico.

(Cultural property is immovable and movable property belonging to the State, regions, other territorial public bodies, as well as to any other public body and institute and private non-profit legal entities, including civilly recognized ecclesiastical entities, which present artistic interest. , historical, archaeological or ethno-anthropological.)

...

(l). le architetture rurali aventi interesse storico od etnoantropologico quali testimonianze dell'economia rurale tradizionale (4).

(rural architecture with historical or ethno-anthropological interest as evidence of the traditional rural economy.)

Not only artistic, historical but also archeological and ethno-anthropological value, and a more detailed information and definition of typologies of cultural heritage have been noted, ranging from archive documents, coin collecting, and manuscripts to public plaza, open urban space. Moreover, the rural buildings with historical and ethno-anthropological significance are noted, which is a blank area in the Chinese national law of cultural relics. Additional to that, chapter 3, “the protection and preservation” displays detailed items including preservation methods, intervention procedures and prevention works, etc. which is also insufficient in the Chinese law of cultural relics.

A detailed comparison between Chinese and Italian law of cultural heritage is not the aim of this work, where the main purpose is rather to show and extract the major problems of Chinese law of cultural relics, which is in urgent need of revision.

2.2.2 Famous historical and cultural towns/ villages System

Famous historical and cultural towns/ villages are an important part of the heritage preservation system. China started relatively late in this regard. *The Cultural Relics Protection Law of the People's Republic of China (2003 Amendment)* has explicitly proposed that :*A town, street, or village with an unusual wealth of cultural relics of high historical value and major revolutionary significance may be a street, village or towns of historical and cultural value, shall be subject to the approval and announcement of the people's governments of provinces, autonomous regions, or municipalities directly under the Central Government, and shall be reported to the State Council for record.* Thereafter, this provision has continued to be used in *The Cultural Relics Protection Law of the People's Republic of China (2003 Amendment)*. Ministry of Housing and Urban-Rural Development and State Administration of Cultural Heritage jointly announced the first batch of 22 Chinese famous historical and cultural towns/ villages in 2003, indicating that a historical and cultural towns/ villages preservation system was basically established, and that the overall preservation of the villages among the architectural heritages has been valued.

In 2003, Ministry of Housing and Urban-Rural Development and State Administration of Cultural Heritage announced the first batch of Chinese famous historical and cultural towns/ villages), and stipulated the evaluation method for the famous towns/ villages based on four aspects: “historical value and characteristics”, “original state preservation degree”, “reaching a certain scale currently”, “a prepared scientific and rational overall planning of villages and towns”.as indicated in Table.2-3.

Table.2-3 Evaluation and Assessment Method for the famous towns/ villages

Aspects	Contents	Standards
Historical value and characteristics	Architectural forms, space morphology, historical and cultural	Architectural heritage, cultural relics and traditional culture are concentrated, which can reflect the traditional style, local

	significance	characteristics and national customs of a certain historical period. It has high historical, cultural, artistic and scientific value. It was built before the Qing Dynasty or even the significant historical and traditional architectural complexes, monuments, sites, etc., built in the history of the Chinese revolution, with the basic features remaining intact.
Original state preservation degree	The intact extent of buildings	The historical and traditional buildings and their architectural details and even the surrounding environment are basically intact; or because of the ages, the historical buildings and their surrounding environment have collapsed and destroyed, but have been restored in an original way. Or the original building complex and its surrounding environment partially collapsed, but the "skeleton" still exists, and some architectural details are also well preserved. The original structure can be restored according to the structure, structure and style of the remains
Reaching a certain scale currently	The holistic scale of preservation on historical buildings	The total existing historical building of the town shall have a construction area of more than 5,000 square meters, and the existing historical and traditional buildings of the village shall have a construction area of more than 2,500 square meters.。
A prepared	The management and	An effective management organization has

scientific and rational overall planning of villages and towns	measure to ensure the preservation work	been set up, equipped with professionals and with special protection funds.
--	---	---

Based on the evaluation method for the famous historical and cultural towns/ village, “*Jiancun [2004] No. 228*” document issued by Ministry of Housing and Urban-Rural Development implemented the *Chinese Famous Historical and Cultural Towns/ village Evaluation Indicator System (Trial)*, which supplemented the contents for the evaluation of the intangible cultural heritage, added the contents of evaluating such aspects as natural environment, spatial form, street and lane pattern, etc., established a hierarchical structure model of the preservation evaluation indicator system(Fig.1-8), and formed a specific quantitative scale table.

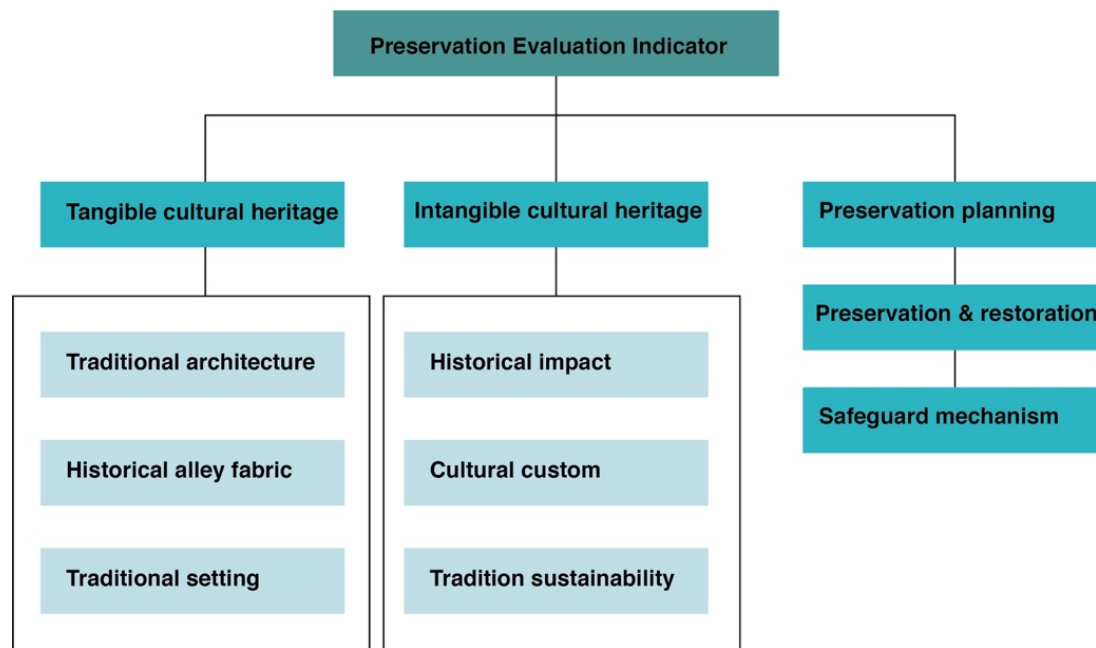


Fig.2-5 A hierarchical model of the preservation evaluation indicator system (Draw by author)

The evaluation and announcement work for Chinese famous historical and cultural towns/ villages shall be conducted from time to time. After the evaluation opinion from

the Expert Committee, it shall be reviewed and approved by Ministry of Housing and Urban-Rural Development and State Administration of Cultural Heritage in the manner of inter-ministerial joint conference. The result shall be announced in the name of Ministry of Housing and Urban-Rural Development and State Administration of Cultural Heritage. As of March 2014, six batches of Chinese famous historical and cultural towns/ villages have been announced, the seventh batch was pre-announced in December 2018. Table.2-4 indicates the 7 Dong villages recognized as the Famous Historical and Cultural Villages in Hunan and Guizhou province.

Table.2-4 List of Famous Historical and Cultural Villages (Dong minority)

Name	Announced batch (Time)
Gaoyi village, Huitong county, Hunan	3 rd batch (May 2007)
Zhaoxingzhai village, Liping county, Guizhou	3 rd batch (May 2007)
Zengchong village, Congjiang county, Guizhou	4 th batch (Oct 2007)
Yutou village, Tongdao county, Hunan	6 th batch (Mar 2008)
Pingtang village, Tongdao county, Hunan	6 th batch (Mar 2008)
Dali village, Rongjiang county, Guizhou	6 th batch (Mar 2008)
Dimen village, Liping county, Guizhou	6 th batch (Mar 2008)

Besides the value characteristic evaluation, “preservation measures” are also incorporated into *Chinese Famous Historical and Cultural Towns/ villages Evaluation Indicator System*, stressing that the preservation and management of famous towns/ village and the implementation of measures are likewise essential conditions for the retention and continuation of value characteristics, which play an important role in urging relevant governmental authorities to develop and implement some preservation measures. The preservation measures are threefold, master planning, preservation and restoration, safeguard mechanism.

i. Master planning

The master planning is a document to guide the famous towns/ villages to correctly

carry out the preservation of tangible and intangible cultural heritage values. Its main contents include delineation of preservation scope, restoration of architectural structures and environment, retention of community life, renovation of infrastructure, etc. Once approved, the master planning is legally enforceable. All the preservations, constructions and developments within the scope of famous towns/ village shall be implemented within the scope of the master planning.

ii. Preservation and restoration

In terms of preservation and renovation at the material level, such as architectural structures, streets and lanes, environment, facilities, etc., some are reflected in the value characteristic evaluation of tangible cultural heritages, and some are not easy to be evaluated visually. Considering relatively-weak links among the existing preservation measures, and some factors such as easy quantitative evaluation, future monitoring and management, etc., the *Indicator System* focuses on such indicators as census registration, publicity of planning and construction, listed preservation and setting of warning signs.

iii. Safeguard mechanism

Any preservation activities shall be carried out based on necessary safeguard measures. Continuous supervision is essential to take the preservation measures, so as to avoid being driven by excessive interests or serving other purpose. In addition, financial budget, loan donation and other financial support, as well as sufficient personnel are essential safeguard measures for successful preservation of famous towns/ villages.

On July 1, 2008, the State Council promulgated the *Regulation on Preservation of Famous Historical and Cultural Cities, Towns and Villages* to give the legal support to the preservation, management and planning of famous historical and cultural towns/ villages.

Chinese Famous Historical and Cultural Towns/ villages Evaluation Indicator System (hereinafter referred to as *Indicator System*) is a national preservation evaluation system for the historical and cultural towns/ villages, in the manner of quantitative

indicators, based on analyzing and excavating the connotation and value of Chinese historical and cultural towns. Compared with the cultural relics rating in the cultural relics protection system, the most distinctive characteristic is that the *Indicator System* clearly defines and scores the value characteristic, and the relevant data are actually more available and comparable.

However, in the actual application, there exist some problems to be improved in the *Indicator System*. The reason for such problems is that Chinese historical and cultural towns/ villages are widely distributed across the country. Due to different regions, different nationalities and different geographical and climatic conditions, the historical and cultural villages and towns have formed obviously different characteristics. The *Indicator System* is actually constructed according to the block diagram of the evaluation indicator system. In terms of the historical and cultural villages of Dong minority, the setting of value indicators focuses on the historical value. However, the survey on scientific value, artistic value and authenticity of the villages lacks of the evaluation of such factors as concept of site selection and spatial pattern of the towns/ village that reflect the geographical characteristics of the Dong minorities' settlements; and existing traditional architectural structures lack of the evaluation of availability, quality, safety and sanitation. As far as the preservation measures are concerned, the *Indicator System* neglects research, intervention, utilization, improvement and development, environmental remediation, education, management and other aspects. Moreover, it also takes no consideration into such factors as developmental potential of the villages and residents' emotion.

2.2.3 Chinese Traditional Village System

Chinese Traditional villages refer to the villages with highly historical, cultural, scientific, artistic, social and economic values, being tangible and intangible cultural heritages value. The *Guiding Opinions on Strengthening the Protection and Development of Traditional Villages* jointly issued by Ministry of Housing and Urban-Rural Development, Ministry of Culture and Ministry of Finance on December

12, 2012 proposes the basic principle of “advanced planning, integrated guidance, overall preservation, integrated development, living heritage, rational utilization, government guidance, villagers' participation”, and clearly indicates basic tasks and work contents for preservation and development work of traditional villages.

Moreover, the *Guiding Opinions on Strengthening the Protection and Development of Traditional Villages* proposes the specific requirements for improving the survey on traditional villages, and establishing national and local traditional villages directory system.

Improving the survey on traditional villages includes work contents in two different aspects. One aspect is to conduct supplemental survey of registered traditional villages to improve the village information archives. The other aspect is to survey the villages with traditional architectural structures, traditional site selection pattern and rich intangible cultural heritages, particularly re-survey minority areas and blank areas, and encourage recommendations from experts and all sectors of society to continuously enrich the information about traditional villages.

Establishing national and local traditional villages directory systems needs to announce and list the villages in consistence with the accreditation conditions of national-level traditional villages into Chinese traditional villages directory, as per *Evaluation and Accreditation Indicator System for Traditional Villages (Trail)*, in accordance with such procedures as provincial recommendation, review and approval of the Expert Committee, social publicity, etc. Besides registering national-level traditional villages, local authorities of Ministry of Housing and Urban-Rural Development, Ministry of Culture, and Ministry of Finance develop the accreditation standards for traditional villages within their respective administrative jurisdictions, conduct review and accreditation of traditional villages within their respective administrative jurisdictions, and establish local traditional villages directory under the guide of the three ministries. Traditional villages directories at all levels shall be announced in batches.

Evaluation and Accreditation Indicator System for Traditional Villages (Trail) issued on

August 22, 2012 is compiled in order to evaluate the preservation value of traditional villages and accredit the preservation level of traditional villages, as per *Notice on Conducting Surveys on Traditional Villages (JIANCUN [2012] No.58)* issued by Ministry of Housing and Urban-Rural Development, Ministry of Culture, State Administration of Cultural Heritage, and Ministry of Finance. *Evaluation and Accreditation Indicator System for Traditional Villages* provides the basis for evaluating and accrediting the preservation value of traditional villages and recommending national-level traditional villages. Moreover, it provides references for the evaluation basis and the score accreditation standard to determine local traditional villages.

The evaluation and accreditation shall be carried out from the three aspects: traditional architectures of the village, site selection and pattern of the village, and intangible cultural heritage values of the village. According to the provisions on the declaration for the first batch of national traditional villages, the village which scored 80 points or above for the first item, 75 points or above for the second item, and 70 points or above for the third item is qualified to be declared a national traditional village.

The Indicator System, based on the analytic hierarchy process in the evaluation system, combines multiple hierarchical structure and scoring standard with qualitative and quantitative evaluations, subjective and objective evaluations. Through deeply exploring the connotation and value characteristics of traditional villages, 20 evaluation factors in the Indicator System can visually and comprehensively reflect the composition and distribution of village values, from point to plane, from historical state to current state, from tangible heritage to intangible heritage, with each evaluation factor being relatively independent, concise, and reasonable. Furthermore, such evaluation indicator system combines quantitative and qualitative evaluations to assign values to each indicator, which can visually show the commonality of different villages, and clearly present the individual differences of different villages. Outlines of the Indicator System can be seen in Fig.2-6.

Under the guidance of the *Indicator System*, the application and evaluation was undergone by stages on December 2012, August 2013, November 2014, December 2016 and December 2018. In total, 5 batches and 6,799 villages have been announced and recognized as the Chinese Traditional Villages among these, 176 Dong villages have been listed as Chinese Traditional Villages (Fig.2-7). Table.2-5 and 2-6 show the detailed information and geographical distribution information according to different provinces:

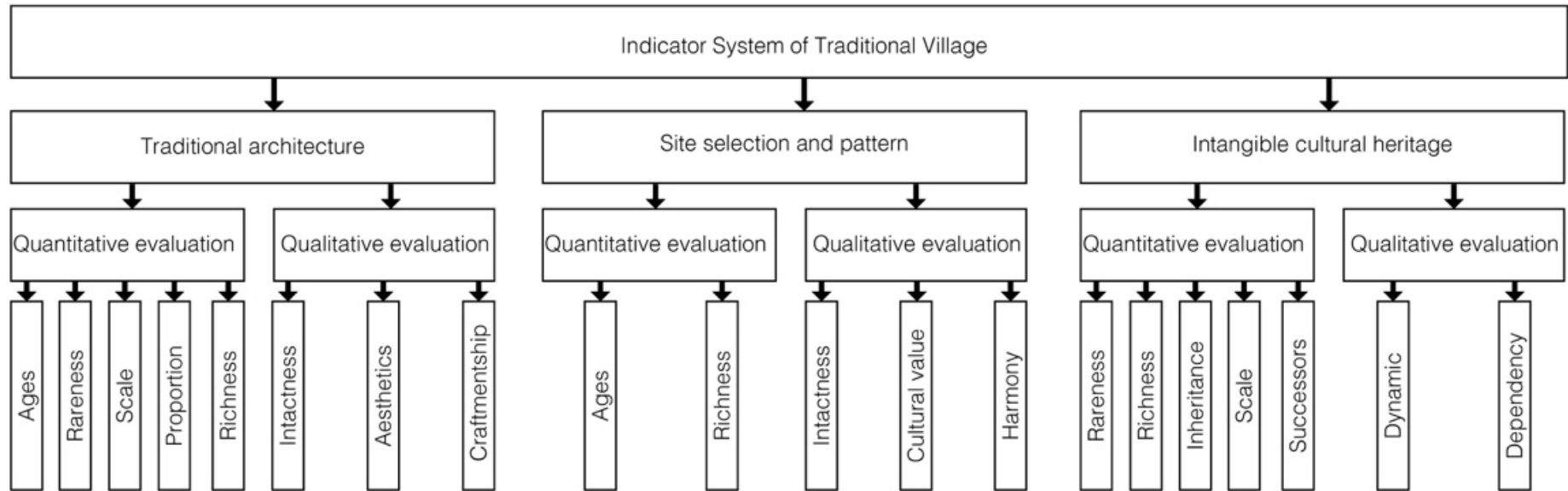


Fig.2-6 Evaluation Indicator System of Chinese Traditional Village (Draw by author)

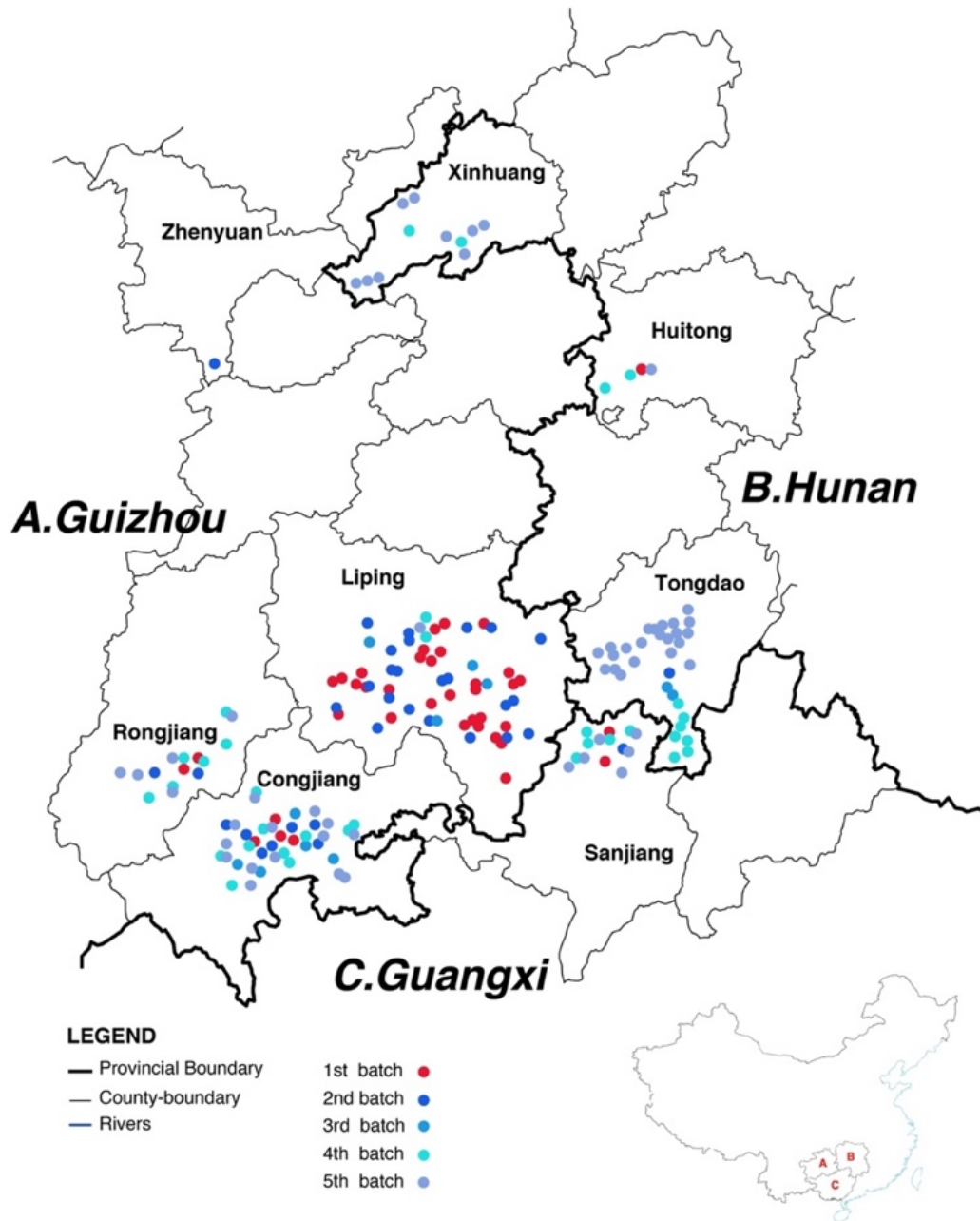


Fig.2-7 Distribution of Chinese Traditional Village System in Dong Area (Draw by author)

Table.2-5 List of Chinese Traditional Villages in Dong minority area¹⁷

Province	County	Township	Name of the Villages
Guizhou	Liping	Bazhai	Bazhai, Chanzhai, Gaochang, Gaoxing, Qingzhai, Gaoxi, Xiangqizhai
		Dajia	Dengmeng, Centao
		Diping	Cenkou, Gaoqing, Guida, Xinfeng, Xiazhai
		Jiuchao	Gaoyin, Gongzhai, Lindong, Gaowei, Dingba, New Darong, Shunzhai
		Maogong	Candong, Chongzhai, Dengceng, Dimen, Gaojin, Liufang, Zhaitou, E'dong, Zhaidong, Zhainan, Ladong, Zhaimu
		Mengyan	Maolin
		Shuangjiang	Huanggang, Sizhai, Zhaigao
		Yandong	Shudong, Yandong, Zaigong, Zhuping, Dazhai, Xiaozhai
		Yongcong	Doudong, Jiulong, Zhonglou
		Zhaoxin	Zhaoxin zhongzhai, Jitang, Jitang shangzhai, Tang'an, Zhaoxin shangzhai, Xia'ge, Xia'ge shangzhai
		Shangzhong	Jiaodong, Yangwei
		Koujiang	Yinchao, Chaoping
		Long'e	Shangdiping
		Dehua	Gaoyang, Xiayang, Biweng
	Congjiang	Wangdong	Zengchong, Zeli, Chaoli, Zengyin, Gaochuang, Xindi, Yangli, Gongzhai, Deqiu, Deqiao, Pinglou
		Guping	Yintan, Gaodiao, Liujia
		Xiajiang	Gaoqian, Gaoliang, Judong, Zhonghua
		Zhaibian	Yindong
		Tingdong	Jiali
		Gaozeng	Bapa, Xiaohuang, Zhanli, Meide
		Xishan	Dingdong, Kaweng, Qiuka, Gunlang
		Guandong	Panjingun
		Luoxiang	Dengba, Pingle, Daqiao
		Binmei	Datang, Laohuo
		Qingyun	Zhuanzhu, Guangli, Baini
	Rongjiang	Donglang	Dangxiang
		Zaima	Dali, Zaidang, Miaolan, Guiliu
		Zaigao	Piaozhai, Wanzhai, Wugong, Shoudong
		Zhongcheng	Dingnong
		Langdong	Kazhai, Gaolve
		Pingyang	Danjiang

¹⁷ According to the announcement list of Chinese Traditional Village, Ministry of Housing and Urban-Rural Development of People's Republic of China (MOHURD). <http://www.mohurd.gov.cn/>

		Leli	Darui, Benli, Baoli
	Zhenyuan	Baojing	Baojing
Hunan	Huitong	Gaoyi	Gaoyi, Wenggao, Dengjia
		Guangping	Jilang
	Xinhuang	Tiantang	Daoding
		Gongxi	Tianjinzhai
		Liangan	Huandan, Pingnan, Huanglei
		Lingchong	Dabao
	Tongdao	Pingtang	Pingtang, Gaobu, Gaotuan, Zhongbu, Hengling, Lingnan
		Shuangjiang	Yutou
		Huangtu	Huangdu Banpo
		Boyang	Shangxiang, Chentuan, Xintuan, Guantuan
		Guochong	Zhanzi
		Ganxi	Leidong
		Xianxi	Xiliu, Gongcheng, Shuiyong
		Wanfoshan	Guantuan
		Yatunbao	Luxi, Wenpo, Fengxiang, Yuanxian
		Xikou	Shanmuqiao, Dingxi, Beima, Pingtou, Mengchong, Huabi
		Longcheng	Zhangli, Laozhai
		Dupo	Diping
	Guangxi	Sanjiang	Dudong
Linxi			Gaoyou, Pingyan, Gaoxiu, Guandong
Meilin			Chezhai
Bajiang			Batun, Guida, Mapang, Zhongchao
Yangxi			Gaolu
Laobao			Laoba
Heping			Heping

Table.2-6 The statistics and distribution of Chinese Traditional Village in Dong area

Province	County	1 st batch	2 nd Batch	3 rd batch	4 th batch	5 th batch	In total	
Guizhou	Liping	31	23	4	2	1	61	115
	Congjiang	4	7	5	10	13	38	
	Rongjiang	2	2	0	6	5	15	
	Zhenyuan	0	1	0	0	0	1	
Guangxi	Sanjiang	2	1	0	5	10	18	18
Hunan	Huitong	1	0	0	2	1	4	43
	Tongdao	0	1	2	7	22	32	
	Xinhuang	0	0	0	2	5	7	
							176	

According to the statistical results, Dong minority villages listed into Chinese traditional villages directory in Guizhou Province have the most quantity and the widest distribution range; compared with Hunan Province and Guangxi Zhuang Autonomous Region, Guizhou Province is apparently dominant in the quantity of Dong minority villages. Only 3 or 4 Dong minority villages in Hunan Province and Guangxi Zhuang Autonomous Region have been listed into the directory. According to the on-site field survey, it was found that Guizhou Province's directory is a relatively comprehensive and authentic reflection of the distribution of Dong minority villages in Guizhou Province. The results of Hunan Province and Guangxi Zhuang Autonomous Region are significantly deviated from their actual conditions. Their directories fail to completely cover Dong minority traditional villages within their respective administrative jurisdictions, namely, some considerably qualified villages have not been listed into their directories. This actually reflects that there exist some problems in the actual application in the *Indicator System*:

1. The Indicator System lacks guidance in the geographical value. The *Indicator System* is used for the declaration of traditional villages across nation-wide, which adopts the uniform standard to measure the characteristics and specific conditions of the different villages within different regions, even same regions. Although there are "region-based characteristics" in the description of evaluation factors, no reference for regional value leads to an error in the evaluation results.
2. The indicators lack of a clear definition. For example, there exist some differences in the ratings of "traditional architectural structure" and "intangible cultural heritage", and unclear concepts can also lead to biased results.
4. The score value needs to be further subdivided. Among the scoring standards, the scores of several indicators are relatively high, but there is no specific reference for scoring. In the process of quantitative scoring, the evaluators' differences in specialty, knowledge level and understanding of the declared villages will lead to different cognitions over the value of traditional villages, thereby resulting in the deviation of results.

2.2.4 UNESCO World Culture Heritage Tentative List System

The organization of the Chinese World Cultural Heritage Tentative List essentially refers to the criteria and procedures of the UNESCO World Culture Heritage Committee for evaluating the world heritage. In terms of the evaluation criteria, each project must have its prominent and outstanding value on region-wide, nation-wide and world-wide scales. Its authenticity, integrity, preservation and management must be in a good condition. Such events as natural destructions, restorations, interventions, etc. that the cultural relics have undergone must be recorded in detail. The standard heritage management is required to implement some practical preservation measures.

In terms of the evaluation procedures, the Cultural Relics Protection Department of State Administration of Cultural Heritage preliminarily reviews the application materials, and then submits the project to be evaluated to Chinese World Cultural Heritage Expert Committee. The Expert Committee assigns experts who have relevant professional background and scientific preservation concept and know well about the preservation and management of the world heritage to investigate on site; also they can make a timely evaluation report on project value, the world heritage criteria, preservation and management conditions, and then submit the evaluation report to the Expert Committee for discussion. The Expert Committee discusses the evaluation report on the conference, makes a recommendation decision, assigns an expert to give the project recommendation and evaluation opinion, submits the State Administration of Cultural Heritage for examination and approval, and announces the result publicly.

According to the *Justification of Outstanding Universal Value*, Dong minority villages perfectly fit criterion (iii), criterion (iv) and criterion (v)¹⁸.

Criterion (iii): The Dong Villages contain historical information of Dong

¹⁸ refer to the <http://whc.unesco.org/en/tentativelists/5813/>

people's origin, migration and lifestyle in the region. It is a major database with large quantity of historical and cultural information and a concentrated reflection of Dong Nationality's history and culture. These historical cultures still exist and continue to evolve after more than thousand years and bear a living testimony to an ethnic minority's cultural tradition which is rapidly disappearing. It is also an important part of the world's diversified culture.

Criterion (iv): The traditional architecture of Dong Villages, especially those for public use such as the drum towers and the roofed bridges, intensively reflect the traditional Dong construction skills and the cultural landscape in the Dong settlements. The ingenious combination of the single public structure and vernacular houses in Dong Villages represents the harmonious co-existence of the village and its natural environment. The architectural elements and landscape features have been adapted and promoted in settlements of Dong people and in other nationalities' settlements, which became an outstanding example of regional architectural culture.

Criterion (v): The Dong Villages are a representative of a traditional human settlement lifestyle featuring Dong people's adaption to nature and harmonious co-existence with the environment, and also an outstanding example of Dong people's sustainable utilization of land and resources in the past nearly one thousand years. They are a manifestation of Dong people's wisdom generated during the long-term production and living, and precious heritage of traditional agricultural civilization in the mountainous area. With the violent and rapid transformations brought about by modernization, urbanization and globalization, these Dong Villages have become one of rare "cultural solitary islands" retaining the age-old tradition.

The nominated Dong villages were announced by State Administration of Cultural Heritage on November, 2012, as the 28th item of Chinese Cultural Heritage Tentative List, as shown in Table.2-7

Table. 2-7 Dong villages in the Chinese Cultural Heritage Tentative List

Province	County	Village
Guizhou	Liping	Shudong, Huanggang, Tang'an, Xiage
	Congjiang	Zengchong, Gaoqian, Zhanli, Yintan, Chaoli
	Rongjiang	Dali, Zaidang
Guangxi	Sanjiang	Gaoding, Pingyan (Ma'antun, Pingzhai, Yanzhai), Gaoyou, Gaoxiu
Hunan	Tongdao	Gaobu(Gaoshang, Kezhong, Gaosheng), Yanglan, Pingtan, Hengling, Yutou, Zhongbu
	Suining	Shangbao

Authenticity and/or Integrity are the indispensable conditions to meet the outstanding universal value, as for the Dong minority villages, the statements Authenticity and/or Integrity are the following,

Authenticity

The nominated Dong Villages have all undergone hundreds of years' development at their original locations, their spatial locations are relatively stable and the eco-environments have been well preserved. The development and expansion of the villages, dependent on the macro natural settings, has continuously maintained the authenticity of the location and environment. The public structures and vernacular houses are all built with timber and tree barks harvested from surrounding forests, employ traditional construction techniques and design, and are of classic Dong architectural form and style, thus having preserved the authenticity

of materials and substance, design and form, traditions and techniques. Significant heritage elements including the Sasui altar, drum tower, public square, vernacular houses, granaries, roads, etc., are still in use and the authenticity of use and function has been well preserved.

The authenticity of the Dong language, festivals, song and dance, medicine, crafts and other intangible heritages has been well preserved in all the nominated Dong Villages, which make the Dong village culture distinct from those of the local and surrounding Han, Miao, Zhuang and other nationalities. The social life and organizational operation of the village have largely inherited the traditional village management mode which has a history of hundreds of years, thus having preserved the authenticity of its traditional system. The aborigines of Dong Villages have retained traditions of nature worship for mountains, rivers and trees, and the ancestor worship for Sasui (famous heroine of Dong Nationality) and ancestors of “major branches”. All these manifest the authenticity of Dong people’s spirit and emotion. It is especially important to emphasize that the core of the authenticity of Dong Villages as a classic model of living heritage lies in the indigenous people and their community, and this element is the carrier of the above three aspects of authenticity. The indigenous people and their community have maintained the authenticity of the extant tangible and intangible heritages of Dong Villages, and they will continue to pass on the authenticity in the future.

Integrity

Firstly, the nominated Dong Villages have maintained their own development law that has been continued for hundreds of years, without major influences from external environment and more powerful cultures. Therefore, the integrity of the development process of Dong Villages has been well preserved.

Secondly, all the nominated Dong Villages are comprehensively comprised of necessary elements of traditional Dong Villages, including vernacular architecture, the agricultural fields, and the surrounding eco-environment, and other spatial elements, which are able to completely represent the Outstanding Universal Value of Dong Villages.

Lastly, the nominated Dong Villages are a complex cultural property integrating tangible and intangible heritages and natural environment, i.e. cultural landscape. The Dong people who have lived in the villages for generations are the main medium for inheritance of the Dong culture, and completely manifest the historical evolution, interactive relationship and dynamic system of Dong culture.

Administrative Measures for the Protection of World Culture Heritages (Order of the Ministry of Culture [No. 41]) has been adopted in the executive meeting of the Ministry of Culture on November 14, 2006, and approved for implementation, in view of protecting the world cultural heritage effectively. Article 21 stipulates: *the cultural heritages listed into Chinese World Cultural Heritage Tentative List shall be preserved and managed as per the provisions thereof.*

In fact, out of Dong minority villages listed into *Chinese World Cultural Heritage Tentative List*, most of villages or architecture complexes and individual architectures in the villages have been also listed into the preservation system of Cultural Relics, Famous Historical and Cultural Towns/ villages, and Chinese Traditional Villages(Table.2-8).

Table.2-8 Dong villages in Chinese Cultural Heritage Tentative List System that also listed in other safeguard system

No.	Villages	Cultural Relics	Famous Historical & Cultural Villages	Traditional Villages
1	Shudong	Shudong Drum Tower		X

2	Huanggang			X
3	Tang'an			X
4	Xiage			X
5	Zengchong	Zengchong Drum Tower	X	X
6	Gaoqian	Gaoqian Drum Tower		X
7	Zhanli			X
8	Yintan			X
9	Chaoli			X
10	Dali	Dali architectural complex	X	X
11	Zaidang			X
12	Gaoding			X
13	Pingzhai			
14	Yanzhai			
15	Man'antun			
16	Gaoyou			X
17	Gaoxiu			X
18	Gosheng			X
19	Gaoshang			X
20	Kezhong			X
21	Yanglan	Yanglan Drum Tower		X
22	Pingtian		X	
23	Hengling	Hengling Drum Tower		X
24	Yutou	Yutou architectural complex	X	X
25	Zhongbu			X
26	Shangbao			

The buildings listed in *Chinese World Cultural Heritage Tentative List* also should be compiled into the “World Cultural Heritage Master Planning” by the provincial People’s Government organizations at all levels in accordance with the requirements of *Administrative Measures for the Protection of World Culture Heritages* for the preservation and management of the world cultural heritages, but the specific

management requirements and protection approaches have not been promulgated yet.

After recognizing the different safeguard systems implemented on Dong architecture, obviously, the targets of Dong minority architectural heritage preservation under the state safeguard system are crossed-repeated. Dong minority architectural heritage includes the individual architectural structures listed in the cultural relics protection entities at all levels, such as Famous Historical and Cultural Villages, Chinese Traditional Villages, even the heritage in Chinese World Cultural Heritage Tentative List. Moreover, some heritages have been listed into the implementation scope of other preservation projects, such as “ethnic cultural village”, “ecological museum”, etc. Taking Zengchong Village, Congjiang county of Guizhou province as an example, the Zengchong Drum Tower is protected as national cultural relic, and the whole village is under the safeguard system of Famous Historical and Cultural Villages, as well as the World Cultural Heritage Tentative List (Fig.2-8).

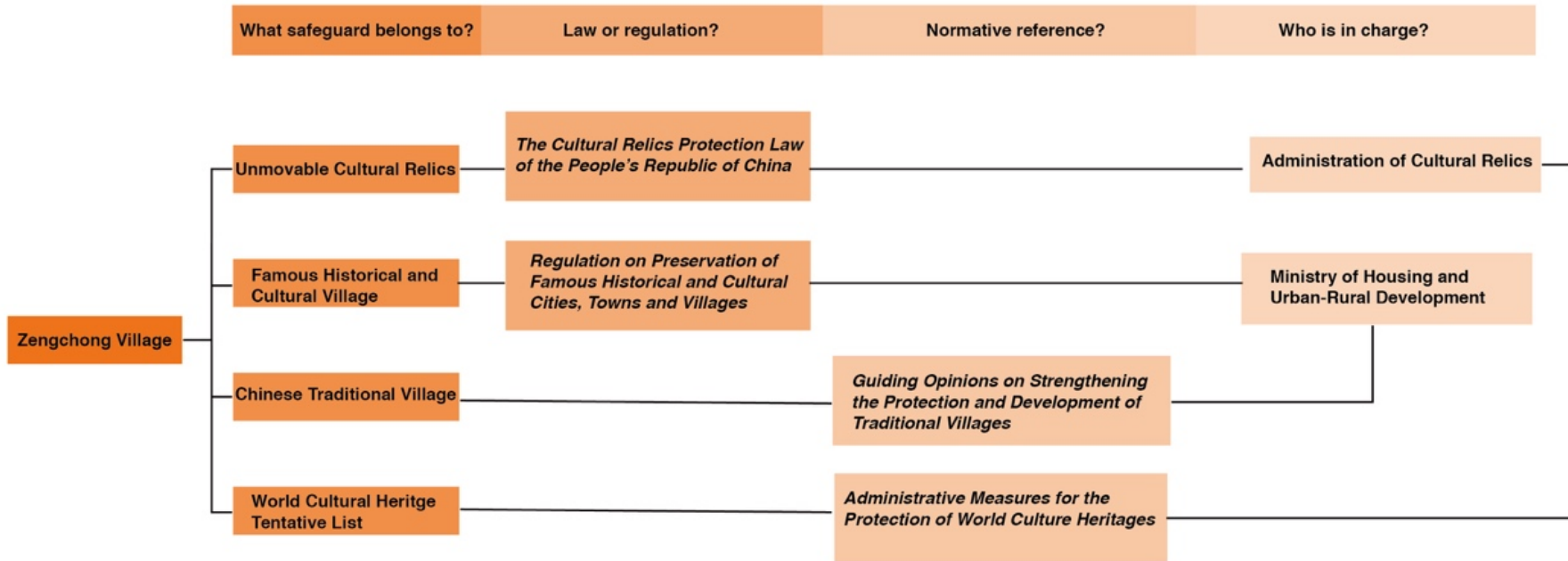


Fig. 2-8 Zengchong Village under different safeguard systems(Draw by author)

Dong minority architectural heritage, due to comprehensive influences from such kinds of behavior as preservation, planning, construction and management, has different evaluation criteria, preservation-related laws and regulations, and methods and requirements for compiling master planning. In terms of industrial centralized management and administrative relationship, Dong minority architectural heritage is managed by different government sectors. As far as the status quo of provincial-level sector management is concerned, the centralized management organization of cultural relics and “Chinese World Cultural Heritage Tentative List” is the Provincial Administration of Cultural Relics, while the industry regulatory authority of Famous Historical and Cultural Villages or Chinese Traditional Villages is Ministry of Housing and Urban-Rural Development. The crossing of the above-mentioned relationships indicates that status and role of architectural heritage in the preservation system have not been defined and classified accurately. Its primary cause is that the preservation of Chinese architectural heritage at the village level is at an initial and exploration stage.

2.3 Assessment of protected level

After discussing the safeguard system mainly based on the scope of the village, it's crucial to recognize how the protected level of architectural heritage is determined? Due to the lack of specific provision for the rating Drum Tower, the following assessment methods are explained in a general way. In this, lots of problems have shown up.

2.3.1 Assessment of significance

Principles for the Conservation of Heritage sites in China (revised 2015), which is issued by ICOMOS China and approved by the State Administration of Cultural Heritage, states Article 19 of Chapter 3:

“Formal proclamation. Sites are managed by government according to

their level of protection as determined through an assessment of significance...”

The assessment of significance is the process of clarifying significance, as well as of determining the relative status of assessment targets in the system on a scientific and operable level. Such relative status is recognized through comparison; therefore, it is inevitable to build a uniform standard to compare and measure different concrete assessment targets, that is, *assessment indicator system*, including intrinsic assessment of significance and reutilization assessment of significance of the architectural heritage. However, China adopts a uniform assessment system, without consideration of local characteristics, which is going to be demonstrated in the following narration.

1. Assessment indicators for intrinsic significance of architectural heritage

In terms of the architectural heritage, the most essential assessment of significance contents is relative to intrinsic significances of architectural heritage, such as historical and cultural, artistic and aesthetic, technological and scientific, etc. Currently, Chinese grading system of preservation for the architectural heritage is the assessment of the above-mentioned significances. In concrete, in the assessment of significance and in the assessment process, there exist some defects, for example, insufficient definition of assessment bases, insufficient application of vertical and horizontal comparative research methods, etc. According to the conclusions on the heritage significances in the *Convention Concerning the Protection of the World Cultural and Natural Heritage* enacted by UNESCO, the intrinsic significances of architectural heritage mainly include: historical and cultural significance, aesthetic significance, technological and scientific significances, etc.

i. Historical significance

The assessment of historical significance shall consider such factors as time, event and character, and authenticity of historical information. The significance of time is supposed to be “the older, the more precious” based on the occasion of preservation of Chinese architectural heritage. For example: presently earliest and most

long-lasting heritage on a nationwide scale, regardless of other factors, must be a national level heritage. Firstly, “time boundary” is the most primary factor of currently domestic primary grading criteria. Secondly, the significance of historical characters and historical events related to architectural structures contributes to its historical significance. The authenticity of historical information focuses on the five indicators: location, design, background environment, material and processing technique¹⁹. Most important are authenticity, richness and uniqueness of historical information. As far as Dong minority area is concerned, the historical significance also includes the craftsmen’s works, architectural technologies and arts, etc. which can reflect the regional culture.

ii. Aesthetic significance

The “typology comparison” research methodology is used to determine significance grading. Main methods include: same type comparison, same region comparison, same era comparison, etc., through which the complete knowledge on the artistic significance of heritage is acquired within limits. The members who evaluate the artistic and aesthetic significances are some experts at art history and aesthetics research.

iii. Cultural significance

The assessment of cultural significance is mainly based on the following factors: if architectural structure is regional landmark; if architectural structure is cultural symbol of minority area. Besides the expert opinions, we must consider intentions and emotional needs of affected resident and community groups, namely, collective memory recognized by the village where the architectural structures are located. Moreover, there are some tangible carriers for intangible cultural heritage or common folk custom.

iv. Technological and scientific significance

This significance grading depends on architectural technology, technical

¹⁹ Chen W., *The Study on the Conservation Theory and Method of Heritage*. Doctoral dissertation of Chongqing University. 2006. P201.

achievements and current preservation status of remaining structures. The comparison method also can be used to evaluate its significance grading.

2. Assessment indicators for reutilization significances of architectural heritage

In terms of China's current master planning, the crucial problem that the architectural heritage has to face and solve urgently is the utilization mode of architecture related to economic effect. The reutilization assessment of architectural heritage is to determine reutilization potential of architectural heritage under new development trends through assessment.

i. Reutilization of architectural heritage

Its significance grading depends on such factors as overall structure, quality reliability (safety, applicability and durability), integrity, etc. of architectural structures. The application scope of future function replacement can be determined through inspecting structural conditions and bearing capacity of ancient architectural structures. Nevertheless, the function replacement of Drum Tower, as cultural and public architectural structure of Dong minority, will devastate spiritual symbol and cultural representatives of Dong minority.

ii. Social significance

Through survey and research of indicators, such as environment, economy, etc. of the region where the architectural heritage is located, the significance grading depends on social and economic benefit of the architectural heritage. For example, the architectural heritage has other contributions: if it could increase urban tourist income; if it could support community interest; if it is of great significance to improve landscape quality of the streets. It mainly serves as macro-control grading management of government planning and cultural relics protection authorities. The reutilization feasibility research of each project will be deepened according to concrete purpose on the afore-mentioned basis.

The author believes that converting assessment of significance into "price" assessment is a kind of post-modern context: the assessment of significance

becomes a kind of rational price assessment. Its purpose is to serve the cultural industry logic. Such assessment of significance has lost the original concept of significance. The inevitable result of significance relativism is transferring to “significance nihilism”. In order to solve practical problems, significance inevitably becomes “quantized” price.

2.3.2 Process and method for assessment of significance

The assessment method for intrinsic significance of architectural heritage is relatively simple, focusing on proper “grading principle and scoring criteria”. Taking assessment of historical significance as an example, according to China’s current assessment criteria and current state, the architectural structure is divided into four grades: First Grading, architecture with the primary structure before Ming Dynasty, or the modern architecture with major historical significance and rich documentation; Second Grading, architecture with the primary structure during Ming or Qing Dynasties, or relatively rich historical significance; Third Grading, architecture with a modern primary structure, or a contemporary architecture with certain historical significance; Fourth Grading, relatively influential contemporary architecture in the society or in the architectural development history from the foundation of People’s Republic of China (1949) to 1970s. The evaluators are composed of experts, such as art historian, archaeologists, cultural theorists, architects and cultural relics restorers. The principle of assessment is to distribute questionnaire, score separately, and summarize comprehensively (Table.2-9).

Table.2-9 The assessment system of intrinsic significance

Significance	1st grading	2nd grading	3rd grading	4th grading
historical one	architecture with the primary structure before Ming Dynasty, or the modern architecture with major historical significance and rich documentation	architecture with the primary structure during Ming or Qing Dynasties, or relatively rich historical significance	architecture with a modern primary structure, or a contemporary architecture with certain historical significance	relatively influential contemporary architecture in the society or in the architectural development history from the foundation of People's Republic of China (1949) to 1970s
Aesthetic one	International standing	Domestic standing	Regional representative	Regional feature
Cultural one	International standing	Domestic standing	Regional standing	no
Science and technique one	Perfectly preserved and great creation	Well-preserved and representative	Fairly-preserved and with technique feature	Poorly-preserved and with little technique feature
Score	100-80(A)	80-60(B)	60(C)	Below 60(D)

As shown in the table, it is not suitable for vernacular buildings. For example, firstly, in the item of “historical significance”, “a rich documentation” is a key assessment factor, however, as for Dong and lots of rural buildings, this is not possible to obtain. Secondly, in the items of “aesthetic and cultural significance”, as far as the author has convinced, the rural buildings hold an opposite request for grading, thus, a “regional feature” is a more crucial factor to a rural building rather than an “international standing”. This is what is shown by the general assessment system if intrinsic significance is not suitable and applicable to the Dong or other vernacular architectural heritage.

The first step for reutilization assessment of architectural heritage is to determine the regional “assessment indicator weight”:

Due to wide distribution and big regional differences of Chinese heritages, it is of great significance to distinguish the indicators for constituting the factors of architectural heritage reutilization under specific regional characters and development modes in different regions. For example, in terms of traffic conditions, the underdeveloped Dong minority area is not as good as the developed South China region; therefore, the weight of the traffic conditions in Dong minority area shall be lower than in South China.

Hierarchical weight decision analysis method (Chen, 2006) is used to determine the weight. According to the difference of required assessment projects, such method is to select a certain number of members who knows well about the project indicator content, and have suitable representatives (including preservation experts, restorers as well as urban planning and management personnel, investors and public representatives) to score the weight, retrieve effective forms and obtain the mean weight based on the method of solving the absolute mean significance, and obtain the ratio of each indicator in the whole indicator system based on the (from top to bottom) layer-by-layer continued multiplication method.

Through the above-mentioned methods, the ratio of assessment indicator for the specific area to the heritage reutilization assessment in this area is obtained. In the following, the architectural structure is evaluated through a building an assessment

form. The method of building the assessment form is to list the content in the architectural heritage reutilization assessment indicator system as an assessment project (for example, beam, frame structure, foundation, Dou-gong[wooden bracket elements]), etc. and then determine the grades, which are: below 60(D), 60(C), 60-80(B) and 80-100(A) four classifications (Table.2-10).

Table.2-10 Assessment of reutilization significance^{20,21}

Content	Assessment criteria			
	80-100(A)	60-80(B)	60(C)	Below 60(D)
Foundation	Well-preserved, without split, checking, crack or sink.	Minor damage, load-bearing available	Obviously damaged, upper structure might be deformed	Seriously damaged and deformation, load-bearing unavailable
Column	Without split, checking, crack or inclination, joints tie stable	Minor split, checking, crack or deterioration, inclination below 3% of column height	Split, checking, crack below 1/3 of column height, depth below 1/2 of diameter of column, inclination below 5% of column height	Seriously decayed, inclination over 8% of column height
Beam	Without deterioration or breakage, joints tie stable	visually slight decays on the surface, its depths are no more than 2mm, no impact on mechanical properties of wood.	Decay's depths are around 5-10mm, and obviously impacts on mechanical properties of wood. Joints	Seriously decayed, joints untie over 5cm

²⁰ National Standard of P.R.C, *Method for field test of natural durability of wood (GB/T 13942. 2-92)* .1992

²¹ Re-edited by author based on Chen W., *The Study on the Conservation Theory and Method of Heritage*. PhD dissertation of Chongqing University. 2006. P206

		Joints untie blow 2cm	untie below 5cm	
Lintel	Idem	Idem	Idem	Idem
Dou-gong	Idem	Idem	Idem	Idem
Storey height	>3m	2.7m-3m	2.4m-2.7m	Below 2.4m
Area of ground floor	>500m ³	200m ³ -500m ³	100m ³ -200 m ³	Below 100 m ³
Material	Wooden structure totally	Wooden structure and masonry structure	Masonry structure generally	Masonry totally
Infrastructure	Water supply and drainage in good condition	Water supply and drainage in basic condition	Without drainage system	Without water supply and drainage system
Located region	Historical city	Historical town	Small town	Remote town
Zone	Historical center	Normal urban zone	Suburban zone	Remote zone
Landscape	Well preserved	Not perfectly preserved	Moderate preserved	Poor preserved
Environmental setting	Harmonious	Not perfectly harmonious	Moderate harmonious	unharmonious
Urban transport	Vehicle, train, flight	Vehicle, train	Coach	Non-motor vehicle
Public transport	5 mins from urban road	10 mins from urban road	15 mins from urban road	At least 20 mins from urban road

Finally, the integrated assessment of intrinsic significance and reutilization significance of architectural heritage provides a basis for determining the preservation grading.

Apparently, Dong Drum Tower, as a vernacular heritage as well as a public building in a Dong society, is remote from the criteria of the assessment of reutilization significance. Hence, it's inevitable to ignore numerous Drum Towers with great significance that should have been involved in the relevant protected level.

Moreover, the assessment system remains a big problem: it regards the Drum Tower as a general cultural relic without recognizing the vitality of the living heritage. It is treated as a "dead" relic or a "living dead", which has resulted in an excessive tourism and relevant problems. Therefore, the preservation of Drum Tower is still under a serious debate.

Part II Preservation of Dong Minority Drum Tower

Chapter 3 Dong Drum Tower at Risk

The reference literature and archives of this research highlighted how only a small number of studies have discussed the current risks of Drum Towers. However, limited information provided by edited sources and documents revealed that this topic is a blank area although deserving to be investigated. Based on the field survey, the actual condition of Drum Towers is not good, as they are suffering from fire risks, alterations, defects, deteriorations mechanical failures and bad interventions. In this problem, both, the definition and the analysis are insufficient. Basic questions are:

What kind of problems are Drum Towers suffering?

What kind of interventions have occurred through history?

Were the interventions appropriate?

How is the preservation situation of Drum Towers, some of which are that protected at a specific level, while others have no protection?

Dose the intervention quality match with the protected level of Drum Towers?

As previously discussed the critical issues concerning the insufficient historical archives, the in-situ survey and interviews tend to be the optimal approach.

In addition to preserve and study the existing historical Drum Tower, the rebuilt Drum Tower should also be studied. Apparently, the reconstruction is the last option from the preservation point of view. But why do local people rebuild the Drum Tower and protect them as well?

i. Concept of time

In western concept, in general, according to the Islamic and Judeo Christian view, the time is linear, beginning with the creation by God, and terminating with the end of present order of things (Gastelli, 2015), with a unique process stretching infinitely. In eastern concept, instead, time is not linear but circular, a process that combines together repetition and transformation, that suggests history repeats itself over

time(Fig.3-1). A clock is not a timeline but a circle and it has no beginning or end, in a similar manner, days and years are circular as well.

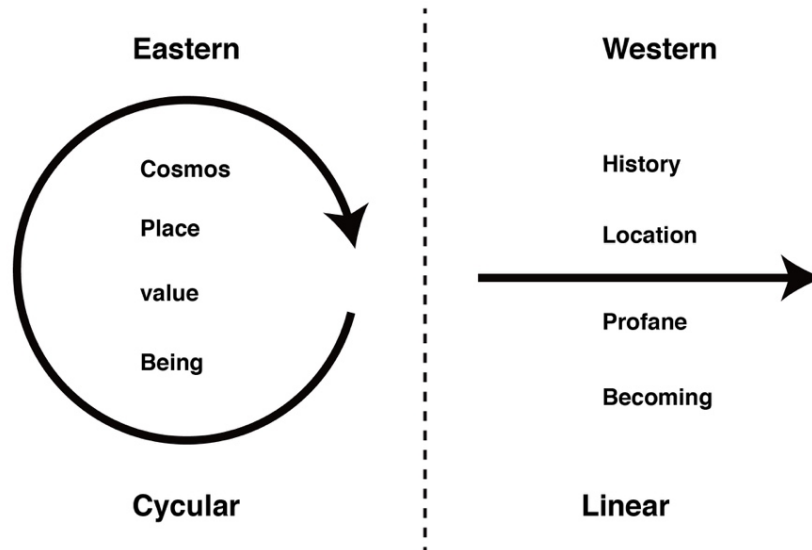


Fig.3-1 Different conception of time between east and west (Draw by author)

From the perspective of circular concept, the “fate” of a building will change along with time, therefore, the building itself is no longer the key essence along the process: the foundation is not the beginning while the destruction is not the ending, but a continual cycle of beginning and ending where nothing is unique anymore.

As aforementioned, the western concept of time is linear, a continuous process that suggests a good connection between past, present and future. Therefore, the western society needs to trace the past and the future. Unlike Chinese concept, an equilibrium at present is rather more important than contemplating disorder in the future. It is convinced that nothing would destroyed once and just for once the previous order would split apart. Cosmos would adjust everything into a new equilibrium as an eternal circular process where life goes, birth and death, up and down, building and rebuilding. Therefore, the Chinese concept is based on the present. Chinese language is a best evidence that we could not cope with the idea of past or future, as the Chinese use only the present tense, it does not have either past or future, but it

describes them with a simple additional preposition, being totally different from Latin languages.

The deliberate act of keeping cultural heritage from the present for the future is known as preservation (American English) or conservation (British English)²², though these terms may have more specific or technical meaning in the same context of other languages. In the terms of restoration, of ideas and meanings often different and sometimes contradictory, a unifying factor still now recognized is that restoration is a particular type of project/ intervention operated on pre-existence that is accredited historical (monument and/ or document) evidence of past value. Thus, in the sense of western concept it is replaceable and unrepeatable for the reason that time and culture are not possible to reproduce. Apart from the factor above, restoration depends on many other factors related to time, history, culture, knowledge, experience, identity, interest, etc.

There is no competition between these two remarkably different civilizations of western/ European and Eastern/ Chinese culture, but only the need of showing the diversity of concepts and thinking. Certainly, it is not exhaustive to only attribute the protection of rebuilt Drum Towers to the differences in the concept of time. However, from another side, it is explained that we do have different approaches and considerations under the same preservation issue.

ii. Protecting reconstruction versus protecting nothing²³

Drum Tower is a fully-wooden structure, for which the fire accident has never completely erased despite the fire-resistant technology increasingly processing in the “modern world”. Almost one Dong village was attacked by fire accident one time a year over the last five years. The Drum Tower will and always receive the first aid supported by the local village and authority.

Since Drum Tower is the cultural identity of Dong people, a traditional Dong village cannot lose the Drum Tower at any condition, is their physical and mental “home”.

²² Refer to https://en.wikipedia.org/wiki/Cultural_heritage

²³ See <https://www.tandfonline.com/doi/full/10.1080/15583050601126095>.

As for the authority, if the burned Drum Tower was under a specific protected level, then the rebuilt one will also be protected. On the one hand, although, a new Drum Tower is a “fake” historical building, a protected rebuilt Drum Tower could even convey more physical, mental and architectural value to local people as well as to the public rather than a burned ruin. For example, Yakushi-ji, one of the most famous imperial and ancient Buddhist temples in Nara, Japan, was attacked by a fire accident in 1528, only the east pagoda remained, the main-hall was rebuilt in 1977 (Fig.3-2) and the west pagoda (Fig.3-3) was rebuilt in 1982, the two rebuilt buildings were constructed in a historical morphology but using steel and concrete. However, Yakushi-ji is still protected as a UNESCO World Heritage Site since 1998. Although they are totally “fakes” without any value, but for conveying the Japanese system in Buddhist temple, the Buddhist ritual or the architectural and aesthetic value, the effect would not worse than a “real” one, at least not worse than the Yakushi-ji with only east pagoda remained. From 1976 to 1985, the restoration project was held in the Mountain Resort in Chengde and outlying eight temples (UNESCO World Heritage Site), China. Some destroyed buildings were rebuilt, and the construction approach was used in a traditional material and structure. The public reaction was better than protecting the ruins. Moreover, the Soviet, Poland and France have rebuilt lots of historical buildings after the second world war, some of them have remarkable values estimated the public. All of them are “fakes”, but brought a true effect (Wang, 2015).



Fig.3-2 The rebuilt main-hall in Yakushi-ji (Source: Wikipedia)



Fig.3-3 West pagoda in Yakushi-ji (Source: Wikipedia)

On the other hand, traditional craftsmanship is no longer completely applied in new Drum Towers due to the vanishing traditional technique and cost-benefit performance. Besides, there are no relevant guidelines or regulations, the “fake” could be produced without any institutional control. Nevertheless, a different cultural background has resulted in different approach and request toward the reconstruction, Chinese prefer the intact, harmonious and elegant appearance, there is an old saying usually applied in the preservation of cultural heritage field: “After rebuilding the temple should decorate the old Buddha a golden painting.” The brand-new elements or even buildings are generally preferable to Chinese. Since the historical and new elements intertwined together in a Drum Tower without distinguishability, the interventions are hardly readable and recognizable. Nevertheless, people still treat them as the protected historical buildings.

3.1 Fragile Drum Towers: recurrent problems

3.1.1 Fire risk

Drum Towers are fully wooden structures, so fire is always a risk. Approximately at least one Dong village has experienced a fire every year over the last five years. Fireplaces pose the primary risk for Drum Tower fires. The fireplace is usually located in the center of the ground floor of the Drum Tower, which serves as an assembling place for ritual activities, but also for everyday life. The local villagers customarily use an open fire to both celebrate during festivals and to provide heat for the whole village in winter. Generally, every family in the village takes turns providing firewood for the fireplace to keep the fire burning for the whole winter. However, this open fire is not surrounded by fire-proofing protection. Some fireplaces are set on the second floor and surrounded by a wooden floor, which poses a considerable risk (Fig.3-4). Due to the limited availability of land resources in mountainous areas, Drum Towers and other wooden buildings tend to have a compact layout, which means that when fires break out, the whole village could be engulfed. Although some

Drum Towers have a pond nearby, or a few protected Drum Towers have a fire extinguisher inside, most of the Drum Towers usually lack water resources nearby for the initial stages of firefighting. Hence, the Drum Towers are extremely at risk of damage and destruction due to fire risk.

Besides, Dong people constantly sit by the fire place whenever in festival or ordinary day. Especially the fire place will be ignited for the whole winter for warming people and the Drum Tower. Over time, the exposed timber components are getting dark or even charred by the fire and smoke (Fig.3-5). The wood cell-wall components start to break down at about 200°C and flammable gases methane and carbon monoxide are released. If a fire is established, ignition of flammable gases will occur about 250°C with timber chars. However, the wood is not a good heat conductor and char surface may serve to insulate the interior timber if direct exposure to the flame is not prolonged. Hence, the structural elements that are exposed to the smoke from fire place are still working but have a dark or charred layer. Nonetheless, the char surface cannot be served as a long-term insulator, and progressively the wood will be on fire if no treatment is done.



(a)



(b)

Fig.3-4. Fireplace at risk (Photograph by author, 2018)

(a). fireplace on fire during the festival; (b.) fireplace surrounded by a wooden floor.



Fig.3-5 Dark and char timber (Photograph by author, 2018)

Secondly, aged and disorganized electrical wires negatively affect the appearance of the Drum Tower but also are dangerous (Fig.3-6), and short circuits are a common problem. A short circuit could occur during the misuse of the electrical system, which may cause circuit damage, overheating, or fires.



Fig.3-6 Aged and disorganized electrical wires (Photograph by author, 2018)

Thirdly, the traditional lightning rod on Drum Towers is a decorated by metal post placed on the top of the roof to provide protection against lightning strikes. However, many Drum Towers lack of wires to conduct the energy to the ground, so lightning strikes pass through the wooden structure, posing a fire risk.

From 1999 to 2019, 25 accidental fires occurred in Dong villages. The Dali Drum Tower, one of the historical buildings protected at the national level, burned down in the 1920s and was rebuilt in 2005. Fires not only destroy the valuable historical buildings and landscape but also considerably disrupt the socio-cultural activities in the communities

Considering that the risks could be arranged according to a priority classification, the fire risks pose the historical Drum Tower in the greatest danger among other risks. Therefore, the local response to fire risks will be explained in the following.

1. Local authorities' response to fire risk in Dong area

- i. Safeguard of fire safety at national level

The primary concern of the government is the fire safety, due to the inherent vulnerability of traditional wooden building to fire risk. In the last 20 years, several accidental fires have frequently attacked the historical buildings in the village, causing great loss. Hence, the Fire Department of Ministry of Public Security, the State Administration of Cultural Heritage jointly issued the *Fire Prevention Technical Guidelines for Historical Towns and Villages* in April 2014. It introduced technical guidelines covering five aspects of fire prevention, including fire safety evaluation, fire mitigation plan, building fire safety, fire-fighting facilities, and fire hazard control²⁴. Of the ten guidelines concerning building fire safety, two approaches are recommended to improve the fire-resistance of wooden buildings. The first proposal is using non-combustible materials or fire-retardant materials when rehabilitating or renovating the buildings. The second proposal is for the dwellings, and suggest to build the gables higher than the roof by using non-combustible materials. However, the first suggestion did not explain any specific measures for improving the fire-resistance of

²⁴ http://www.gov.cn/xinwen/2014-04/09/content_2655772.htm HP of Chinese Government.

wooden buildings without substituting the original materials, for example the practicable fire-retardant treatment. The second suggestion tends to be limited in concerning the diversity of different regions. For example, the Drum Tower or even the historical wooden dwellings in Dong area are negatively-suited to brick gables higher than the roof. Moreover, the structure is not capable of supporting a brick gable.

While the fire safety regulations at national level provide several guidelines for historical buildings and their villages. However, the specific methods for improving the fire-resistance of wooden buildings remain unclear and untargeted.

ii. Safeguard of fire safety at provincial level

Guizhou provincial government issued *Fire Protection Regulations* in 2002, Hunan provincial government issued *Guidelines for fire-resistance of historical buildings(trial)* in 2015 and Guangxi provincial government issued *Suggestions on Strengthening Fire Protection Measures for Wooden Structures in Minority Villages* in 2016. All the authorities encourage the local villagers to renovate their residential buildings using fire-resistant materials, but no detailed references or guidelines were listed. Thus, the safeguard of fire safety for historical buildings at local level have either no guidelines or rules to refer. The cause of the fire accidents can be attributed to the compact layout of village without any fire-breaks, the traditional life style of using open fire and insufficient water resource nearby, etc. Regarding this situation, for instance, Guizhou provincial government plans to implement a program of “Five improvements”, which aims to replace the open fire with a brick oven, to update the aged electrical wires, to improve the wooden buildings into brick or other fire-resistant materials, to create fire-breaks in compact wooden villages, and to improve the water system to ensure the sufficient water resource.

However, according to the field survey, the local villagers still use the open fire-place in Drum Tower or use induction cooker in their own house instead of brick oven. Since mostly the elders and children remain in the village, the brick oven is too big for most families. Moreover, no additional water storage or other system was set up for providing sufficient water resource near to the Drum Towers.

2. Local villagers’ response to fire risk in Dong area

As stated above, Drum Towers are constructed purely from highly flammable Chinese fir without any fire-resistant coating. Although a wooden frame of Drum Tower is covered with gray tiles, any fire-resistant coating is lacking.

This research has carried on a questionnaire to interview the reason for that, it was found out that 48% of the villagers responded that the financial support from local authority is limited, and 23% claimed that they lacked knowledge for fire-resistance, 15% of them considered that no preservation or improvement action is needed (Fig.3-7).

Local villagers' response to fire risk

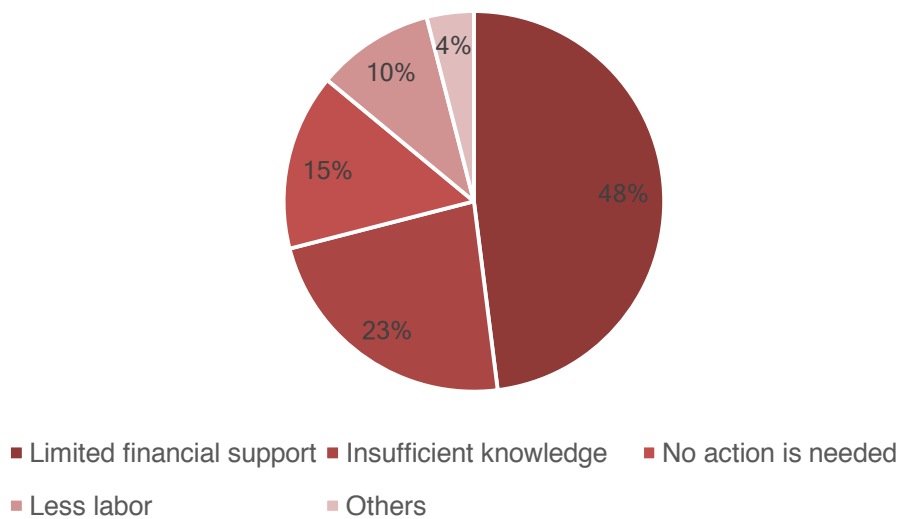


Fig.3.7 Local villagers' response to fire risk (Draw by author)

In 2018, the per capita disposable income of the rural villages in Southeast Guizhou was a mere Euro 1,199²⁵, compared to the average income of Euro 1,672²⁶ among the rural areas in national-wide. Therefore, financial limitations are common in Dong area. Regarding another side, limited knowledge of the building technology for avoiding or solving the problems, especially the main fire risk, is available and the local villagers have no guidelines to refer.

²⁵http://www.congjiaing.gov.cn/zwgk/xxgkml/zfxxgkml/ghjh/gmjjhshfzgh/201903/t20190327_3411550.html HP of Congjiang county government, 2018.

²⁶ http://www.stats.gov.cn/tjsj/zxfb/201902/t20190228_1651265.html National Bureau of Statistics of the PRC, 2018.

Regarding the perception of no need of preservation or improvement. It was analyzed above that villagers consider that the circular conception plays a dominant role in the villagers' perception of facing risks. The Dong minority has been used to the continuous migration and disasters throughout the history, which means they have no perception of the tradition of pursuing permanent buildings. Moreover, according to the local regulations made by villagers, which claimed that the one who pose fire unconsciously or consciously that affect the Drum Tower or neighbor's buildings must be seriously punished by the "village board". Therefore, the local villagers, especially the elders, who insist that fire prevention awareness is much more crucial and effective than preservation and maintenance, since they have no knowledge about avoiding fire risks and improving fire resistance of the historical wooden buildings.

3.1.2 Alteration

The definition and term is referred to the standard, UNI 11130: 2004 - Cultural heritage

Wooden artefacts - Terms and definitions concerning wood deterioration:

Any kind of modification to wood (biological, mechanical, chemical) or to

metallic materials occurring after installation.

Alteration does not necessarily imply a worsening of the characteristics of the wood, but natural modifications caused by environment, like the sunlight, wind, etc. Therefore, for the circumstance of Drum Tower, the alterations can be divided into change in color, dust and smoke deposition.

i. Change in color

Many of the chemicals of timber elements have some color and also that can be easily oxidized and form a new chemical with a different color. Since timber elements are exposed to air and sunlight, the exposure can result in rapid oxidation. Natural change of components that define color and weathering are often present on entire external wood surface.

ii. Dust and smoke deposition

Due to the constant use of fire-place by Dong people, the exposed timber elements are gradually impacted by the smoke. Limited darkening takes place with a general unattractive appearance, usually due to the presence of superficial material.

3.1.3 Defect

Defect implies wood features which can negatively influence strength and stiffness, and/or the general structural behavior (e.g. the efficiency of joints) of timber members. Defects include knot, splitting and checking, etc. Generally, knot is one of the defects that could provoke dangerous conditions, like slope of grain. And insects and fungi will attack them. However, knot is not considered as one of the defects in Drum Tower because of two reasons: firstly, their presence, extent and distribution have not been accounted for in terms of influence on strength, based for instance on some sort of visual grading approach according to the field survey; secondly, as afore-mentioned in section 1.3.1, local carpenters prefer to use the green wood with small knots. Although it is controversial actions, the prevalence of compressive and shear stresses could even take advantage of knots in the structural frame of Drum Tower.

Shrinkage is a natural phenomenon in wood that can lead to splitting and checking, it occurs because wood is a hygroscopic and anisotropic material, so the moisture content of timber changes in response to daily and seasonal changes in the relative humidity (Fig.3-8). When the air is humid, wood absorbs moisture and swells; when the air is dry, wood loses moisture and shrinks. Splitting and checking can occur in longitudinal, radial, and tangential directions. They are very different in the three directions, and less important in the longitudinal direction.



Fig.3-8 Splitting and checking on elements (Photograph by author, 2018)

(a). splitting on column; (b). checking along the connection of elements

Splitting and checking occur in Drum Towers distributed on the upper and lower surfaces of joint where connection between tie-beam and column is present, and expand along the depth direction(Fig.3-9). Splitting and checking could cause a reduction of resistance and can pose serious risks to the whole structural frame.

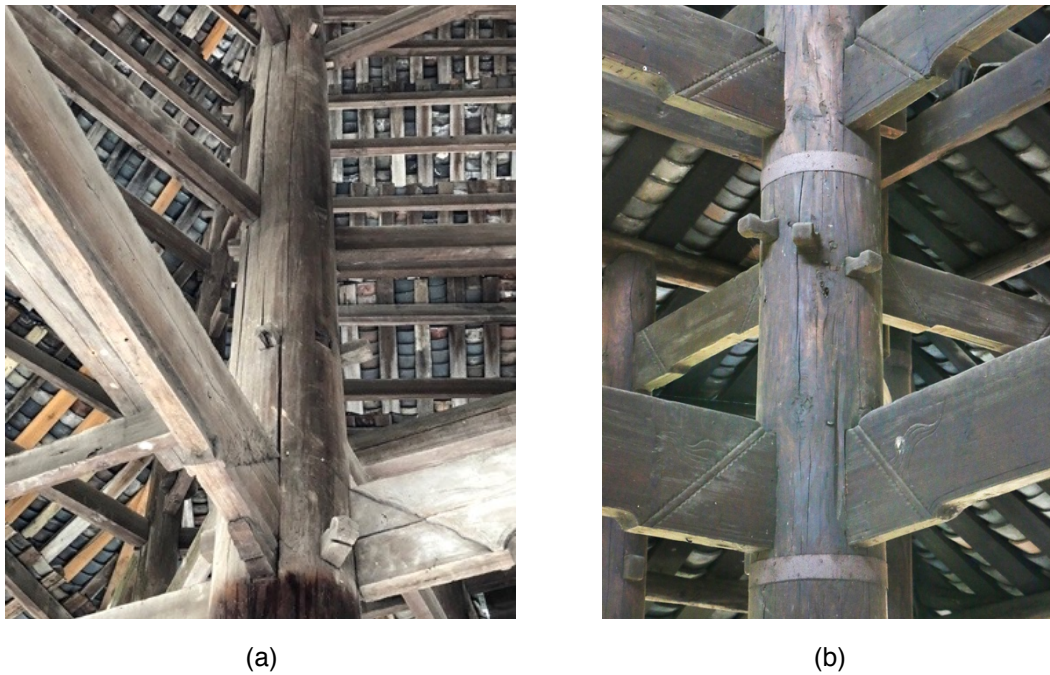


Fig.3-9 Splitting along the connection of column and tie-beams (Photograph by author)

(a). Jitang Drum Tower, Guizhou; (b) Yashang Drum Tower, Hunan

3.1.4 Deterioration

As the definition and term is referred to standard, UNI 11130: 2004 - Cultural heritage Wooden artefacts - Terms and definitions concerning wood deterioration, it means:

Modification of wood, of different origins, which in any way worsens its characteristics (in particular, but not exclusively, the mechanical ones). In general, it can be caused by chemical, physical, mechanical, biotic agents and / or their combinations.

Deterioration occurred in Drum Towers are not only caused by biotic agents, including insects, fungi, etc. but also physical or mechanical agents. Therefore, deterioration can be divided into insect attacks, rot (fungi attacks), lacuna (it could be caused by rot), detachment (usually caused by insect and fungi attacks) and discoloration.

i. Insect attacks

The timber elements of Drum Towers are sometimes attacked by various types of wood-boring insects (Fig.3-10). Many of the most destructive saprophyte insects are beetles (Coleoptera, such as *Anobium punctatum* and *Hylotrupes bajulus*); these beetles use the wood as food and an abode, boring complicated tunnels inside the timber, reducing the bearing strength. The second most destructive is the wood wasp (Imenoptera), which causes less severe damage than the beetles. The wasps generally create a hole as a nest in the surface of the timber but do not live in the wood; the hole usually is not deep and could approximately contain one wasp. Termites (Isoptera Order) are extremely serious insect pests that affect timber, causing serious damage inside the wood that is barely visible from the outside. Wood decay caused by insects can lead to progressive loss of mass, resistance to load, and hardness, as well as weakened bearing sections.

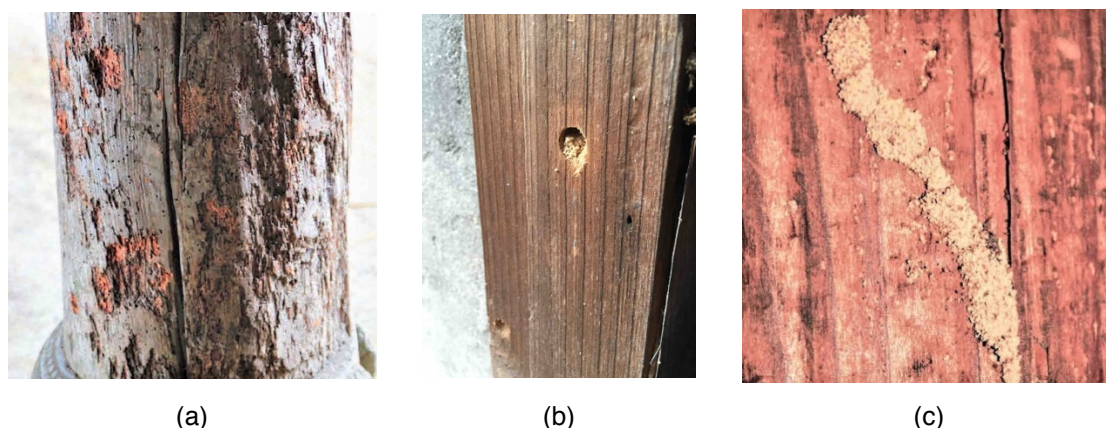


Fig.3-10 Timber elements attacked by insects (Photograph by author, 2018)

(a) attacked by beetles; (b) attacked by wasps; (c) attacked by termites.

According to the survey investigation, the main insect pests are beetles, of which *Anobium punctatum* and *Hylotrupes bajulus* are common in the Dong area. Termites were rarely found in Dong Drum Towers during the investigation. However, termite prevention activities should also be conducted.

ii. Rot

Rot is usually caused by the fungi attacks. Most of the fungi have a fine network of “roots” (hyphae) that extensively extend within the substrate and grow together and result in a visible loss of mass, resistance to load, and hardness, as well as changes in color and appearance of the wood. Fungi are present only with humidity in wood of more than 18%–20%. For Dong Drum Towers, there are two problems (Fig.3-11): the first main problem is absorption of water from the ground through capillary action (the conductive cells in wood), especially in the column without a platform that is directly in contact with the soil. Another problem is the risk of infiltration due to poor or absent tile maintenance.



(a)

(b)

Fig.3-11 Timber elements attacked by fungi (Photograph by author, 2018)

(a) attacks in the bottom of the column; (b) attacks on top of the roof

iii. Lacuna

Lacuna means a missing part that causes an empty space, obviously located in the place of some formerly existing part and it regards a portion of a wooden element.

iv. Detachment

Detachment of a superficial layer of the timber element. Prelude to loss of the layer or limited decay of superficial layer on internal or external elements.

v. Discoloration

Lots of decorated painting discolored from the wooden board below the roof. The discoloration negatively impact the appearance of Drum Tower and the value of decorative painting

3.1.5 Mechanical failure

Definition and term are referred to standard, UNI 11138:2004- Cultural heritage, Wooden artefacts- Building load bearing structures - Criteria for the preliminary evaluation, the design- and the execution of works, the mechanical failure is:

Changes of timber members or timber structures which appears as mechanical ruptures, caused by internal or external mechanical actions.

However, for the circumstance of Drum Tower, the mechanical failure is not as serious

as ruptures or cracks, but no more than disconnection. It is movement of element or of the structure, consisting of a mechanical disconnection due to internal or external actions.

The Drum Tower is a building with a wooden frame structure, and the load-bearing members are columns, main beams, and tie-beams. The roof is composed of a wooden base and construction materials such as mud, ash, and tiles. The wooden base contains rafters, slabs, and other components; the enclosed wooden board does not support the load, and is only used for maintenance and cold protection. As afore-mentioned Chuan-dou and Tai-liang are two structural typologies of the Drum Tower, the mechanical characteristics of two different types, the resulting damage to the components are different.

Tai-liang typology always applies a wooden frame with three or five main columns, the repeating and wooden frame extends horizontally to create an expanding interior space. This type of framework has excellent in-plane stability, but the number of out-of-plane columns is relatively small, and usually consists of a small number of horizontal tie-beams. Therefore, this kind of typology would possibly cause a horizontal overall tilt (Fig.3-12).



Fig.3-12 Overall tilt of Xiaozhai Drum Tower (Photograph by author, 2015)

Despite Chuan-dou Drum Tower has different roof morphology because of the structural configuration, they share a repeating wooden frame that consists of tie-beams and short columns. The structure has a strong stability. However, Chuan-dou Drum Tower usually has 5 to 9 stories, which suggest the load of upper frame is transferred to the main load-bearing elements of lower frame, that is the main columns and cross beams (Fig.3-13). Therefore, usually carpenters apply thicker main tie-beams and columns in Drum Tower.

Field survey found that there were a lot of splits and checks s along the direction of wood fiber on the main columns and short columns of the Drum Tower. The splits and checks distribute on the upper and lower surfaces of joint where connection between tie-beam and column, and expand along the depth direction. The splits and checks could be caused by the combination of shrinkage and the load of the upper frame.

As afore-mentioned Zaidang Drum Tower which applies the “removable inside columns”, the load of frame A may cause splits, checks or even cracks in main tie-beams because of the high prevalence of shear stresses. Therefore, in this kind of Chuan-dou Drum Tower, the main beams are rather thicker than other types of Chuan-dou Drum Tower.



Fig.3-13 Upward view of Lusheng Drum Tower (Photograph by author, 2015)

Above all, regardless of Chuan-dou or Tai-liang typology, the main structural elements conform to the mechanical properties of the natural wood texture, and depend on type of stress conditions. However, the stability of the structure is still inevitably confined to the different type of structural frame and mechanical anisotropy of wood. And the typical mechanical actions (spits, checks, disconnections, etc.) are mainly distributed at the joints of the tenon and mortises where the horizontal load-bearing members and the vertical load-bearing members are connected, and main columns and tie-beams. Therefore, any maintenance and reinforcement measures must first consider this problem.









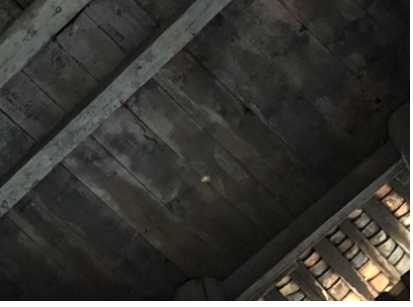
According to the field survey, Drum Towers suffered from similar risks, which mainly occur in wooden components, and also in some other components, like roof tile and decorative sculpture. Zengying and Yashang Drum Towers are both protected at a high level, Zengying Drum Tower is protected at provincial level, and Yashang Drum Tower is protected at national level, they are good examples to show the relationship between protected level and protected status. In addition, Zengying and Yashang Drum Towers are proved to be the cases that contain most types of problems.


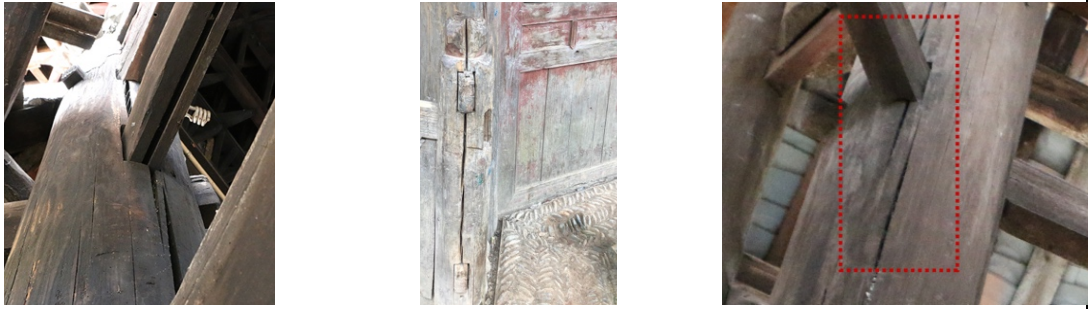

i. Zengying Drum Tower

Zengying Drum Tower locates at Congjiang county, Guizhou. It is protected at provincial level since 2015. The problems in Zengying Drum Tower occurred in wooden elements (Table.3-1) and also the other components (Table.3-2). Modifications are mapped in one of the representative sections (Fig.3-14), which reflect the distribution of the analyzed features.

Table.3-1 Main modifications of wooden components in Zengying Drum Tower

Alteration		
01	Change in color	The wooden components change in color happened because of the UV effects, it may cause lignin degradation and loss of grain cohesion.

		
<p>02</p>	<p>Dust deposition</p>	<p>The dust deposition is common in the timber elements where is not accessible, especially the tie-beams, tiles in the upper space of Drum Tower, the extinguisher that not used for a long time as well.</p>
		
<p>03</p>	<p>Smoke deposition</p>	<p>Because of the use of fire-place, the exposed timber elements which near the fire-place get dark or even smoked by the fire and smoke.</p>
		
<p style="text-align: center;">Mechanical failure</p>		
<p>04</p>	<p>Disconnection</p>	<p>The disconnection between column and beam, column and the base, and also the tie-beam out of joint which is consisting of a mechanic breakdown and dangerous problem to the</p>

		structure.
		
Defects		
05	Splitting	Splitting occurs on the upper and lower surfaces of the joint where the connection between tie-beam and column expands along depth direction.
		
Deterioration		
06	Insect attack	Beetles bore complicated tunnels inside the timber. Wasps create holes in the surface of timber. Insects can lead to progressive loss of mass, resistance to hardness, as well as weakened bearing sections.
		
07	Rot	The rot decay happened where the humidity in

		<p>wood is over 18%–20%, which would possibly cause loss of resistance to load, and hardness.</p>
		
<p>08</p>	<p>Lacuna</p>	<p>Wooden ceiling is partly missing or removed, and the empty mortise of the column which is apparently one of the portions was missing.</p>
		
<p>09</p>	<p>Detachment</p>	<p>The superficial layer was detached from the column or tie-beam, it is usually caused by insect or fungi attacks.</p>
		
<p>10</p>	<p>Discoloration</p>	<p>Lots of decorated painting discolored from the wooden board below the roof. The discoloration negatively impact the appearance of Drum Tower and the value of decorative painting</p>

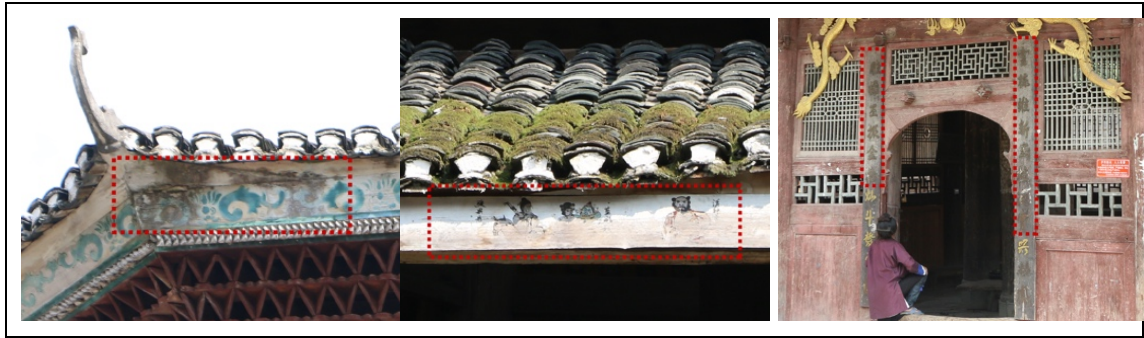


Table. 3-2 Main problems of other components

Alteration		
01	Staining	The clay sculpture on the eave corner are constantly exposed to the environment, and no periodical cleaning. The discoloration negative impact the appearance of Drum Tower.
02	Incursion of Vegetation	Due to the rain, the deterioration is aggravated when the roots of the vegetation grow inside the roof tile.

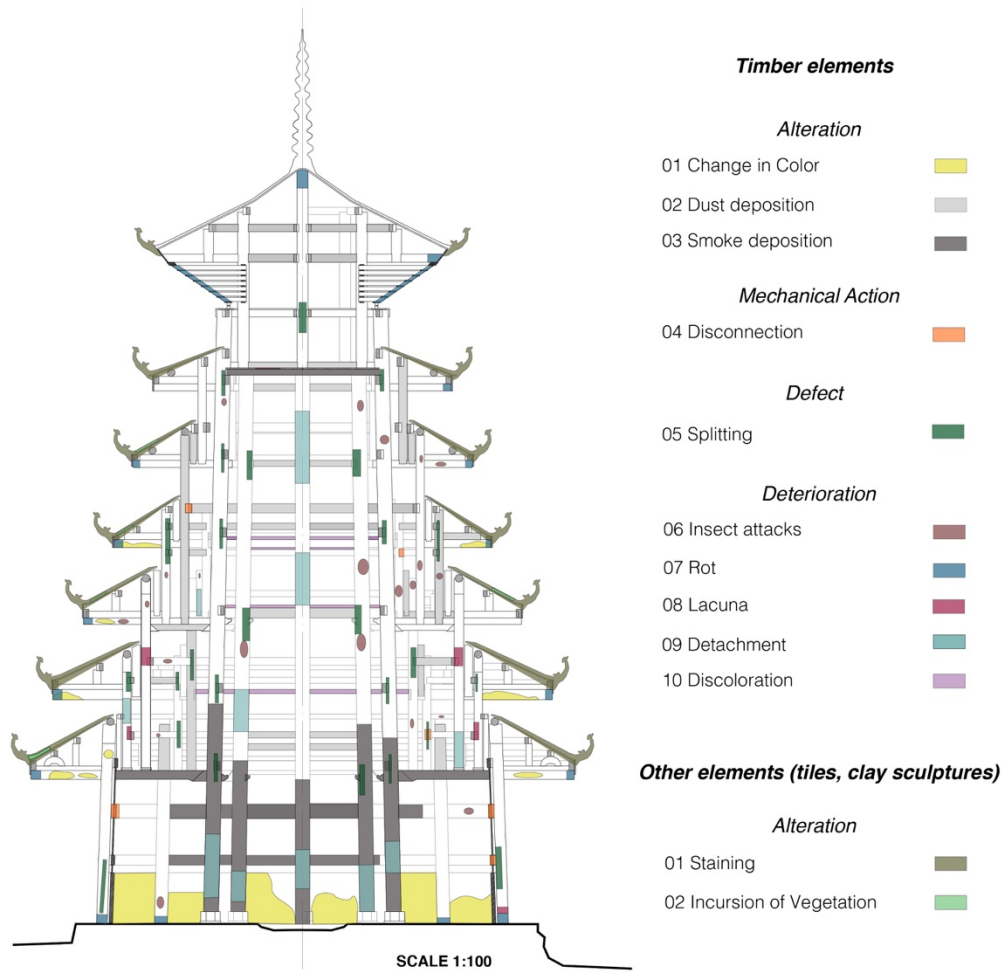





Fig.3-14 Distribution of the alteration, defect and deterioration in representative section of Zengying Drum Tower (Draw by author)

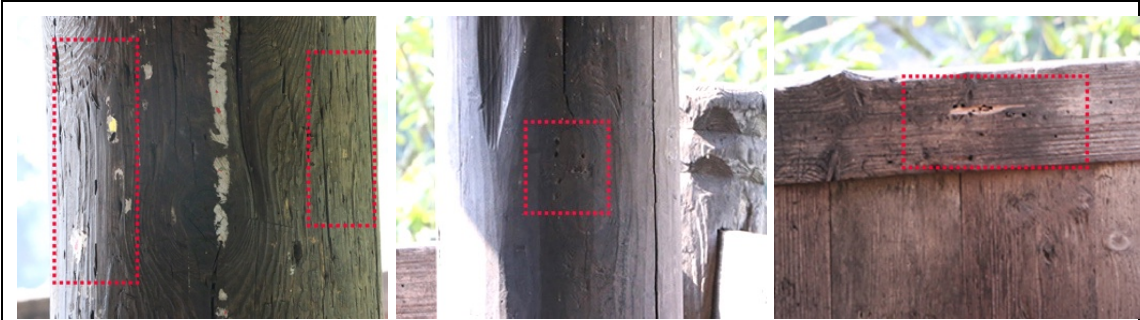



ii. Yashang Drum Tower

Yashang Drum Tower locates at Tongdao county, Hunan. The problems in Yashang Drum Tower mainly occurred in wooden components (Table.3-3). Modifications are mapped in one of the representative sections. (Fig.3-15).

Table.3-3 Main defects of wooden components of Yashang Drum Tower

Alteration		
01	Change in color	The wooden components change in color happened because of the UV effects, it may cause lignin degradation and loss of grain cohesion.

		
02	Smoke deposition	Because of the use of fire-place, the exposed timber elements which near the fire-place get dark and smoked by the fire.
		
Defects		
04	Splitting	Splitting occurs on the upper and lower surfaces of the joint where the connection between the tie-beam and column expands along the depth direction.
		
Deterioration		
05	Insect attack	Beetles bore complicated tunnels inside the timber. Wasps create holes in the surface of timber. Insects can lead to progressive loss of mass, resistance to load, and hardness, as well as weakened bearing sections.

		
06	Rot	The rot decay happens where the humidity in wood is over 18%–20%, which is result in a visible loss of mass, resistance to load, and hardness.
		
07	Detachment	The superficial layer was detached from the column or beam, it could lead to progressive loss of mass of material.
		
08	Discoloration	Lots of decorated painting faded from the wooden board below the roof. The fading negative impact the appearance of Drum Tower
		

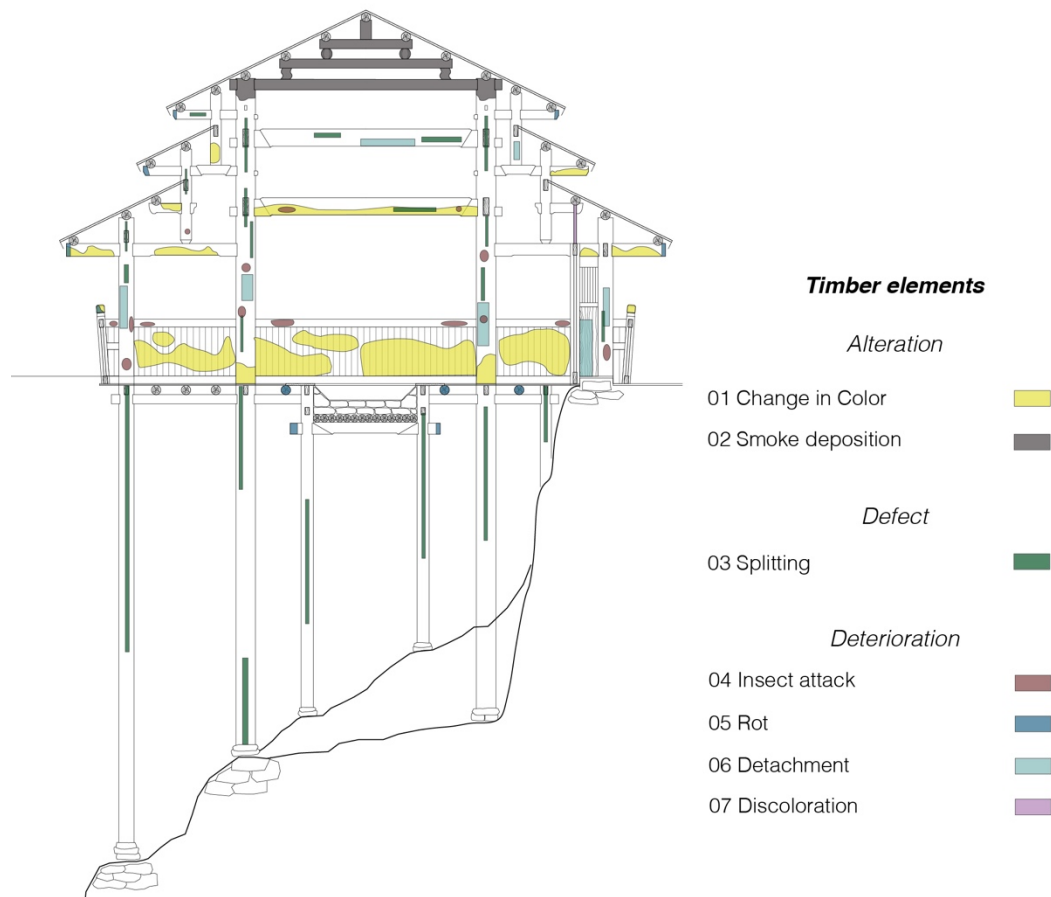


Fig.3-15 Distribution of alteration, defect and deterioration in representative section of Yashang Drum Tower (Draw by author)

3.1.6 Bad maintenance intervention

According to the field survey, the bad maintenance interventions are twofold: the first one is inappropriate additions, like in Zengying Drum Tower (Fig.3-16). As local villagers said, the additional elements are used for lifting up the Drum Tower to make roofs more tight with one and another, and make the building more “magnificent” (Fig.3-17). Besides, the connections between additional elements and the historical ones is pretty rough, which they are just bound with iron wires.



Fig.3-16 Zengying Drum Tower (Photograph by author, 2018)



Fig. 3-17 Inappropriate additions of Zengying Drum Tower marked in red lines

(Photograph and Draw by author, 2018)

The second one is inappropriate replacement of historic elements. For example, Gaochuan Drum Tower, which author has visited in 2015 and 2018 (Fig.3-18). Lots of replacements have been done, particularly the Pai-lou, which is the decoration and structural elements in the top tier of the Drum Tower. The historical elements have been replaced into a simplified and “economic” ones without respecting the tradition(Fig.3-19).

The historical Pai-lou not only have beautiful and flowing wave-like shape, but also they connected each other with mortise and tenon joints, which requests a higher level of carpentry skills. The new Pai-lou used simple and curved elements instead, the connections between two units of Pai-lou applied an additional wood board instead of mortise and tenon joints (Fig.3-20).



(a)



(b)

Fig.3-18 Gaochan Drum Tower (Photograph by author)

(a). Photograph in 2015; (b). Photograph in 2018



Pai-lou of Gaochan Drum Tower, 2015



Pai-lou of Gaochan Drum Tower, 2018

Fig.3-19 Inappropriate intervention on Gaochan Drum Tower (Photograph by author)

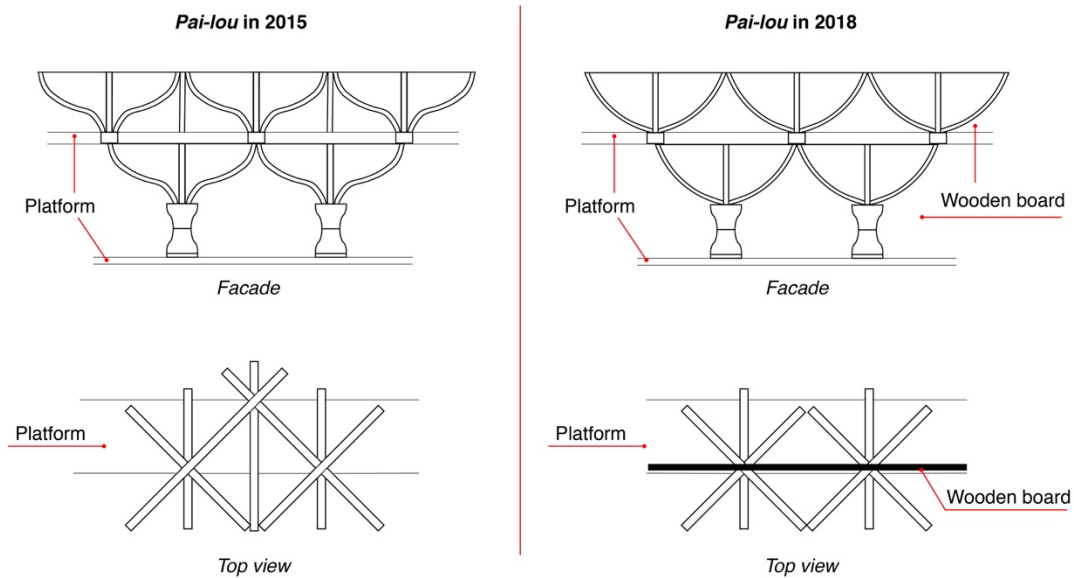


Fig.3-20 Comparison of Pai-lou in Gaochuan Drum Tower (Draw by author)

3.2 Case study: actual condition of Drum Tower

According to author's interview to local authorities, only Drum Towers protected at national level, could be treated as an official restoration project financially and technically supported by authority. Due to the huge amount of Drum Towers and also the insufficient financial support, numerous Drum Towers have been neglected at institutional level. Despite only five restoration projects' documents obtained by author, the information has been re-organized and evaluated as below.

i Zai'e Drum Tower in situ inspection and restoration project (2014)

The restoration project was conducted by Guizhou Provincial Research Center of Cultural Heritage Protection, and the document is preserved and archived in Culture Heritage Bureau of Congjiang county. The in-situ survey is not analyzed in an in-depth way, which briefly indicates "in a good condition" or "partly decayed". In particular, the different types of elements are not identified and photographed for representative samples, but it is concluded that "the purlins are decayed and deformed up to 50%; rafters are decayed and deformed up to 70%."

And the historical and new elements are not distinguished. Moreover, the interventions are not recognizable, because the new timber elements are applied with the same coloring coating as the historical ones.

ii Zengchong Drum Tower and surrounding buildings' restoration project (2008)

The restoration project was conducted by Guizhou Provincial Research Center of Cultural Heritage Protection, the document is archived in Culture Heritage Bureau of Congjiang county. In similar to the problems of the restoration project of Zai'e Drum Tower, the in-situ survey remains unclear. For instance, "the frame structure is basically stable and firm. Peripheral columns, central columns and tie-beams are decayed up to 20%, the elements at the top roof are generally attacked..." and for the intervention analysis, "replace and arrange the seriously decayed timber components as same dimension and carpenter techniques as the historical ones." Either of them has been identified and photographed in list, but with some simple description.

Unlike Zai'e Drum Tower, interventions applied in Zengchong Drum Tower are readable(Fig.3-21). Besides, some historical short columns and beams are bound with a strengthening iron ring (Fig.3-22). In total, 1 peripheral column and 4 short columns are bound with iron rings, 21 rafters and 4 short columns are replaced into new elements.



Fig.3-21 The old and new elements are visually distinguished in Zengchong Drum Tower

(Photograph by author, 2018)



(a)

(b)

Fig.3-22 Columns strengthened by an iron-ring (Photograph by author, 2018)

(a). A short column; (b). A peripheral column

- iii Restoration project of historical buildings complex in Yutou village, Hunan (2009)
This restoration project was conducted by Beijing Jiagong Architectural Design and Research Institute, the document is archived in the Culture Heritage Bureau of Tongdao county. The objects of the restoration project not only include Lusheng Drum Tower, but also Zhongbu Wind-Rain bridge, the old Yutou primary school, Drama stage, Commission Hall and the old dwelling Yang Zheng'an. The historical interventions are illustrated in detail via analysis of every single roof tier. All interventions that happened in timber components are clearly indicated, the main corresponding interventions are replacements, wood patching(repair) and strengthening metal ring. This case will be analyzed and depicted in 3.2.2.
- iv Restoration project of Matian Drum Tower in Tongdao, Hunan (2014)
This restoration project was conducted by Beijing Jiagong Architectural Design and Research Institute, the document is archived in the Culture Heritage Bureau of Tongdao county. The decay analysis has been performed according to the different composition of building, including ground, structural frame, decoration, roof tile, window and door, etc. In total, 11 main columns have been repaired via wood patching, 2 short columns in the top roof have been replaced, 2 doors in the first floor and second floor have been replaced, 2 doors have been repaired.

6 window battens have been supplied after missing, and also the 60% rafters and 50% tiles have been replaced.

v Restoration Project of Mapang Drum Tower (2005, 2012)

Both restoration projects in 2005 and 2012 were conducted by Guangxi Provincial Research Center of Cultural Heritage Protection, the documents are archived in the Culture Heritage Bureau of Sanjiang county. As for the restoration project in 2005, the decay analysis remains unclear and lacks of representative photographic lists which could identify and locate the specific problems. In total, 4 tie-beams have been replaced and 1 peripheral column has been repaired. However, the interventions are not readable either locatable. The restoration project indicates the traditional repair method for the column and tie beam.

Compared with the old project, the version of 2012 has upgraded another level. Firstly, every single timber component is numbered and listed according to their structural types. Secondly, decay analysis is clearly described, even the depth of decay is precisely recorded. Thirdly, interventions are performed by every frame structure with numbered timber elements. Regardless of the actual performance of this restoration project, the methodology of preservation of historical building is clear and legible compared to above-mentioned projects. This case will be analyzed and depicted in the 3.2.1.

Summarizing the in-situ surveys and the collection of all the obtainable documents, Mapang Drum Tower and Lusheng Drum Tower are selected to be the case study of actual conditions.

3.2.1 Mapang Drum Tower

i. Historical analysis

Mapang Drum Tower is located in Sanjiang County, Guangxi (Fig.3-23). Sanjiang County is located in a low-latitude area, and a hilly zone with many mountains and little flat land, with a forest coverage rate of 77.44%. Within the mid-subtropical zone and the Nanling (a major mountain range in southern China) humid climate zone,

Sanjiang County is mild in climate and abundant in rainfall, with the annual mean rainfall of 1493mm. Moreover, Sanjiang County is raining and hot during the same period, and distinct in winter-cold and summer-heat, with the annual average temperature of 18.3 degrees. Its annual mean frost-free period is 321 days, which is suitable for farming in the four seasons. But Sanjiang County has limited sunshine duration, distributed unevenly in the rainy season, and frequently flooded in Summer, easily drought in Autumn, and frequently influenced by natural disasters such as cold wave, hail, hurricane, etc. in Winter and Spring. Mapang Drum Tower was originally built in Qing Dynasty and reconstructed in 1943(Fig.3-24), with a distance of 35 km away from the urban area of Sanjiang County. There are some villages in the north, west and south of the Drum Tower, in which the stilted buildings have a distance of 20-50m away from the Drum Tower. In the east, the Drum Tower is adjacent to the Mapang River flowing towards the county (Fig.3-25), with a distance of 10 meters away from the river bank. Moreover, there are tens of ancient banyans trees around the Drum Tower (Fig.3-26).



Fig.3-23 Location of Mapang Drum Tower
(Draw by author)



Fig.3-24 Mapang Drum Tower (Photograph by
author, 2018)



Fig.3-25 Mapang rivulet along the village
(Photograph by author, 2018)



Fig.3-26 An old banyan tree next to Mapang
Drum Tower (Photograph by author, 2018)

Mapang Drum Tower was originally built in Qing Dynasty, and reconstructed after fires in 1943²⁷, and rebuilt in 1944 (Fig.3-27). It was funded by the Dong people of Mapang Village, designed by Mark-ink carpenter of Mapang Village, Mr. Wenxin Lei, and completed in 1945. On February 26, 1963, Guangxi Provincial People's Government announced it as a key provincial cultural relics protection entity. In 1983, Sanjiang County was stricken by an extraordinary rainstorm, and Mapang Drum Tower was soaked by the flood, so its foundation at the northeast side and the columns were sunken, a few tie beams were bent, and the eaves boards and tiles were also damaged. Then, Guangxi Provincial People's Government appropriated the fund of RMB20,000 for its emergency rescue and maintenance.

²⁷ Information provided by an old man in the village.



Fig.3-27 The historical construction dates were recorded by an old man in his notebook

(Photograph by author, 2018)

In 1983, a fire-fighting water pool was built at the south side of the Drum Tower, with the water storage capacity of 200 m³. In 1984, considering the fire safety of the Drum Tower, the 7 private houses around the Drum Tower were relocated to unblock the fire path. In 1998, the Drum Tower was partially maintained, strengthened its foundation, and replaced its rotten eaves boards, tiles, sculptures, colored drawing, etc., and a Mapang Drum Tower Management Group consisting of 20 villagers from the village committee and the society for the elderly was established. In 2002, due to the hurricane that Mapang Village has suffered from, many big trees near the Drum Tower were blown down, and the tiles on the Drum Tower were blown over, so the Drum Tower management group timely organized the villagers to repair the Drum Tower roof. On June 2, 2006, Mapang Drum Tower was announced as one of the sixth batch of major historical and cultural sites protected at the national level.

Mapang Drum Tower is located in the east and faces the west, and uses a Chuan-dou structure system. The five jian (A modular unit, the distance between two roof-frames) in the width direction have a full width of 11.7 meters. The five jian in the depth

direction have a full depth of 11.7 meters. Its floors have the full height of 13 meters. Its roof is covered with small grey tiles. Mapang Drum Tower is a planar square Drum Tower with double eaves and gable and hip roof, being one of the largest Drum Towers in Sanjiang County. Mapang Drum Tower uses the four big Chinese firs as its central columns way up to the top roof, and consists of 9 tiers of double roof eaves, which ascend step by step and shrink tier upon tier in an equal distance to form a pavilion-type lofty Drum Tower. The eaves ridges are ornamented with sculptures on birds and animals(Fig.3-28). The first floor of the Drum Tower only has one door at its west side. There are benches and altar inside the Drum Tower, and a fire place in the center. Moreover, there is a 400m² slab-stone plaza outside the Drum Tower, and a drama stage in the front of the Drum Tower.



Fig.3-28 Decoration on eave ridge (Photograph by author, 2018)

A long drum is arranged at the top of Mapang Drum Tower (Fig.3-29). In case of a major event, the *Chuanshi* who guards the Drum Tower climbs the Drum Tower and then beats the drum to call on all the villagers, and the village elder presides over the discussion. On New Year's Day or other festivals, all the villagers come together

inside the Drum Tower to perform dos-yeeh songs and Lusheng dance. In daily life, after their hard work, the villagers sit around together inside the Drum Tower to rest, chat, play and sing folk songs.



Fig.3-29 A long drum set in the Drum Tower (Photograph by author, 2018)

ii. Intervention analysis

According to the restoration projects in 2005 and 2012 and in-situ inspection, the two-time projects are defined as protective maintenance: dismantling the top roof, demolishing and replacing severely-rotten unusable components to suppress the damage of building, recovering its original structural properties, and eliminating the safety hazard, for the purpose of keeping it in good condition.

The wood components, such as beam, tie-beam and purlin were maintained based on the following methods:

- a) When the depth of component splitting (if there exist splitting in the opposite side, its depth value is the sum of the two) is less than 1/4 width or diameter of component, its maintenance shall use the patch method (Fig.3-30), that is, patching batten for splicing, and then strengthening it by at least two tiers of iron

rings. However, patching method is still a controversial intervention. On the one hand, it could have a wedge effect and cause further splitting. On the other hand, it could make insects less possibilities to lay eggs inside the splitting and fissure, and also raise the fire resistance.



Fig.3-30 Wood patching method (Photograph by author, 2018)

(a). On short column; (b). On inside main column

- b) When the depth of component splitting (if there exist splitting in the opposite side, its depth value is the sum of the two) is greater than $1/4$ width or diameter of component, and the component cannot meet the requirements according to the mechanical calculation, such component must be replaced;
- c) If such component is intact, and only rotten on its surface, and the proportion of the rotten area and the sectional area is less than $1/8$, remove the rotten part, process with the same timber according to its original shape, and then patch it with applying epoxy resin. If the proportion of the rotten area and the sectional area is greater than $1/8$, such component must be replaced, and its

strengthening method is the same as above.

- d) If the component is severely down-warped, and has no splitting on the lower end of the middle component, such component still can meet the use requirement. Therefore, it should keep unchanged.; if splitting are found, its maintenance must be conducted as (i) required above.

In terms of maintenance and strengthening of the column, if the depth of splitting of the column is not more than 1/3 diameter of column (or sectional dimension in this direction), its maintenance were conducted according to the following patch method:

- a) If the width of splitting is between 10-30mm, the batten should be used in its patching, and bonded by the latex adhesive;
- b) If the width of splitting is greater than 30mm, the batten should be bonded by the latex adhesive, and then the section of the column should be strengthened by 2-3 tiers of iron rings. If the section of the column is relatively long, the distance between the iron rings should not be more than 0.5m. The iron ring should be embedded into the column, so that the skin of the iron ring is aligned with that of the column. The patched batten should use the batten as intact as possible, instead of chips which affect the appearance.

If the column needs to be patched and strengthened according to its rotten degree, the column should be treated by use of removal-and-patch method or splicing joint method:

- a) Removal-and-patch method:
if the column core is intact, and its surface layer has a rotten depth of less than 10mm, remove the rotten part; if its surface layer has a rotten depth of more than 10mm, remove the rotten part, patch with the dry timber according to its original shape and dimensions after the preservative treatment, and bond it with the epoxy resin.
- b) If the column foot is severely rotten, but the length of the rotten part from bottom to top is no more than 1/4 height of column, the column should be treated by use of the splicing joint method (Fig.3-31). Prior to the splicing joint approach, remove the rotten part, and then select the mortise and tenon style of the splicing

joint according to the remaining part, for example, “palm joint”, “cross-hand joint” (Fig.3-32). If the height of the severely-rotten column footing is no more than 800mm, the “palm joint” (the simplest style, overlapping at least 40mm-long tenon) should be used. If it is more than 800mm, the “cross-hand joint” (draw a line on the section of the column to divide it into the four parts, remove the two untouched parts, and then fit the remaining column and new parts tightly) should be used. During the construction, be sure to perfectly fit the mortise and tenon of splicing joint, and add the iron rings.



Fig.3-31 Splicing joint method in the foot of column (Photograph by author, 2018)

(a). Yashang Drum Tower; (b). Pingtan Drum Tower

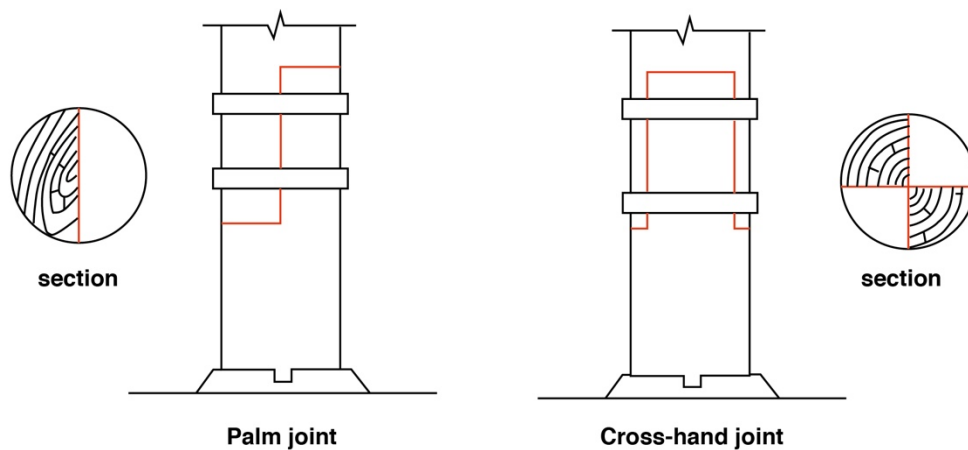


Fig.3-32 Two main splicing joint methods of column (Draw by author)

If the column is severely rotten, worm-eaten, so that patch and strengthening method cannot be used, considering to replace it with a new one. Prior to its replacement, be sure to do well the following things:

Determining height of original column: If the column is damaged, the height of original column should be verified according to the same wood column. If necessary, refer to the characteristics of the age that such building was built to determine the height of column.

- a) Processing requirements: If the column needs to be replaced, duplicate according to its style and dimensions.
- b) Material selection: The column to be replaced should select the dry timber of the tree species same as that of the component. The wet timber (its moisture content is greater than 20%) needs the drying treatment.

Depicted by the following intervention analysis (Fig.3-33), basically all the timber components are numbered and recorded, this project is recorded by the structural frame, which numbered from SF01 to SF14. Within the structural fame, the timber components are classified into purlin(PL), short column(SC), tie-beam(TB). Interventions include substitution and wood patching. As seen in the Table.3-2, the substitution rate is calculated. Taking the whole structural fame as an example, in total, around 40.9% elements are replaced.

Abbreviation

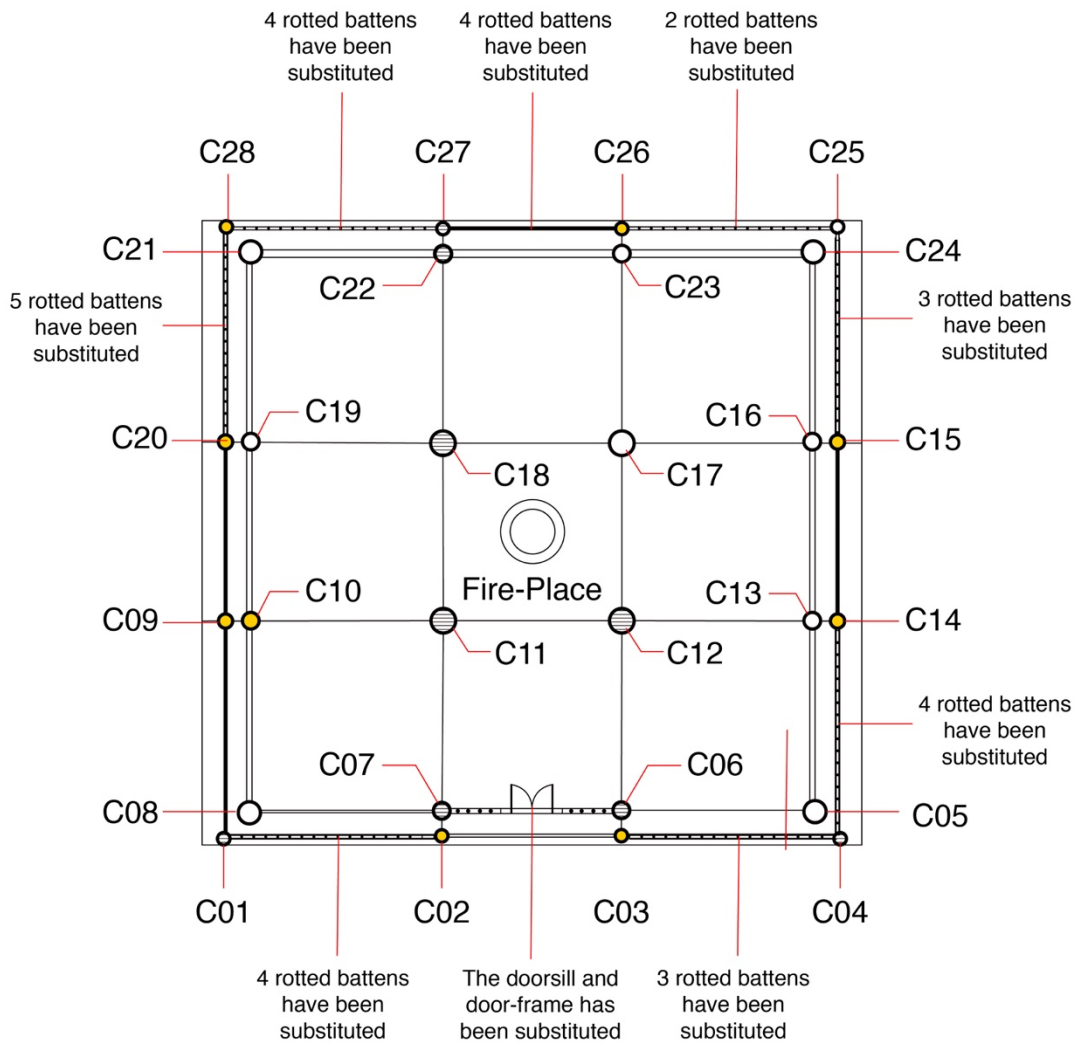
C: Column

*The unmarked elements are in good condition

 replaced elements

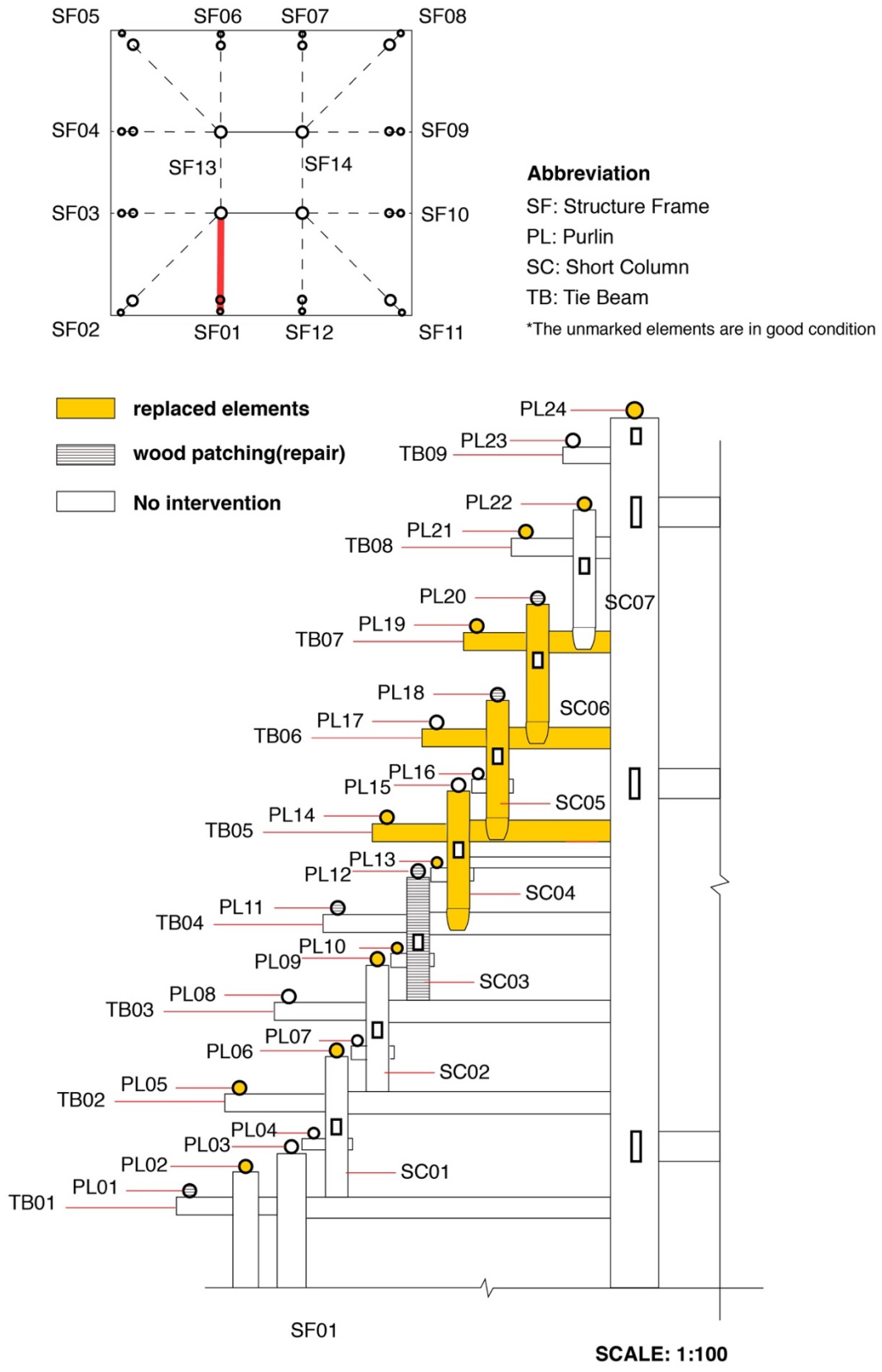
 wood patching(repair)

 No intervention



SCALE: 1:100

(a)



(b)

Fig.3-33 Intervention analysis of Mapang Drum Tower (Draw by author)

(a). Diagram of ground floor; (b). Diagram of structure frame 01

Table.3-4 Substitution rate according to each structural frame.

Structural Frame	Numbers of substitution elements	Numbers of total elements	Substitution rate
SF01	17	40	42.5%
SF02	13	37	35.1%
SF03	17	37	48.6%
SF04	24	40	60.0%
SF05	17	37	45.9%
SF06	17	37	45.9%
SF07	16	40	40.0%
SF08	15	37	40.5%
SF09	16	37	43.2%
SF10	23	40	57.5%
SF11	17	37	48.6%
SF12	16	37	43.2%
SF13	6	17	35.2%
SF14	5	17	29.4%
			40.9%

3.2.2 Lusheng Drum Tower

i. Historical analysis

Lusheng Drum Tower is located in Yutou village, Tongdao county, Hunan (Fig.3-34). The name of Yutou (literally means a taro) Village was derived from its earliest settlement like a taro, Yutoujie. The bluestone post road built through Guizhou during the tenth year of Wanli reign of Ming Dynasty (A.D. 1592) is at the foot of Yutou Mountain. During the Shunzhi reign of Qing Dynasty, Yutou Village had suffered from a fire, and then was rebuilt. Through more than 300 years of development, Yutou Village reaches today's scale (Fig.3-35). During the reigns of Qianlong and Jiaqing of Qing Dynasty, the construction of the villages entered a prosperous period. Some

main public buildings, such as Longshi Drum Tower and Yashang Drum Tower, were built during this period. The Lusheng Drum Tower was built in the ninth year of Daoguang reign of Qing Dynasty, and then reconstructed at the original site in 1993 (Fig.3-36). Apparently, it was not reconstructed as it was (The Drum Towers at the same period in Hunan did not have the double eaves and pavilion roof), but changes were made in its structure and morphology. First of all, its structure adopted the *Chuan-dou* structure instead of *Tai-liang* one, which made a breakthrough in height. The cross tie-beam and the additional short columns passing through the king-post are used to change the façade above the third double-eaves, that is, converting quadrilateral pavilion roofs into octagonal ones. The conversion in the structure technique directly resulted in erecting Lusheng Drum Tower, with an image of “tower”, in the center of village, which is different from the Longshi and Yashang Drum Towers with the “Han-style” Hall. On June 25, 2001, Lusheng Drum Tower and other ancient buildings in Yutou Village were announced as the fifth batch of national key cultural relics protection site.



Fig.3-34 Location of Lusheng Drum Tower (Draw by author)



Fig.3-35 Yutou village today (Photograph by Xiaotie Chen, 2013)



Fig.3-36 Yutou Drum Tower (Photograph by Xiaotie Chen, 2013)

Lusheng Drum Tower, as a four-layer safeguard system site, belonging to the national cultural protected heritage, “Famous Historical and Cultural village”, “Chinese Traditional Village” and the “World Cultural Heritage Tentative List”. Except the cross beam, which was getting dark because of smoke produced by the frequently-used fire-place, the protection condition is in a good state(Fig.3-37).

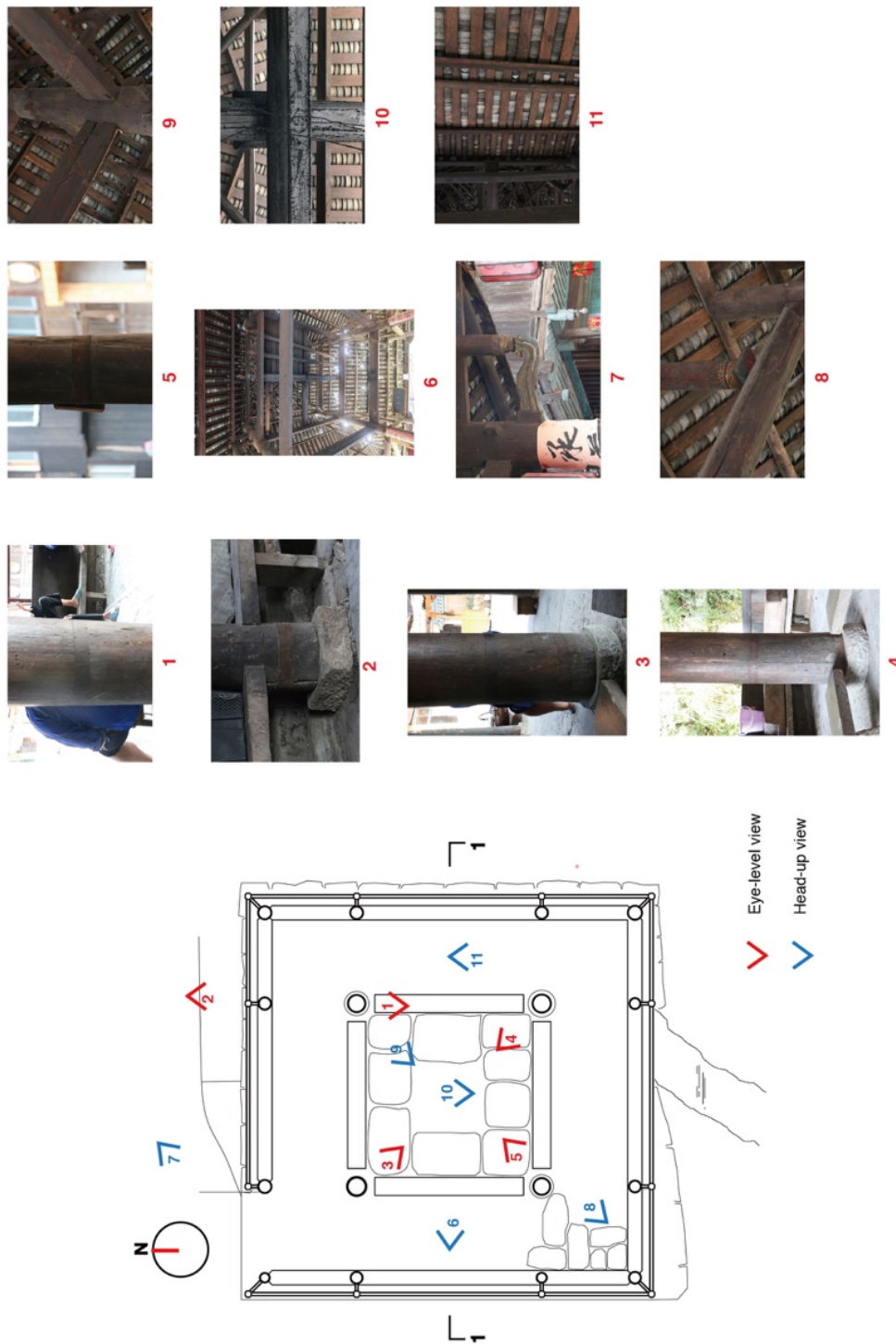


Fig.3-37 General photographic survey of Lusheng Drum Tower (Draw by author)

ii. Intervention analysis

According to the restoration project in 2009, the main purpose of the restoration, which belongs to protective maintenance and strengthening, is to dismantle the top roof, consolidate the roof truss firmly, redo the roof tile, patch damaged components, maintain the Drum Tower intact and healthy, and maximize authenticity and integrity of the Drum Tower as much as possible.

Main contents for the maintenance of wooden framework are as follows:

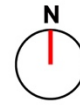
- i. Replacing the components. The framework cannot bear the weight of short columns, purlins and other components due to severe splitting rotten groove, mildew and natural aging arising from natural environment; the component are severely-damaged by termites, worms and other creatures (often only remains the outer shell), and should be replaced according to the original dimensions; the component which is deformed and displaced due to extra slenderness of its material, should be replaced by enlarged dimensions according to structural calculation.
- ii. Timber splicing joint. If the column footing is severely rotten, but the length of the rotten part from bottom to top is no more than 1/4 the height of the column, this should be treated by use of the “palm tenon” splicing joint method, and then strengthened by the iron rings.
- iii. Timber patch. If the splitting or crack of the column body has a length of 10-30mm, and a depth of no more than 1/3 diameter of column, the splitting or crack should be patched with the battens and bonded with the latex adhesive. If column head and column foot are cracked, and the key stress part of the column are cracked, in addition to the above methods, it is necessary to strengthen with 1-2 tiers of iron rings. If the length of splitting exceeds 1/3 the height of the column, it is necessary to strengthen it with 2-3 tiers of iron rings at the cracked position.
- iv. Timber bonding. If the column core is intact, but the surface layer is slightly rotten, and the rotten part is no more than 2/5 of the sectional area, the column should be strengthened by use of the raw material bonding method. Prior to bonding,

remove the rotten part firstly, conduct the preservative treatment, select the dry wood according to the required shape and dimensions, bond with the latex adhesive tightly, and then strengthen with the iron rings. If the partial rotten area of such components as tie beam, purlin, etc. is less than 1/5 of the sectional area, the components should be strengthened by use of the bonding method; if it is more than 1/5 of the sectional area, the components should be replaced.

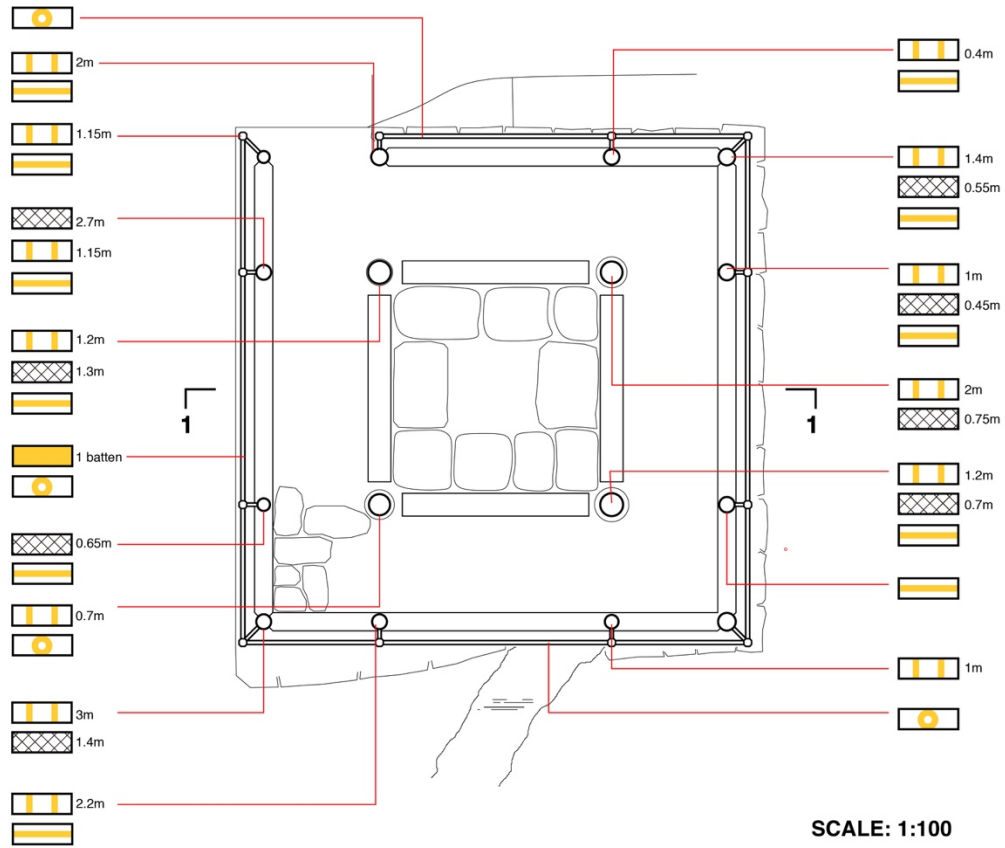
Depicted by the following intervention analysis (Fig.3-38), analyzed at every single story, including the ground floor and the section. the main interventions are replacements, wood patching(repair) and strengthening iron ring. In total, 1 tie-beam at the first story, and 1 batten of the wooden window at the ground floor and 93 rafters (48 in 5th story, 25 in 7th storey and 20 in 8th story) were replaced.

LEGEND

- | | | |
|--|--|---|
|  preservative treatment |  clean |  No intervention |
|  metal ring strengthening |  splicing | |
|  wood patching(repair) |  wood replacement | |



NOTE: The attached number is the length in total of the corresponding intervention.
 preservative treatment includes epoxy resin, etc.

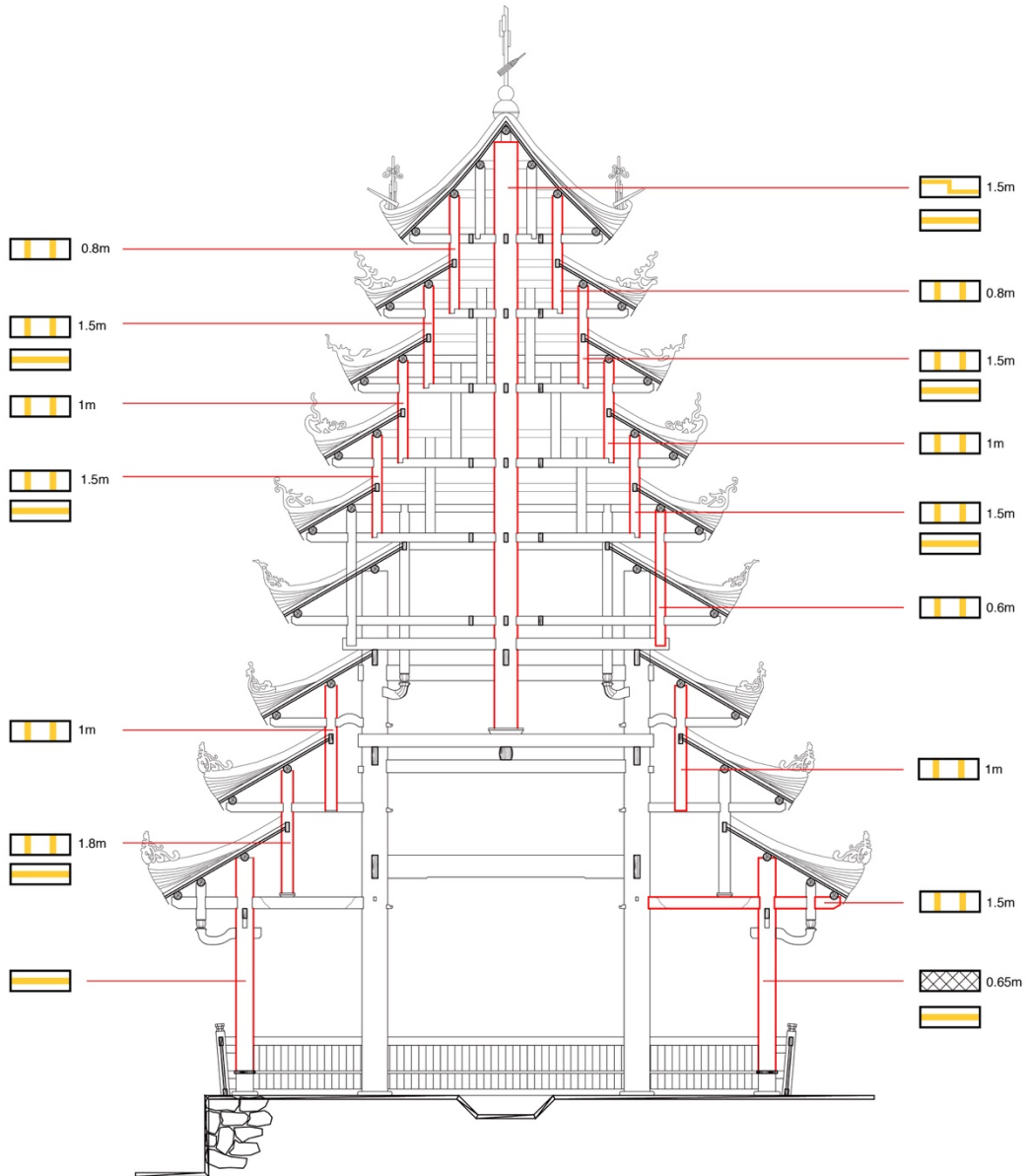


(a)

LEGEND

- | | | |
|--|--|---|
|  preservative treatment |  clean |  No intervention |
|  metal ring strengthening |  splicing | |
|  wood patching(repair) |  wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc



SCALE: 1:100

(b)

Fig. 3-38 The intervention analysis of Lusheng Drum Tower (Draw by author)

(a). Diagram of ground floor; (b). Diagram of section1-1

Apparently, maintenance and restoration of the Drum Tower mainly involves the replacements of non-load-bearing components, like roof-tile and rafter, the wood framework is not determined a fixed maintenance schedule. Therefore, most of the load-bearing components in need of repairing have basically lost their mechanical performance. As mentioned above, the building materials of the Drum Towers are relatively simple, with the local Chinese fir being the main construction material, cut and processed on the site. The “economic” and “direct” intervention, which replaces the old with the new, is very common, without deep structural understanding and symptom analysis. For example, in many cases of restoration of Drum Towers , the splicing joint of the column foundation is used to repair the column foot, or the old component is directly replaced; however, the problem often rebounds again quickly. On the other hand, very few Drum Towers are protected by the government, and quite a few eligible Drum Towers have not been listed. In Dong local authority, the integration of the historical and cultural site protected at the county level with Radio and Television, Sports, and Tourism departments, insufficient input of the vernacular architectural heritage preservation, and local financial embarrassment, the Drum Towers that are not included in the protection list mainly rely on the spontaneous awareness of protection and restoration. Through the village elder organization, the villagers actively donate money, materials and manpower for the construction and repair of the Drum Towers. However, the final result of the villagers’ spontaneous behaviors is often barely satisfactory. The main problems are as follows: insufficient protection funds, relatively simple protection method, relatively backward protection theory, and lack of professional scientific technical guidance.

3.3 Quality of intervention versus protected level

Does really the higher protected level of Drum Towers correspond to a higher quality of intervention? This sections aims to explore the relationship between quality of intervention and protected level of Drum Tower. To evaluate the quality of intervention of a historical building, today experts in the field generally agree in observing certain

"principles", or "rules" set out by international documents (primarily the "Venice Charter" of 1964, today the ICOMOS Recommendations and Guidelines).

According to *Principles for the Conservation of Heritage sites in China (revised 2015)*, as Article 12, Chapter 2 read:

Minimal intervention. Intervention to a heritage site should be restricted to the minimum necessary to ensure its preservation. Preventive conservation measures should be undertaken to reduce the need for interventions.

Principle for The Conservation of Wooden Built Heritage (2017), which was adopted by ICOMOS at the 19th General Assembly in Delhi, India, as for the intervention criteria, Article 12 and also Article 14:

Interventions should follow the criteria of the minimal intervention capable of ensuring the survival of the construction, saving as much as possible of its authenticity and integrity, and allowing it to continue to perform its function safely.

Any replacement timber should preferably: a. Be of the same species as the original; b. Match the original in moisture content; c. Have similar characteristics of grain where it will be visible; d. Be worked using similar craft methods and tools as the original.

The Nara Document on Authenticity (1994), in which authenticity has been highlighted, paragraph 13, is expressed as:

form and design, materials and substance, use and function, traditions and techniques, location and setting, and spirit and feeling, and other internal and external factors.

Charter on the Built Vernacular Architecture (1999), in which the part "Guidelines and practice" paragraph 4, 5 and 6:

4. Replacement of materials and parts

Alterations which legitimately respond to the demands of contemporary use should be effected by the introduction of materials which maintain a consistency of expression, appearance, texture and form throughout the structure and a consistency of building materials.

5. Adaptation

Adaptation and reuse of vernacular structures should be carried out in a manner which will respect the integrity of the structure, its character and form while being compatible with acceptable standards of living. Where there is no break in the continuous utilisation of vernacular forms, a code of ethics within the community can serve as a tool of intervention.

6. Changes and period restoration

Changes over time should be appreciated and understood as important aspects of vernacular architecture. Conformity of all parts of a building to a single period, will not normally be the goal of work on vernacular structures.

Overall, there are 6 main guiding principles that should always be considered in a preservation project.

i. Minimum intervention

As stated above, first and foremost, it is convinced that a proper restoration project and intervention on a historical item must be considered to minimize the impact with the dual aim of maximizing the performance of historic materials and reduce cost of intervention. The minimum intervention allows then, at the same time, to achieve goals that can be considered as moral and ethical.

ii. Reversibility

In the past, in some cases, during the maintenance or restoration interventions, have been used materials which, in a medium or long term duration, have or create

problems. It is, in medical terms, the same problems that affects people when, after surgery, show the so-called “rejection”. A dilemma choice between removal of an historical data (the added material that created problems) and the subsistence of the building, or a part of it, often requires the drastic removal of what of harmful was applied later. Today, during the choice of restorative materials, traditional or innovative, it has to be always respected the future possibility, and if is necessary, of the removal if the new material used during restoration shows some problems.

The restoration material must be always made with materials coherent with the preserved historical ones and in any case with materials whose reliability has been adequately tested and known, which suggests that unjustified removals of historical material data, although similar, are not permitted.

iii. Compatibility

Compatibility is the flip side of the previously described concept of reversibility, just to avoid damaging outcomes in the medium-long term, in using materials proved not good over time, it is preferable to locate products and materials of proven physical and chemical compatibility with the historical materials to which they overlap or integrates it, moreover, the esthetical compatibility also should be considered.

The proven incompatibility of the material, or of an addition, and the technical impossibility, to obviate this risk condition of integrity of the totality of the material/building, provides a valid reason for its removal and/ or replacement after a proper documentation. Similarly, the proven impossibility of a new function compared to the characteristics of the building, except possible heavy modification of its feature and cultural significance through interventions, induces a re-thinking of the proposed hypothesis about reuse.

iv. Durability

Interventions and materials proposed in a new restoration project must be not only compatible but also a long-term lasting. The requirement will reduce the need for frequently planned conservation interventions and will reduce the management costs of the building after restoration as well.

v. Distinctness

Interventions must be well-recognized, it is not permitted today doing a fake intervention, such as the ancient way of construction and use of materials that deceiving the non-experts people. The distinguishability of a replaced material can be also achieved through the use of the same one as it was in the past, however, with the foresight to make it distinguished as well as recognized that new part “accompanies itself”, with a different language, to the of historically preserved ones.

vi. Authenticity

Interventions have to respect not only the originality of the building but also its authenticity. A building is frequently palimpsest or stratification of successive layers within years or centuries. Each added stage in time often brings with its value, meaning(sometimes even today it is not yet recognizable) and authenticity linked to the time when it was created. These tracks, if compatible, should be preserved because they constitute the real, unique as well as irreplaceable essence of the cultural heritage.

The material is the authentic document of a building or of a cultural heritage. Without the authentic material there is not cultural heritage but a fake copy. However, to the wooden heritage, like Drum Tower, the timber components are replaced relatively frequently because of their medium-term biological properties.

Hence, for an authentic cultural heritage in China, the key content of authenticity is, whether it is an authentic cultural heritage? Which means that interventions are not confuse, concealed or disparage the authentic identity of the cultural heritage, which suggests that old and new parts should be well readable and distinguished. Therefore, under this circumstance, the proper and reasonable replacements could always be permitted. Nevertheless, the composition of a cultural heritage like Drum Tower is rather complicated, some elements are absolutely not authentic. Such as the re-painted plastering a decade ago on the roof ridge of Yanglan Drum Tower (Fig.3-39). These parts are trying to imitate and copy the historic ones, which is a real serious problem in restorations and interventions in China. Hence, from the author’s perspective, compared to the numerous authentic parts still remaining among in the heritage, how many deceiving copies or fake “illusions” are rather primary problem.

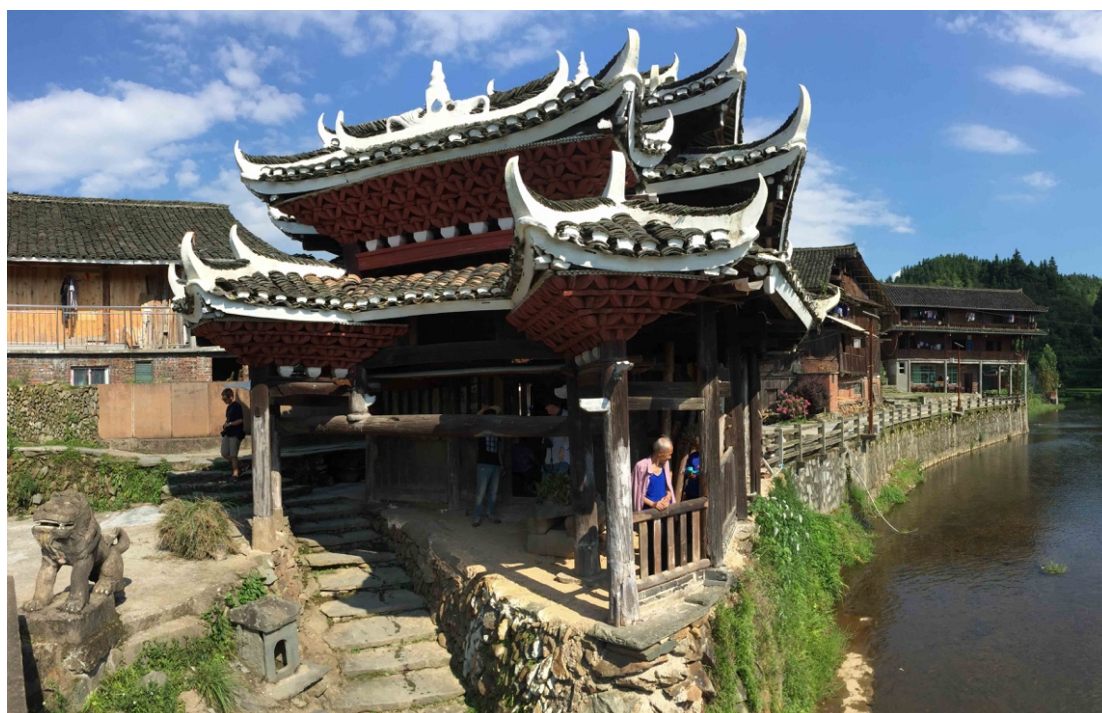


Fig.3-39 Re-painted plaster in Yanglan Drum Tower (Photograph by author, 2014)

Apparently, any restoration project should obey the 6 guiding principles above. Furthermore, in case of replacement is unescapable, respect to the tradition should be requested in any condition. However, as afore-mentioned, the principles are not a compelling law, as they might bring a barely acceptable outcome from a restoration project, especially in a rural area.







On the one hand, numerous Drum towers have not been protected in a proper level, that is, without the protection at institutional level. Therefore, it's common to see the inappropriate interventions or even dismantling by a random company or team. On the other hand, despite the Drum Tower that has been recognized as belonging to a relevant protected level, the guidelines for intervention and preservation are insufficient. Only principles or the aforementioned charters could be obtained, nevertheless, they are not operable and understandable for local people when conducting interventions.

The following table shows the relationship between the protected level and quality of interventions of investigated Drum Towers. Due to the insufficient documentations

about the Drum Tower, the information offered is mainly based on the interviews to the local elder people as well as on site survey, the 6 main guiding principles can be the assessment indicators(Table.3-5). The results may be not objective enough, but the relationship can reflect the current problems of preservation of the Drum Tower.


Besides, QI is short for quality of intervention, PL is short for protected level; the relationship “ $QI \approx PL$ ” means that the intervention has considered the 6 guiding principles as much as possible, meanwhile, the protected level is appropriate, they are basically match with one another; “ $QI < PL$ ” suggests that intervention has not completely considered the 6 guiding principles and the protected level of the Drum Tower has been overestimated; “ $QI > PL$ ” suggests that the intervention has considered the 6 guiding principles as much as possible, or basically inappropriate interventions have been done at limited extent. Thus, the protected level of the Drum Tower has been underestimated.

Table.3-5 “Quality of Intervention” versus “Protected level” among investigated Drum Towers

Protected level	Province	Name	In-situ photos	Minimum intervention	Reversibility	Compatibility	Durability	Distinctness	Authenticity	Outcome	Notes
National level	Guizhou	Zengchong		Yes	Yes	Yes	Yes	Yes	Yes	QI≈PL	
		Dali		No	No	Yes	Yes	No	No	QI<PL	It was rebuilt in 2003.
		Gaoqian		Yes	Yes	Yes	Yes	Yes	Yes	QI≈PL	The main frame structure has been kept unchanged
		Zai'e		No	No	Yes	No	Yes	No	QI<PL	It was rebuilt in 1986.
	Hunan	Matian		Yes	Yes	Yes	Yes	No	Yes	QI≈PL	Only 2 short columns have been replaced in the top roof
		Lusheng		Yes	Yes	Yes	Yes	Yes	Yes	QI≈PL	Few elements were replaced according to official document

		Longshi		Yes	Yes	Yes	No	Yes	Yes	QI≈PL	Only repair and metal-strengthening
		Yashang		Yes	Yes	Yes	Yes	Yes	Yes	QI≈PL	In total 6 columns and have been replaced.
	Guangxi	Mapang		No	Yes	Yes	Yes	No	No	QI<PL	Around 40% elements have been replaced
Provincial Level	Guizhou	Jitang		Yes	Yes	Yes	Yes	No	Yes	QI≈PL	
		Zeli		Yes	Yes	Yes	Yes	Yes	Yes	QI>PL	It is accessible to the top floor and few replacements; distinct Dou-gong made in traditional way

		Zengying		No	No	No	No	No	No	QI<PL	Random additional wooden battens are just for extra-height of the Drum Tower.
	Hunan	Yanglan		No	No	No	No	No	No	QI<PL	Fake plastering on roof ridge
County-level	Guizhou	Rongfu		Yes	Yes	Yes	Yes	No	No	QI≈PL	Some beams and most of rafters have been replaced
		Jingou		Yes	Yes	Yes	Yes	Yes	Yes	QI>PL	Most old elements had been kept. Dou-gong made by an old-craft way among this region
		Gaochuan		No	Yes	Yes	Yes	No	Yes	QI≈PL	

Yaxian		Yes	Yes	Yes	No	Yes	Yes	QI>PL	<p>Mostly old elements had been kept. Dou-gong made by an old-craft way.</p>
Yintan		No	No	Yes	No	Yes	Yes	QI≈PL	<p>it's easily distinguished from the old and new; fake additional decorations.</p>
Gaocai		Yes	No	Yes	No	Yes	Yes	QI≈PL	<p>One frame structure has been attacked by a fire accident, the new ones are readable.</p>

Apparently, the table shows the current situation of interventions and protected level of Drum Tower based on author's field survey. For the Drum Towers that are protected at national level, 6 Drum Towers are "QI≈PL", other 3 are "QI<PL". It suggests that around 30% of Drum Towers protected at national level are overestimated. For Drum Towers that are protected at provincial level, 2 are "QI<PL", and one is "QI>PL", the others are "QI≈PL". For Drum Towers that are protected at county-level, 2 are "QI>PL", which suggests that around 30% of Drum Towers protected at county-level are underestimated.

The table is not expected to provide the final result of the preservation situation of Drum Towers, these "relationship" results are basically evaluated by personal observation and relevant documentations. Nevertheless, the cases have reflected various problems in Drum Towers, ranging from the assessment of protected level by authority to the intervention by restoration companies or local craftsmen.

Chapter 4 Toward Recommendations for Preservation of Drum Tower

As stated above, the preservation of Drum Towers is considered as a minor issue by local people, with limited concern and awareness, even if the Drum Towers are, at present, in a poor state of preservation. In the following, some ideas are developed in order to provide support to the formulation of recommendations for the preservation of Drum Towers.

Firstly, the Scandinavian experience of the Stave Church Program is introduced to serve as an example of the preservation of historical timber structures, aiming to inspire and enlighten the preservation of Drum Towers. Secondly, it is recalled that a well-organized knowledge activity is fundamental and indispensable for any preservation action. Thirdly, Dong traditions of fire prevention will be addressed, which involves the local taboos on fire and the local customs on fire prevention. It aims to regain the traditions of fire prevention. Fourthly, it will explain that multi-risks prevention in the Drum Tower is a huge project that integrates policies, regulations, technologies, engineering, local culture and other measures. It relies on a widely-involved and coordinated government support system and a local support system. Finally, recommendations are proposed with the purpose of controlling the most fatal risks, ranging from fire, insect and fungi risks, with operable acceptance by local people and authorities.

4.1 The Scandinavian experience concerning preservation of timber heritage: the Stave Church Program

The motivations for taking examples from the Stave Churches are fourfold:

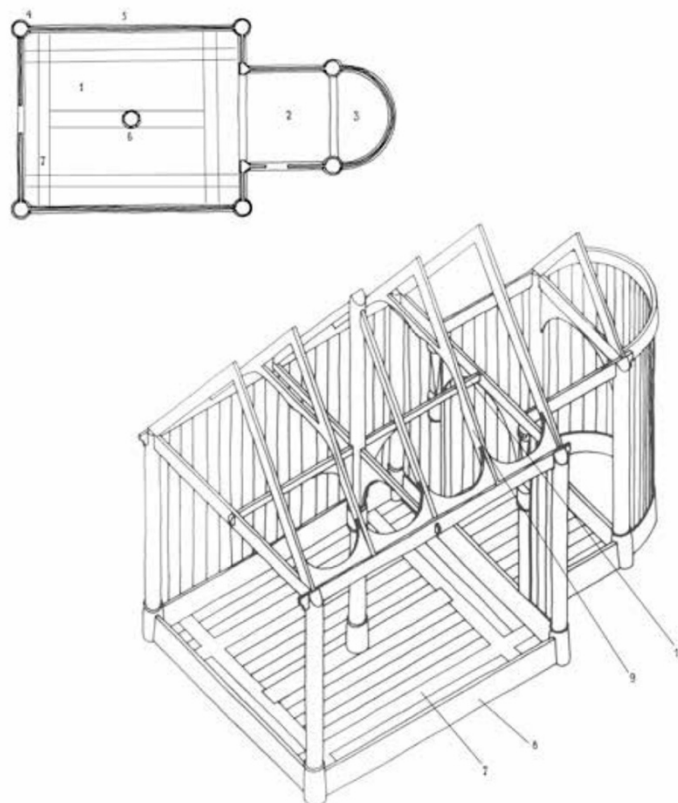
Firstly, the Scandinavian Stave Churches heritage is similar to the Chinese Dong Drum Towers from the point of view of the construction material being totally wooden historical buildings, which are vulnerable to fire risks, fungi, and insect risks;

Secondly, the Stave Churches and Drum Towers are both located in remote places, far away from urban areas. However, they both serve as public buildings within their local community, playing a key role in people's cultural identity;

Thirdly, the Stave Churches and Drum Towers both show unique and traditional craftsmanship and customs that may be lost and forgotten.

Finally, Scandinavian countries have an advanced preservation experience of timber heritage. Therefore, the Scandinavian experience is analyzed via the case of the Stave Church Program, in view of enlightening recommendations for the preservation of Drum Towers.

The term Stave Church refers to the way the church was built. Stave construction is a method of building with posts – staves – as the load-bearing elements (Fig.4-1). In principle, a stave building is a frame construction consisting of horizontal and vertical elements resting on stone foundations on the ground (Bakken, 2016).



Church with central mast, for example Uvdal stave church. 1) nave, 2) chancel, 3) apse, 4) corner post, 5) wall planks, 6) central mast, 7) raft beam, 8) sill beam, 9) rafter, 10) tie beam. Based on a drawing by Håkon Christie.

Fig.4-1 Structural frame of Uvdal Stave Church (Source: Bakken K., Preserving the Stave Churches, 2016, P20)

In the 1990s, many of these churches were unfortunately suffering from a lack of maintenance and were in a state of disrepair. The Norwegian Directorate for Cultural Heritage therefore found it necessary to establish a special Stave Church Program, which was started in 2001. The objective of the national program was threefold:

- i. to repair the Stave Churches so they could be preserved for posterity,
- ii. to preserve the church decorations and art,
- iii. to supplement documentation about the Stave Churches in order to provide a basis for research and the reconstruction of missing parts.

The Stave Church Program had a project manager with day-to-day responsibility for its implementation. This included everything from initial inspections of a church, to planning and completion of the work.

The many specialists who have taken part in the program have also acquired a great deal of knowledge about traditional craftsmanship, so now, fortunately, many more craftsmen know how to use these techniques. This will create more local value with respect to future maintenance of the Stave Churches. The work done within this program has been well documented by photographs and reports. Supplementary surveys and documentation are now in place. The work has required a cautious and analytical approach to prevent any needless damage. The goal has been to preserve as much as possible of the original parts.

The following case of Urnes Stave Church present a short overview of the Stave Churches included in the Stave Church program, Both the repair works on the church and the preservation of the church art are presented. The intention is to inspire and enlighten the preservation of Drum Towers. Hence, not all the cases will be presented, but just a selection.

The reasons for selecting the Urnes Stave Church are threefold:

- i. The Urnes Stave Church is the only Norwegian Stave Church on World Heritage list, and over 30 Drum Towers are on World Heritage Tentative list. Therefore, they are both protected under the UNESCO World heritage protection system;
- ii. Stave Churches are usually constructed by a log-structure with the surrounding

log wall serving as the load-bearing structure to support the roof. However, the load bearing structures in the Urnes Stave Church are not only the log walls, but also the wood columns. The columns are one of the most important load-bearing structures in Drum Towers. Therefore, the preservation experience from the Urnes Stave Church may be referred to Drum Towers from the structural point of view.

- iii. An advanced fire protection system with suppression systems and monitoring has been installed in Urnes Stave Church, which may be useful for Drum Towers.

Urnes is one of the oldest and is an outstanding representative of the Stave Churches (Fig.4-2). The church expresses in wood language²⁸.



Fig.4-2 Urnes Stave Church (Source: Birger Lindstad, 1995)

Urnes has, like other Stave Churches, gone through many changes in its lifetime. Over a long period of time, it suffered stability problems, with subsidence on its north side (Fig.4-3). As part of the Stave Church Preservation Program, comprehensive analyses were made on the ground around the church. Poor drainage was thought to be the cause. This had led to a critical situation for the north wall, generating an extra

²⁸ Refer to <https://whc.unesco.org/en/list/58/>

load on the wall planks. In the Stave Church Preservation Program the north side of the church was jacked up and new foundations were provided beneath all the structural supports. The ridge turret was straightened after the church was raised. At the beginning of the preservation program the calvary group in the church was taken apart and consolidated. Later the entire church was emptied of furnishings and the floor was removed. In connection with this work, the condition of the ornamental distemper decoration in the chancel was assessed and it was cleaned and consolidated. The remaining church art was also assessed and treated where this was deemed necessary. The systems are continuously maintained. All fire protection measures have been carried out with as little physical damage to the fabric of the building as possible, particularly to the medieval parts.

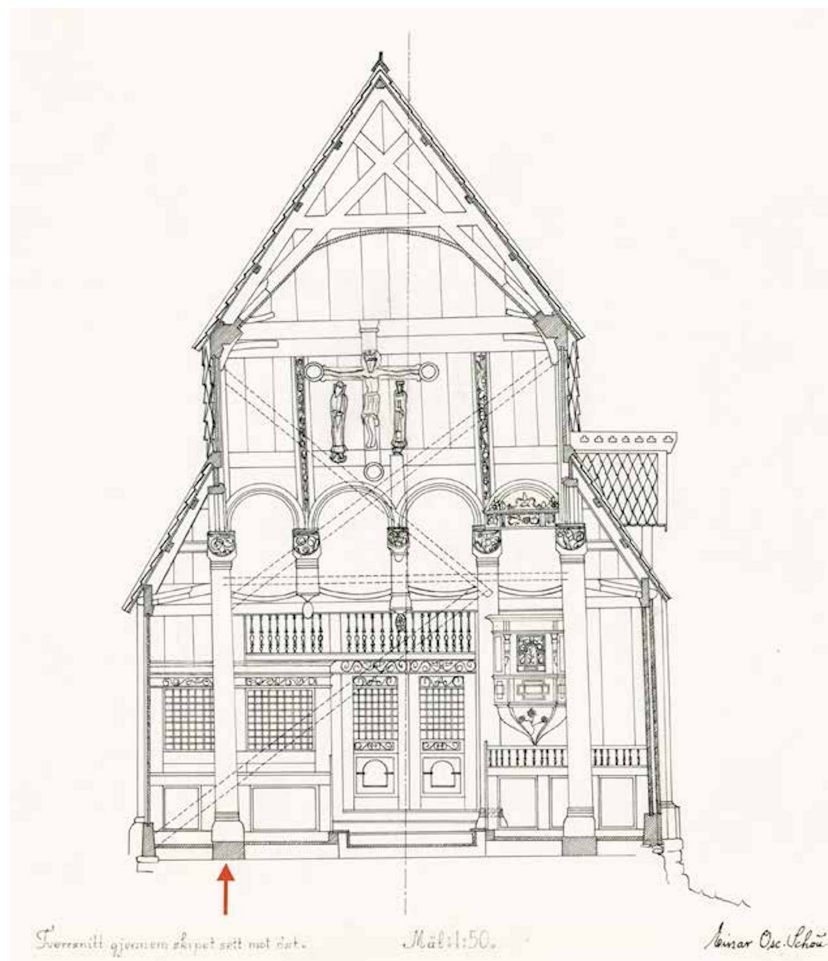


Fig. 4-3 Section of Urnes stave church, subsidence on the church's north side is indicated by a red arrow (Source: Bakken K., Preserving the Stave Churches, 2016. P34)

In 2010 an extensive restoration program led by the Directorate of Cultural Heritage was concluded, and the church is now in a good state of preservation. An advanced fire protection system with suppression systems and monitoring has been installed. Due to the remote location of the church, tourism to the site is still modest. Although arrangements for tourism are kept to a minimum, they are carefully designed. Any new activity is handled under the supervision of the cooperation group, and will be subject to procedures of the authority in charge.

Overall, the Stave Church Program provides a good picture of preservation of timber heritage; the selected cases also provide insight into the principles guiding the program, and show how different choices were made to meet the needs of the individual churches. Although Drum Towers differ from the Stave Churches, a common preservation process could be defined, starting from a knowledge activity, which includes the initial inspection and detailed assessment, then to solve the actual problems and control different risks. Finally, acting the appropriate interventions if can be proposed necessary.

4.2 Recommendations for acquiring knowledge of Drum

Towers

The knowledge activity for historic buildings has become a major issue. However, it is still not well-formulated for the preservation and maintenance of Drum Towers. It is the result of the need to improve existing buildings for a better condition of use, and also of the recognition of the importance of preservation of the historic building.

The knowledge activity to be performed before interventions on a Drum Tower or any historical building consists, in general, of the following phases (Fig.4-5):

- i. Need for assessment
- ii. Preliminary survey
- iii. Instrumental diagnosis

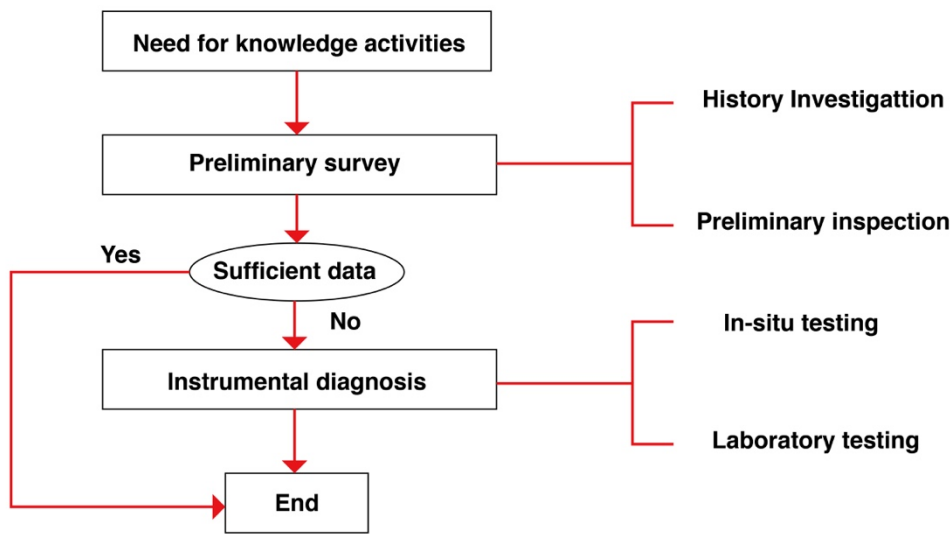


Fig.4-4 Procedure of a knowledge activity (Draw by author)

4.2.1 Need for knowledge activities

The critical first phase involves understanding the situation in which the activity will take place and clearly defining the problem or issue to be solved and why it is important to do so. The phase must involve the entire team and also the local villagers and authority to make sure that everyone has the same or a similar understanding of what is needed. Based on this step, the purpose of the required activities will be defined. In many cases, organizations invest considerable time and financial resources in research that offers necessary information to carry out this step.

The specific need for assessment of the Drum Tower is usually motivated by one or more of the following circumstances:

- i. The existence of visible modifications (alterations, defects, deteriorations, mechanical failures or damages) in the building;
- ii. Damage after a particular event that affects its stability (fire accident, etc.);
- iii. Requirement of the competent authority; for instance, local authority has carried out increasing actions for Drum Towers which were involved into UNESCO tentative cultural heritage list;

Given that official documents, such as standards or codes, are insufficient for the

knowledge activities on Dong Drum Towers, the required targets shall be established prior to the intervention by agreement among the local villagers, the team and authority. In particular circumstances, the performance level of the building could be still adjusted during the assessment phase, by agreement among the above entities.

4.2.2 Preliminary survey

i. Historical investigation

After clarifying the need for knowledge activities, next step is the historical survey. It covers the entire life of the building; usually, it aims at understanding the concept and the purpose of the building²⁹, the techniques used in the construction, the alterations made and its surrounding environment as well as the events that could provoke damage to the structure. As mentioned about the difficulties about the historical survey of Drum Towers, it is important to take advantage of all the existing and obtainable documents and other information. In fact, existing documents, in general, have a limited coverage of structural aspects. Nevertheless, the source of information should be graded according to their value or the possibility that they inspire.

As for the Drum Tower, information could not only be obtained from the historical archive, or other written sources like reports, drawings, photos, etc. but could also be obtained during the inspection as well as from the interview to local villagers who are familiar with the Drum Tower and the village.

ii. Preliminary inspection

The preliminary inspection is usually the survey of the existing conditions, it is carried out through visual inspection of the building, or with the assistance of some simple hand devices. In the case of the Drum Tower, with difficult access to the higher levels, the inspection might require the installation of appropriate and safe accessing systems, like scaffolding, cranes, etc.

The result of the preliminary inspection would be given through templates and reports,

²⁹ UNI 11138:2004- Cultural heritage -Wooden artefacts- Building load bearing structures - Criteria for the preliminary evaluation, the design- and the execution of works: p.4.

in which the deterioration as well as the damage to structural elements shall be presented³⁰. The report shall be accompanied by detailed pictures, and, sometimes, a video report; a thematic map could also be useful, which could allow for even more detailed and visible information about the situation of the Drum Tower.

It would be also important to obtain information about the geological condition of the soil supporting the foundation; if degradations are present in the lower part of the building, it would be convenient to get samples of soil, in order to verify if there is contamination by aggressive substance.

The preliminary assessment aims to decide whether investigations have to be continue (or not) and urgent measures have to be undertaken, like installation of temporary supports for safety purposes.

4.2.3 Instrumental diagnosis

When available information is not sufficient to elaborate the diagnosis of the building, the preliminary assessment should be complemented by an instrumental diagnosis, comprising in-situ testing and laboratory testing. The instrumental diagnosis is the procedure for identifying or determining the cause of the defects in timber structures.

As the above testing activities are expensive in general, and carrying them out could affect the cultural value of the building at some extent, the number and the location where they are planned should be accurately considered.

Testing should be non-destructive, in order to have a reduced influence on the building. If non-destructive testing is not sufficient, the destructive testing should be considered, but it would be carried out only after a cost-benefit analysis.

After carrying out tests, the obtained results should be carefully analyzed, mainly if different test methods have been used, and results should be compared for calibration.

Diagnosis is a very delicate task in that the available data refers to the “symptoms”,

³⁰ UNI 11138:2004- Cultural heritage -Wooden artefacts- Building load bearing structures - Criteria for the preliminary evaluation, the design- and the execution of works: P4.

usually they come along with several concomitant causes that need to be identified. At some extent, intuition and experience are essential to the diagnosis.

A model, serving as a scenario to interpret existing defects, can be established based on the results of preliminary inspection. When the information is not sufficient, it should be complemented by a detailed inspection and a modelling of the building.

Eventually, the interpretative model (scenario) would be established and confirmed. In case the situation is not completely clear, the best solution would be to keep the building under monitoring for some time, which allows to follow the evolution of the phenomena; subsequently, a better understanding would be obtained.

4.3 Vanishing tradition of fire prevention in Dong area

4.3.1 Dong traditional taboos on fire

Regarding Dong people's taboo on fire, according to *Overview of Dong Minority* (Xian, 1995), Dong minority people believe that the fire can bring people disaster. Therefore, fire is considered as an “evil monster”³¹, meaning that fire is utterly evil. In case of fire or at the end of each year, Dong people buy a piglet on a certain day, take a pinch of ashes from the hearths of each household, arrange some persons to make a “boat”, then carry the boat and other sacrifices to a riverside at midnight, and hold a ritual of dispelling “fire evil”, on which people place the “boat” into the river to drift freely, and then eat on the ground (Fig.4-5). After the meal, people wash the cooking utensils and chopsticks and discard the leftovers, implying that people clean them up without leaving any bane. The lamps in the Drum Tower go out, without any light and spark. Some guards are arranged to prevent strangers from entering the Drum Tower. Otherwise it is invalid. Violator bears the expenses, and the ritual is performed again. In addition, Dong minority people believe that the god of fire lives in the fire-place in the Drum Tower. The tripod over the fire is not allowed to be beaten (Fig.4-6). Unclean materials are not allowed to be used for igniting. Children are not allowed to pee into

³¹ In Dong language, it is called “Xangp buil”.

the fire-place. Otherwise it can enrage the god of fire to cause a fire. At the end of the year, Dong minority people will set off a raging fire in the fire-place all night long, implying “auspiciousness” in the coming year. When moving to a new house, they also do so, because they believe that "high fire implies prosperity of family, while the unextinguished fire in the fire-place implies unceasing prosperity of offspring", which are regarded as auspicious symbols. Therefore, when Dong minority people hold a wedding ceremony, the new house must greet new light (fire) which cannot be extinguished.



(a)

(b)

Fig.4-5 A “fire evil” dispelling ritual (Photograph by Wanxin Huang, 2010)

(a). People carry food to the riverside; (b). people eat on the ground



Fig. 4-6 A tripod on fire-place (source: <https://www.oldkids.cn/blog/view.php?bid=663666>)

When investigating in Jitang village, Liping county, Guizhou, the author learned a local custom: In case of fire, people in the Drum Tower cannot run around, and must run into or stand in a river, with a pot lid or a covering on their heads, so that the fire cannot spread around, and can be put out. This taboo has been proved in some data. Jiulong village in Liping county has such a real case. In 1979, this village caught a big fire that caused the burnout of the Drum Tower. Locals believed that the violator ran around against the taboo; wherever the violator went, the fire followed, and the whole village was burned out.

A saying goes in the Dong area: "old trees protect the village, elder men manage the buildings." Before 1949, in Jitang village of Guizhou, anyone did not dare to disturb grasses and trees in "Feng-shui Forest" around the village; even if the trees withered or died, no one dared to pick them up as firewood; if the taboo is violated, the violator gets ill or even goes blind. According to a local legend, an elder in the village went blind because he picked up the dead woods in "Feng-shui Forest" as firewood. Traditionally, the dead trees in the "Feng-shui Forest" and the dead old trees around the village can only be made a fire under the Drum Tower for heating in cold winter. Moreover, only the elders are allowed to take the dead trees or touch them firstly, and then young people carry them to the Drum Tower for heating.

Although these folk taboos seem to be related to "god" and are controlled by supernatural power, they are possible to prevent fires. For example, leftovers are discarded in the ritual of dispelling "fire evil", implying that people clean them up without leaving any combustible materials; the lamps in the Drum Tower go out, without any light and spark. It aims to aware people of fire prevention. In addition, the purpose of discarding leftovers (in some villages, cooking utensils are also discarded) is to prevent continued burning of sparks. Likewise, in case of fire accident, people must jump into water, with the pot lid on head, and must be prohibited to run around, for the purpose of preventing possible "spark" carried by people from igniting other combustible materials to cause a greater loss. Dead woods in the forest may have been struck by lightning and exposed to the weather. Therefore, the dead woods as firewood, at a certain extent, may cause a potential risk. Although these fire-related

taboos are superstitious at some extent, they are experiences that Dong minority people have accumulated in life have produced the crystallization of wisdom of Dong people.

4.3.2 Local custom on fire prevention in Dong villages

Almost all of the villages in the Dong area have the same custom, that is, shouting at villagers by striking a gong. At a nice evening, during long drought days, and in hot summer, it is extremely easy to make a fire accident. At this time, it is arranged a stentorian man to shout at the villagers by striking a gong. He patrols along the route in the village, shouting while walking and striking a gong: "beware of fire", "Summer is hot like fire. Do not bring a fire sickle³² with you." (Fig.4-7) After hearing this, people check fire-places of their own homes and the Drum Tower, or check fire maker, which cannot be used in places where it is easy to ignite items so as to eliminate fire hazard. Whenever there is a festival or a public ceremony, the excessive use of fire is easy for something to catch fire. The village head arranges someone to shout at the villagers as well, for example, "There are many happy events during the festivals, please pay attention to use of fire", "When relatives and friends get together, please pay attention to use of fire", for the purpose of reminding the villagers of fire prevention. Every family in the village takes turns to add firewood into the fire-place in the Drum Tower for heating in harsh winter. However, it is a period when fire accidents occur frequently. Therefore, in Dong area, especially in the snowy and freezing winter, someone shouts at the villagers for fire prevention, for example, "Fire is used for heating, please beware of fire risks.", "Do not leave if fire is on; leave only after fire is extinguished."

³² A traditional lighter, it is named after the shape of curved sickle and the flint when it can ignite.



Fig. 4-7 The Chinese traditional lighter: fire sickle (source:
<https://spenceou.pixnet.net/blog/post/210623311>)

Winter and spring in Dong area are relatively long, grasses and mountain forest are very dry when the cold wind blows, and are even dryer in a sunlit winter, which are easy to cause a fire accident. Village head often arranges someone to shout at the villagers, for example, "Do not go up a mountain with fire maker, because grasses and trees are dried in winter and spring", "If someone set mountain on fire, you will put into prison sooner or later.", for the purpose of reminding everyone of fire safety. For a long time, shouting at villagers by striking a gong has become a fine tradition for fire prevention in the Drum Tower, even in the entire Dong village. However, this tradition is gradually vanishing.

Vulnerability and limitations of Dong villages determine that fire prevention cannot rely entirely on a "fire truck" of government, and also shall give full play to its self-rescue ability: Dong traditions on fire prevention. With development of history and advancement of modernization, these traditions have been "forced" to be forgotten gradually. However, not all the advanced and modern fire preventions are suitable in

Dong area. These gaps need to be filled by those vanishing traditions, because they have adapted to local conditions. The fire prevention tradition has gradually vanished in the process of social change and rural modernization. Fortunately, Dong traditions and rituals have been regained in recent years, which have been recognized to the public at some extent. The local authority and people should take advantage of this trend to regain the Dong traditions on fire protection.

4.4 Adaptive proposals for risk prevention of Drum Tower

A disaster anthropologist Oliver Smith addressed that: "The occurrence of disasters is the result of combining external variability and internal complexity. The external variability refers to destructive natural and technical phenomena that occur under condition of objective environmental vulnerability. The internal complexity refers to society and culture associated with subjective, destructive natural and technical phenomena." (Smith, 1999)

The occurrence of risks in the Drum Tower is also the result of combining external variability and internal complexity. Firstly, internal conditions, such as wooden structure, dense space and remote location, are extremely destructive when those risks occur. Secondly, social transformations, the collision of foreign cultures and indigenous cultures, and changes in population structure make Dong people eager for adaptation to popularization of knowledge in modern life, assistance of technology, investment in infrastructure construction, and adjustment of measures according to local conditions in the system formulation. Therefore, these gaps in Dong area have resulted in vulnerabilities to fire or other risks caused by environmental changes. It is far from enough to perform effectively on risk prevention of the Drum Tower solely on the basis of governmental regulations. Controlling multi-risks in the Drum Tower is a huge project that integrates policies, regulations, technologies, engineering, local culture and other measures. It relies on a widely-involved and coordinated government support system and a local support system.

In addition to regain Dong traditions on fire prevention, adaptive modern measures for

controlling risks are in urgent need in relation to all the fatal ones: fire, insect and fungi. An adaptive and sustainable proposal for multiple targeted risks must be created foremost for the local villagers and craftsmen, as well as experts; it should be simple, economic, and easy to implement with respect to the actual Drum Tower conditions.

4.4.1 Principles and measures

In 1993, the European Council adopted a recommendation directed to governments of its member states which reflected the need for legislative, administrative, financial, educational and other measures to protect the built timber heritage from fire and other natural disasters. It underlined the need to find a balance between technological and management solutions to counter the disastrous effect of fire and other attacks. As for the case of Drum Towers, the principles and measures could be also referred to the following items³³:

i. Administrative and legal framework

Dong communities coexist with the surrounding natural environment while preserving their inherent culture and tradition. The preservation should focus on the continuity, authenticity and integrity of the whole village. Therefore, authorities at national, provincial and local level must introduce a particular and specific preservation system, and must make provisions for the whole village and all non-protected level Drum Towers considered, not only the heritage ones. Of course, a priority classification of the Drum Towers has to be considered when deciding the resource or finance arrangement.

At each level of authorities should establish and supplement the lists of the historical buildings, objects and heritages of interest. Copies of the lists should be deposited and shared with all the relevant authorities. All items on the lists should be registered, and inventories, as detailed as possible, should be produced. Authorities responsible for the architectural heritage should be responsible for disaster prevention

³³ The items are based on the protections the architectural heritage against natural disasters, Council of Europe, 1993.

and mitigation in their field of competency. They should employ trained staff to: produce and maintain records; monitor disaster activity and produce protection strategies; implement salvage, recording and emergency works; provide educational and technical assistance and guidance; plan and implement restoration projects after disasters.

Authorities should encourage the development of technology targeting preservation and maintenance of the Drum Towers. A practical and detailed guideline targeting different risks and problems is under proposal, which was developed foremost for the local villagers and craftsmen, as well as experts in order to be simple, economic, and easy to implement with respect to the actual condition of Drum Towers.

For bridging a link between authorities and educational institutions, encouraging the knowledge spreading in villages, authorities should cooperate with educational institutions in promoting courses for specialists. and providing subsidy/scholarship programs to encourage and attract young apprentices to learn the traditional craftsmanship. Competitive job opportunities should be provided to qualified graduates. The demand for specialist should be reinforced by introducing standards that prescribe the quality of work on preservation projects, and regulations that require the engagement of specialists on preservation projects. What is more, community awareness and appreciation of the skills of traditional local carpentry and craftsmanship should be promoted through public events such as on-site workshops and open days.

ii. Financing and insurance

Local villagers are lacking of financial capacity to conduct preservation and maintenance actions by themselves. Thus, financial support is essential. Low-interest or interest-free loans should be provided to inspire the local villagers' motivation on knowledge activities, preservation and maintenance actions. Adequate and quickly accessible resources should be established both for planned maintenance, upgrading and preventive work and for contingency funding, for instance by setting up national and local funds.

Authorities should remove any legal obstacles and facilitate the insurance of buildings

and objects belonging to the architectural heritage against loss and damage and against theft and arson. Policies should cover the full cost of the loss or damage, in order to repair, restore or reinstate the buildings or objects to their condition before the damages, using materials, craftsmanship and techniques according to the best preservation action. If a policy stipulates an excess or co-insurance, the insured should prove that he has the means to cover such sums out of his own funds. Efforts should be made to ensure full co-operation and the exchange of information and expertise between the authorities and the insurance companies.

iii. Education and training

In order to improve preservation awareness, education should be promoted at different levels: to the general public through informed media coverage and in the school systems as part of the curriculum, which should target young trainees to promote a career in preservation of architectural heritage; to the professionals and technicians through general training and in specialist courses; and to occupiers of Drum Tower, which are the local villagers or tourists, by the provision of suitable guidance.

Training at a professional and technical level, must take into account the following considerations: only specially qualified and experienced teachers should be used to provide the specialist knowledge and training required; all professionals should be taught general principles and practice at pre-qualification or undergraduate level and specialist post-graduate courses should be undertaken by those who wish to, or have to, specialize or practice in this field; all courses should be multi-disciplinary; all practitioners should undertake continuous professional training in order to keep abreast of new events and developments; the international and regional exchange of teaching staff and circulation of ideas and information should be encouraged; other interested parties such as educational institutions or insurance companies should be offered specialist training; specialist research programs should be initiated and encouraged.

iv. Risk prevention and mitigation strategies

Risk prevention and mitigation strategies require preparation and planning and the

implementation of technical and physical measures, in order to prevent or reduce loss or damage, both in the event of risk and in the aftermath. It is recognized that it is impossible to prevent or to predict the occurrence of some risks. Nevertheless, in all cases, probability studies and a thorough understanding of the risks are vital for the formulation of a strategy.

The success of a strategy depends on the effectiveness of regional, national or even international cooperation and coordinated policy, as well as on the vigilance and good maintenance by the authority and occupiers of Drum Towers. It is important that bodies responsible for a Drum Tower should adopt a major role and establish disaster protection units. "Risk plans" should be developed and implemented immediately. They must include an evaluation of the risks, based on a thorough knowledge of the hazard, and an assessment of the vulnerability of the buildings.

4.4.2 Control fire risk

In relation to fire, as one of the most disastrous risks for Drum Towers, emergency planning service and minimum invasive detection should be included into the preservation program and made aware of importance for historical building to the local villagers.

The main aim is to reduce the risk by undertaking systematic fire prevention. The strategy seeks to assess the risk of outbreak of fire, to minimize that risk and to prepare a plan of action in the event of a fire; to ensure safety of occupants and timber elements, and to prevent fire from spreading; to train and educate at least one local villager in fire-fighting and in the implementation of salvage priorities and plans; to ensure that the use of the building is consistent with safety requirements; to ensure that the building is not subject to either arson or vandalism; to keep records of protection activities and to evaluate the effectiveness of the strategy.

The recommendations for controlling the potential fire risk here are categorized as passive or active actions. In general, passive actions indicate the fire prevention that can be reconciled with the traditional uses of Drum Tower, which may be sufficient to

prevent fire accident. However, when passive actions are insufficient to avoid the fire risk, active actions should be undertaken to avoid or minimize the risk of fire by using additional devices.

Kuan activity, clan activity, customs and daily activity maintain Dong society and collective culture. Drum Tower is always the center of these activities. Therefore, passive actions can be proposed based on the different custom and daily activities:

i. Rest and entertainment

Drum Tower is the place where people usually rest, and enjoy entertainments(Fig.4-8). After work is over, people come to the Drum Tower, ignite the fire-place at the center, and sit around the fire, chatting, singing, playing lusheng; elders talk about history, tell stories and watch TV(Fig.4-9); children play around.



Fig.4-8 People rest and amuse around fire-place (Photograph by author, 2018)



Fig.4-9 People watch TV in Drum Tower (Photograph by author, 2018)

To control the spread of fire, a stone-ring pile could be added around the fire-place. The stone ring could act as a natural fire-resisting material to control the spread of fire (Fig.4-10). An overlapping with more stone-ring piles could be used when the fire or the size of the fireplace is bigger. Before leaving the Drum Tower, the fire must be extinguished completely, the extra small combustible materials, like Lusheng, playing cards, small wooden furniture, etc. must be removed from the fire-place area (Fig.4-11). All parts of Drum Tower should be inspected regularly and always cleared of unnecessary material and kept clean.

Watching TV in Drum Tower reflects the collective culture in Dong society: people prefer to watch TV together in Drum Tower rather than alone at home. On the one hand, in terms of the preservation, TV set is not compatible to a historical building. Besides, no one maintains and checks regularly the TV set, which could generate potential fire risks. On the other hand, in terms of utilization value, however, this can be one of the elements that keep Drum Towers still "alive".



Fig.4-10 A stone-ring around fire-place (source: <https://toppng.com/drawn-campfire-fire-png>)



Fig.4-11 Combustible materials around fire-place (Photograph by Francesco Augelli, 2017)

ii. Courtship and marriage

Drum Tower is also closely connected with the marriage customs. It is a good place for young men and women for “singing songs and sitting on the moon”. As villagers say, this is an ancient form of courtship, singing songs at the Drum Tower or the Drum Tower square, the antiphonal singing between singers or groups in a multiple-voice version of Dong big song. The site of the wedding feast is also around Drum Tower. In the feast, the relatives and the close friends occupy the place next to Drum Tower and sometimes in the Drum Tower (Fig.4-12).



Fig.4-12 Wedding feast around Drum Tower (Source: The Dong Oral Architecture, 2016)

During the wedding feast, alcohol and oil is unavoidable to splash near the fire-place or even pour into the fire-place, which could accelerate the fire propagation and people could be in danger. Therefore, people as well as their food and alcohol should keep a distance from the fire place.

iii. Festivals

Drum Tower is a festive gathering place for all kinds of ceremonies. At festivals, Dong people dress in festive costumes, gather at the drum tower to sing Dong songs, and perform local dances. One such is the grand ceremony of “Sa”, before spring ploughing or after autumn harvest. The ceremony of Sa Ma is started by an old woman who performs Sa Ma by holding a half-open black umbrella and walking to the altar of Sa Ma. Dong females follow the old woman, then walk around the village, giving Sa Ma's blessing to each household. When the team arrives at Drum Tower, people start to sing and dance. The fire is unceasing during the ceremonies, and all the lights are on (Fig.4-13). The electrical installations and circuits may cause overheating. The festivals in Drum Tower will always be held even in rainy days.



Fig.4-13 Festivals in Drum Tower with fire and lights on (Photograph by author, 2018)

Firstly, fire-place should be, in any cases, kept away from extra combustible materials and extinguished before leaving the Drum Tower.

Secondly, electrical installations, circuits and equipment should be regularly tested, properly maintained, utilized and overhauled. For example, the electrical system should be brought to code so that cords are not dangling from the beams and the exposed cables do not decay due to weathering. The recommendations are two-fold for the electrical system: replacing the electrical system with a solar system, using natural energy to provide the electricity without any risk of short circuits, and using the traditional electrical wires but adding a copper pipe covering.

A small solar panel could be used for light-emitting diode (LED) lighting (Fig.4-14), to completely remove the risk of electrical problems but still satisfy the lighting need for villagers inside Drum Towers. A calculation would need to be completed to determine the minimum number of solar panels needed for proper lighting. The solar panel could be managed by an inverter and battery bank, serving as storage in the daytime and providing lighting at night. Small solar panel could be, at some extent, invisible on the top of the roof, with a color similar to the grey tiles.



Fig.4-14 A small solar panel with LED lighting (source:

<https://www.joom.com/en/products/5b84e41c1436d40167479776>)

If the above option is not preferred for providing lighting, the electrical wires could be covered by a copper pipe. Due to its durable and flexible characteristics, copper pipe is preferred. With a bacteria-free environment, the integrity of the electrical wires is guaranteed. The copper color matches the timber elements, which is preferable to exposed wire.

Thirdly, when a rainy day with thunder and lightning comes, Drum Tower and people inside may be at risk because of the traditional lightning rod in Drum Towers, which is actually the king-post lifting out of the roof top and covered with a decorative metal (Fig.4-15). In the old tradition, this is the protection device against the lightning strike. However, lots of Drum Towers lacking of wires must be connected to the ground. Otherwise, the lightning strike would pass through the wooden structure and provoke a fire accident. Therefore, lightning rods should be properly designed and maintained, the wire should be installed along the roofline as invisible as possible.



Fig.4-15 A “lightning rod” decorated with metal (Photograph by author, 2018)

Active actions are twofold:

i. Minimum invasive fire detection

Fire detection systems are in general effective fire safety measures for heritage buildings and museums (Jensen, 2006). The bare minimum should be fire bells or an electrically operated system. Preferably, automatic and active fire detection systems should be installed and connected to an alarm center and to the local fire brigade.

Although open fire in fire place brings a mass of smoke, Drum Towers with exposed structure have a good condition of ventilation. Therefore, for indoor applications in Drum Towers, a heat detector is more reliable than a smoke detector.

Among heat detectors, line heat detectors are by far most suited for Drum Towers and other historical buildings. Line heat detectors may hardly be visible, are sensitive along their lengths, very reliable, cost-effective and some may be repaired locally with no special parts (Fig.4-16). The Stave Churches are also monitored by unobtrusive line heat detectors.



Fig.4-16 Line heat detector (Source: Robert C., Other detection and alarm devices. 2018)

ii. Fire-fighting facilities

(a). In any case, water is the only solution to fight fire. Why not use the extinguisher? Firstly, for an aesthetic reason, as it would have a negative impact on the appearance of the Drum Tower. Secondly, it requires a periodical maintenance; typically, a fire extinguisher is out of order when the accidental fire occurs. Therefore, the extinguisher or other facilities that require a periodical maintenance are not suitable for rural area. As lots of Drum Towers are equipped with a nearby water pool, it is possible to take advantage of that; if they are not equipped with a water pool, it is

recommended to establish a water storage nearby.

(b). Fire-proofing material coating is twofold: potassium aluminum sulphate, which is used as a fire retardant to make wood less flammable, or potassium aluminum sulphate, which can minimize the damage due to flame, after-glow, and the spread of fire; Intumescent coating is often applied in buildings as a passive fire-fighting solution. Rather than controlling heat, the protection prevents the spread of fire and smoke through the timber elements. However, intumescent coating provides a glossy appearance that is unnatural and not suitable for wooden historical buildings. A coating could be applied but only if a transparent and glossy look is acceptable. Intumescent coatings are not a good choice for Drum Towers.

4.4.3 Control insect risk

Three types of insect attacks can be found in Dong Drum Towers. The first type is beetles; *Anobium punctatum* and *Hylotrupes bajulus* are common in the Dong area. The second type is wasps, and the last is termites, which were rarely found in Drum Towers during this investigation. However, preventive actions to control termites should be undertaken. Insects may be attracted by wood if it has not been appropriately preserved. Generally, controlling insects is effective when using chemicals particularly tailored for wood-boring insects, which are known as preservatives. Before preservative treatment, several steps should be completed for general insect attacks during their initial stages and to decide if chemicals should be used:

For seriously decayed wood, the following actions are recommended:

- i. Diagnostics: A skilled person should conduct a resistance drilling test to check the condition inside the timber (mainly to check the condition of termites' damage).
- ii. Repair, if necessary, by replacing of the seriously decayed part.
- iii. All the existing exit holes should be sealed with natural beeswax so new attacks can be more easily recognized after intervention.

- iv. Monitor by surveying the wood condition. If insect attacks occur again, chemical treatment can be applied.

For less seriously decayed timber:

- i. Seal the existing holes.
- ii. Monitor by surveying the wood condition. If issues arise, apply chemical treatment.

For surveying wood condition, at least one local villager should be trained to use the tools, like an auger and a wooden mallet for checking if timber has been attacked by insects. A periodic survey of the timber condition and examination of early signs of insect attacks must be performed by well-trained villagers.

Firstly, to address the risk of beetle attacks:

(a). Apply transparent and uncolored preservative, which is brushed on to wooden elements for a better result (Fig.4-17); a double layer of preservatives should be applied using different techniques. Chemical treatment must be employed only if the attacks are active or it is determined that future attacks are probable after an in-deep survey.

(b). Spray a preservative product within the building to create a fumigation fog. Fogs are particularly indicated where large or inaccessible places must be treated, such as the upper space in the Drum Tower, which is may be inaccessible if additional scaffolding or ladders are lacking. And smoke production in the Drum Tower have also contributed to prevent insects at some extend.



Fig.4-17 Brushing preservative on timbers

(Source:<https://www.colorivernici.it/soluzioni-tecniche/impregnante-per-legno-trattamento-protettivo-esterno/>)

Secondly, the risk of wasp attacks must be addressed. Wasps create holes in the timber as a nest for laying eggs. Compared with other insect attacks, generally, the wasp attacks produce less damage. All the existing holes should be sealed with natural beeswax after monitoring the timber surface. If sealing is not effective against the wasp attacks, the applications for dealing with beetle attacks could be also applied.

Third is the risk of termite attacks. The previous treatment with preservatives could also be effective against termites but may not be sufficient. The key method used to prevent termite attacks is to destroy the termites' community as much and as soon as possible. If the survey finds signs of termite attacks, electronic termite detector diagnostics could be employed by experts.

Two possible actions are possible to prevent and address termite damage:

(a). Bait boxes are usually applied underground and around the buildings. These boxes provide a feeding station for a big group of termites. When the termites find the bait box, they recruit large numbers from the community to the new food source. After eating the food, termites are dosed with a slow-acting insecticide. Gradually, the termites form a poison-delivery system, carrying the toxin back to the rest members of the colony. The bait is composed of cellulose, which is blended with a slow-acting insecticide that affects the normal growth of termites. It can be delivered throughout

the whole colony before any termite is killed. However, the insecticide takes at least two weeks to affect the colony. Therefore, continued and complementary feeding should be used.

(b). The soil around the building should be deeply treated with biocides. As such, the termites are unable to cross this trench and the building will be adequately protected for some years.

4.4.4 Control fungi risk

Rot is generally confined to areas where the moisture content in the timber has remained high. Therefore, identifying the origin of the dampness, stopping the entrance of moisture, and maintaining dryness are required.

- i. Check if some parts in the Drum Tower are being infiltrated by water or are frequently damp;
- ii. Train at least one local villager to use tools, like an auger and a wooden mallet, to check if fungi are infecting timber. The timber surface should be checked carefully and tools should be used to assess the level of damage already caused by fungi.
- iii. Diagnostics should be conducted by a skilled person performing a drilling test to check the wood's internal condition.

If any deterioration is considered dangerous for the safety of the Drum Tower and for people after surveys and diagnostics, the actions below could be undertaken:

(a). Badly decayed wood parts should be removed and replaced treated timber with the same characteristics as the old one or using other compatible well-designed reinforcement systems.

(b). For the column base or any wooden elements in contact with moist soil, salt transparent and uncolored preservatives should be applied, like boron-based treatments, that could improve and prolong the durability of wood in damp conditions.

(c). Monitoring. A periodic survey of the timber condition and for early signs of damage should be performed by well-trained villagers.

For columns supported on a platform, the platform should be maintained in good condition avoiding the absorption of water from the soil. If the platform is in good conditions, regular checks of it are needed. If it is in poor conditions, with the column already decayed, then preservative treatment should be applied. For columns without a platform, adding a new platform under the column is not recommended. Preservative treatment should be applied to the foot of columns to avoid the absorption of water from the soil.

Due to the infiltration risk caused by rain, periodic maintenance of the roof tiles is greatly needed. Weeds or other plants should be entirely and regularly removed. Any applied chemical treatment should be safe for people using the Drum Tower as well as for the roof tiles or timber elements. The roof tiles should be cleaned regularly and checked for leaks. Any problems should be repaired from the roof to the column. If the cause of damage due to absorption and infiltration is addressed, no further interventions are required beyond maintaining the good condition and periodic surveys.

Apparently, due to the frequent use of Drum Towers by local villagers, the risks to Drum Towers and to people who use them should be addressed. The general recommendations are aimed to control the problems during their initial stages. Hence, they were developed foremost for the local villagers and craftsmen, as well as experts to be simple, economic, and easy to implement with respect to the actual Drum Tower conditions. Although there are a lot of improvements which should be conducted in the future, this idea will hopefully serve as a protocol for Drum Tower preservation and maintenance in the Dong area, and be of benefit to similar wooden historical buildings.

Conclusions and Future Developments

A critical issue that was set out at the beginning of this work is that few written historical archives and documentation can be found for the knowledge study of Dong Drum Towers. In addition, according to the discussion developed in the literature review and in the previous contributions on Drum Towers, existing knowledge remains fragmented, nor it is synthesized as a systematic whole or analyzed together. Moreover, there are few further discussions on the preservation of Drum Tower. Therefore, a massive and in-depth field survey and interviews with the locals have been adopted as the sole response to this in the thesis.

The comprehensive description and analysis of Drum Towers undertaken in Chapter 1 has shown the physical and mental significance of the Dong Drum Tower, and how the Dong social structure, construction system, and custom system need people's participation and collaborative work, as people are the creators and users of buildings. They have a shared social structure, culture, custom, building form, and life pattern, which provides a coherent totality.

For further issues of the current legal context concerning the protection of Drum Tower. In Chapter 2, a re-organized and evaluated safeguard system is addressed and critically reviewed. None of the current safeguard systems has issued or introduced any specific provision to the Drum Tower; this has resulted in a bad legal state of preservation of Drum Towers.

Besides, a few case studies in Chapter 3 have suggested that the Dong Drum Tower is suffering a "chronic" risk, which requires proper and periodical maintenance, otherwise it will gradually impact negatively on the aesthetic appearance, authenticity and even structural safety of Drum Towers. All this is due to situations ranging from observable modifications to bad maintenance interventions. Moreover, the Drum Tower, like other timber historical buildings, has been suffering from the disastrous risk of fire. Especially, open fires generated by fire places are one of the riskiest sources of ignition and heat. In fact, it is a really interesting issue for preservation as people need fire both physically and mentally. However, fire provokes potential

disasters, Overall, Drum Towers are, at present, in a poor state of preservation which requires recommendations based on their actual conditions together with a critical approach to fire.

In chapter 4, the Scandinavian experience of Stave Church Program is introduced to enlighten and inspire recommendations for the preservation of Drum Towers. Despite the Drum Tower differs from the Stave Church, a common preservation process could be identified starting from knowledge activities, then to solve the actual problems and to control the various risks. Finally, appropriate interventions will be applied if necessary. However, it is important to consider also differences in scale and socio-economical context, which may have a significant influence on the applicability and transferability of Scandinavian experience. A preliminary knowledge activity is indispensable for Drum Towers, encompassing preliminary survey and instrumental diagnosis. However, they are still not well-formulated for the preservation and maintenance of Drum Towers.

In Dong area, there are some taboos on fire, and the local customs on fire prevention, which are the experiences that Dong people have accumulated in life and production over time. However, they are gradually vanishing and forgotten by the new generations. As the most adaptive and understandable proposal to the local people, regaining the lost traditions is really essential to fire prevention today. It is considered also as an in-between solution before the local people can understand and use “modern technology”.

Recommendations for risk prevention reflect the need for legislative, administrative, financial, educational interventions and other measures to protect the Drum Tower from fire and other fatal risks, underlining the need to find a balance between technological and management solutions to oppose the disastrous effect of multi-risks. In order to control the fire risk, passive and active actions have been recognized. Passive actions indicate how traditional uses of Drum Tower can be reconciled with the preservation and in particular fire prevention, ranging from rest and entertainment; courtship and marriage; festivals. In which, control fire-place is the key factor. From a critical point of view, is the open fire really indispensable for the villagers? Or the

“symbolically fake fire” without risk of damage could be substituted for the open fire? The answer is not just simple yes or no. It must be applied delicately with great respect for the local tradition and culture.

Active actions are also twofold: minimum invasive fire detection and fire-fighting facilities. Not all facilities can be adapted to Drum Tower and accepted to the local people in the first place. They need time to get used to recognize and maintain “modern” technology. Therefore, proposed actions are in terms of both technical and practical measures based on operable acceptance of the locals and the actual conditions of Drum Towers.

The thesis is not only driven by nostalgia and appreciation; the work undertaken in this thesis could be supplemented by further investigation and analysis of current approaches to preservation and maintenance in the Dong area, which is accessing a new stage of preservation of Drum Towers at a practical level. Facing the change in rural society, social organization, construction materials, traditional or modern techniques, people’s thinking, etc. For this, the Dong area is demanding more documentation, survey, time, cost, human resources than those available for this single thesis. Furthermore, technical measures require more on-site testing and response collection from the locals whether it fits well in Dong area. Therefore, this research is actually a big project, which could last for decades. However, this is worthwhile for all the implied researchers.

Appendix: Survey cards

A five-year period research was carried out in Dong areas since April 2014, among Hunan, Guizhou, Guangxi provinces. Especially the last phase from July to October 2018. The time the author spent in the Dong villages of Congjiang, Rongjiang, Tongdao, Sanjinag county, and local archive authorities of cultural heritage, allowed author to obtain historical restoration projects' documents and related files of Drum Tower. Subsequently, the last phase in Dong areas was contributed by observation, collection and analysis of the intervention of Drum Tower. The table below records the general information of in-situ observation in July and August 2018(Table.3-1). The abbreviations in the table lists below, NCH: National Cultural Heritage; PCH: Provincial Cultural Heritage; HCFV: Historical and Cultural Famous Villages; TV: Traditional Villages; WCH: World Cultural Heritage(Tentative); CCR: County-level Cultural Relics.

Table.3-1 The general information of in-situ records

Name of Drum Tower	location	Protected Level	Original Built year	Interventions year	Wood species	Substitution (visual inspection)	Notes
Dali	Zaima Village, Rongjiang, Gui-zhou	NCH, HCFV, TV, WCH	1740	Rebuilt in 2003 Restoration in 2017	Chinese fir	Lintels, tiles	Fire accident in 1984, the building was totally destroyed. Documents of restoration project 2017
Gaoqian	Xiajiang Village, Congjiang, Gui-zhou	NCH, TV, WCH	1723-1735	2014 restoration	Chinese fir	Purlins, rafters, tiles	Documents of restoration project 2014
Jitangxia	Zhaoxing village, Liping, Gui-zhou	PCH, TV, WCH	original built in 1813 (Jiaqing 18 th era, Qing Dynasty)	restoration in 1978, 2007 and 2017	Chinese fir	Purlin, rafters, tiles	Restoration: Purlin, rafters, tiles in 2017; Funds raised by local villagers
Rongfu	Wangdong village,	CCR	1915	1989 rebuilt 2016	Chinese fir	Lintels, purlin, rafters, tiles	Restoration in Jun 8 th , 2016 and Holistic refurbishment in Nov 2017

	Congjiang, Gui-zhou			restoration			
Zai'e	Xiajiang Village, Congjiang, Gui-zhou	NCH	Yongzheng era, Qing dynasty (1723-1735)	Rebuilt in 1986 Restoration in 2004	Chinese fir	King post, purlin, rafters, tiles	Documents of restoration project 2014
Zengchong	Wangdong Village, Congjiang, Gui-zhou	NCH, HCFV, TV, WCH	1672 (Kangxi 11 th era, Qing dynasty)	1982, restoration 2008 restoration	Chinese fir	Rafters, struts, lintels, windows, railing, verge board, wooden floor	Financial support by local government; Documents of restoration project 2008
Zengying	Wangdong Village, Congjiang, Gui-zhou	PCH	Original built in 1655(Shunzhi 12nd era, Qing dynasty)	2006.8, restoration	Chinese fir	Add the struts and lintels to lift up and incline the roof structure	Restoration in Aug 2006, work has been done by local carpenters and painters, funds raised by local villagers

Jingou	Wangdong Village, Congjiang, Gui-zhou	CCR	1884(10 th era of Guangxu, Qing dynasty)	2017, restoration	Chinese fir	Restoration: Purlin, rafters, tiles, verge board	Restoration done by local painters and carpenters from Gaoqian village
Zeli	Wangdong Village, Congjiang, Gui-zhou	PCH, TV	1664 (4 th era of Kangxi, Qing dynasty)	2008, restoration	Chinese fir	Decorative painting, rafters, tiles	restoration in 2008, funds raised by local villagers; Listed as PCH in 2015
Gaochuan	Wangdong Village, Congjiang, Gui-zhou	CCR	1980s	2016 restoration	Chinese fir	Dou-gong, tiles, rafters, verge board	The construction way on <i>Pai-lou</i> (Dou-gong) has been changed
Gaocai	Wangdong Village, Congjiang, Gui-zhou	CCR, TV, WCH	1873, Tongzhi 12 th era, Qing dynasty	1969 partly frame structure get burned; Restoration in 2012	Chinese fir	Columns, beams, lintels, struts, tiles, rafters, verge board	The verge board inclined along the top roof tier

Yaxian	Wangdong Village, Congjiang, Gui-zhou	CCR	1924	2005 restoration	Chinese fir	tiles, rafters, verge board	restoration in funds raised by local villagers; the time of construction was recorded on the plinth; “Cejiao” – an ancient construction method as inclined columns to enhance stability
Yintan	Guping village, Congjiang, Gui-zhou	CCR	1997	2014, 2017/1/15	Chinese fir	tiles, rafters, verge board, columns, beams, struts, lintels	only the old peripheral columns remained, other elements are almost renovated
Longshi	Yutou village, Tongdao, Hunan	NCH, HCFV, TV, WCH	1787		Chinese fir	-	batten inserting and mental loop-strengthening in the columns and struts
Lusheng	Yutou village,	NCH, HCFV, TV,	1829	Rebuilt in 1993, restoration in	Castanopsis chinensis	restoration: rafters and tiles	Documents of restoration project 2009; Mental loop-strengthening in

	Tongdao, Hunan	WCH		2013, 2016	(columns, beams, king post) ; other elements are Chinese fir		columns
Yashang	Yutou village, Tongdao, Hunan	NCH, HCFV, TV, WCH	1789	1821-1850, 1871, 2008 restoration	Chinese fir	Columns, lintels	Partly columns were replaced into new ones (same material) in 2008; Referred to the figure; Metal reinforcement rings on the old columns and lintels
Yanglan	Yanglan village, Tongdao, Hunan	PCH, WCH	1787	1840,1883, 1925,1956, 1984,1990	Chinese fir	Rafters, rake angle	Re-painted on rake angle
Matian	Tianxin Village, Tongdao,	NCH	Original built in 1644-1661	1948 restoration; 1984	Chinese fir	Restoration: Purlin, rafters, tiles, verge	Restoration in 2016 (funds raised by villagers): main beam was dismantled during the “Cultural

	Hunan			restoration; 2014, 2016 restoration		board in 2016; Painted in tung oil in 2016	Revolution”, which was dated the construction information; rake angle was destroyed; drawing done by a Beijing construction company. Documents of restoration project 2014
Mapang	Bajiang Village, Sanjiang, Guangxi	NCH	1928	1943 rebuilt 2005 restoration 2012 restoration	Chinese fir	Restoration: Purlin, rafters, tiles, verge board	Undertaken by Liuzhou construction company. Documents of restoration project 2005 and 2012

This survey is conceived to be the very first preliminary one, aiming to collect the general preservation status of the Drum Towers. Nevertheless, it is the first record that even local authorities did not preserved and collected in order. As seen in the table, the section, plane and the details in addition to a series of photograph of the frame structure and wooden joints, of importance, the detailed information about the intervention is requiring to fill up. A comprehensive and detailed survey card is in need, aiming to achieve the purposes :

- i. Offering a comprehensive documentation of specific Drum towers in architectural point of view, ranging from morphology to wooden joints;
- ii. Providing an actual condition, intervention analysis of the structural components and identified decay phenomena;
- iii. Offering a practical material for the following preservation and maintenance work.

Hereby presenting the survey cards of Lusheng and Mapang Drum Tower.

Name: Lusheng Drum Tower

location: Yutou village, Shuangjiang town,
Tongdao county, Hunan province



Protected level of the building:

National level

Provincial level

Prefectural level

Protected level of the village:

Historical & Cultural Famous Villages

Traditional Villages

UNESCO Tentative lists



Original built in: Qing Dynasty 1829 Republic of China _____

People's Republic of China _____

Historic Change: Restoration 2009 Rebuild 1993

In charge: Local villagers Local authority

Government document: Collected restoration project in 2009

Uncollected _____

Structural Type: Chuan-dou Tai-liang Tai-Chuan complex

Roof morphology: Pyramid Hip-and-gable Overhanging-gable

Special crafts: Clay sculpture Decorative painting

Wood carving Dou-gong

Historic settings: Plaza Pond

Alley Village gate

Drama stage

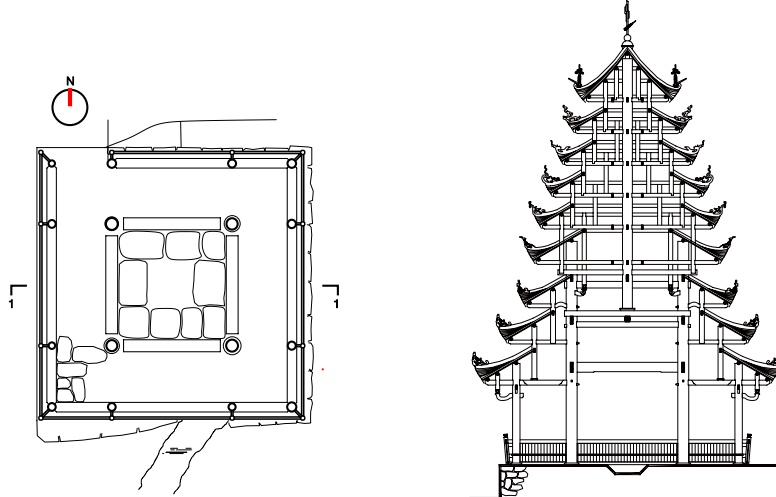
Name: Lusheng Drum Tower

Items: Geometric drawings

Author: Ling Cai, Yi Deng

Date: 08/2002

Content: Plan, section1-1



Name Lusheng Drum Tower

Items: Photography

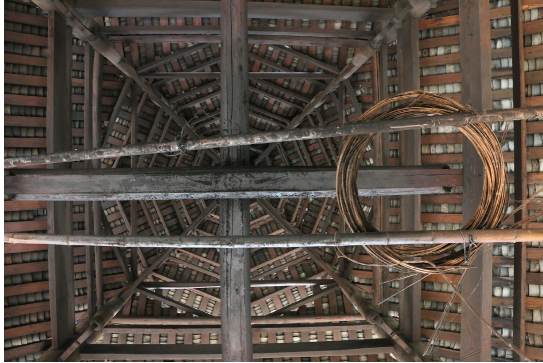
Author: Shiruo Wang

Date: 07/2018

Content: General view- east side(left) and north side(right)



Name: Lusheng Drum Tower
Items: Photography
Author: Shiruo Wang **Date:** 08/2018
Content: The view of frame-structure



Name: Lusheng Drum Tower
Items: Photography
Author: Shiruo Wang **Date:** 08/2018
Content: The view of some distinct crafts



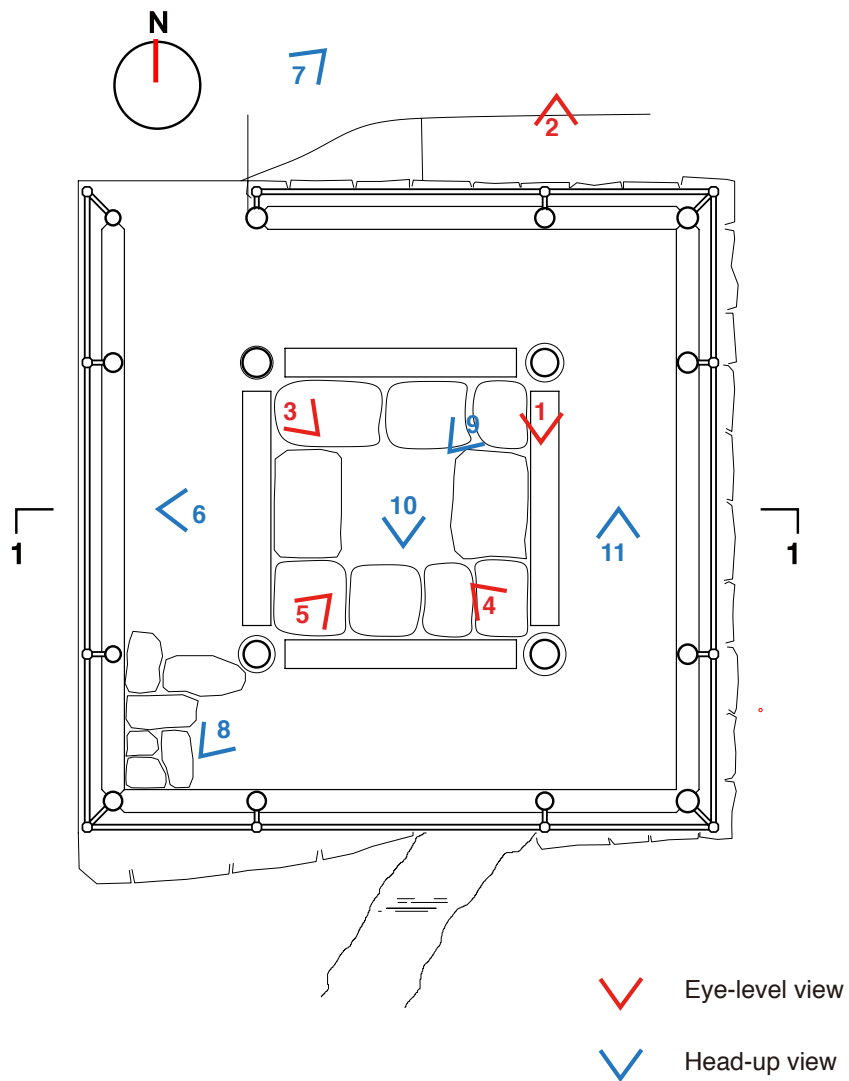
Name: Lusheng Drum Tower

Items: Analysis of actual condition

Author: Shiruo Wang

Date: 08/2018

Content: Indication in ground floor



Name: Lusheng Drum Tower

Items: Analysis of actual condition

Author: Shiruo Wang

Date: 08/2018

Content: Photograph according to the indications



1



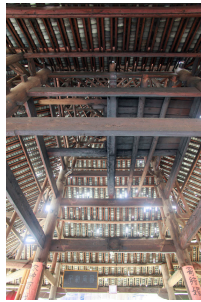
5



9



2



6



10



3



7



11



4



8

Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 08/2018

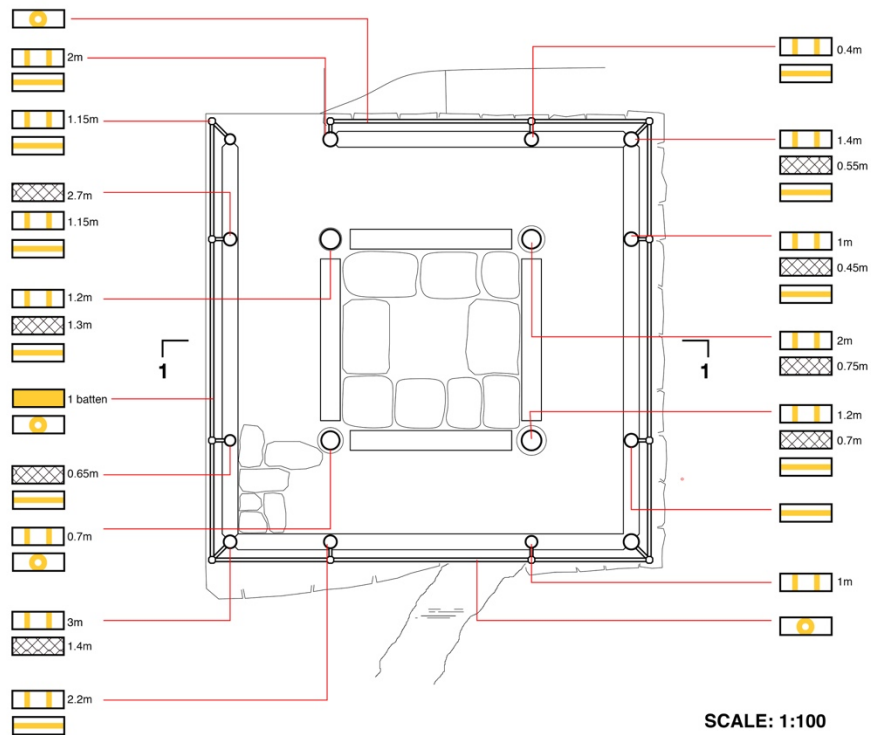
Content: Gound plan (re-edited by Shiruo Wang)

LEGEND

- | | | |
|---|--|---|
|  preservative treatment |  clean |  No intervention |
|  metal ring strenthening |  splicing | |
|  wood patching(repair) |  wood replacement | |



NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc.



Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

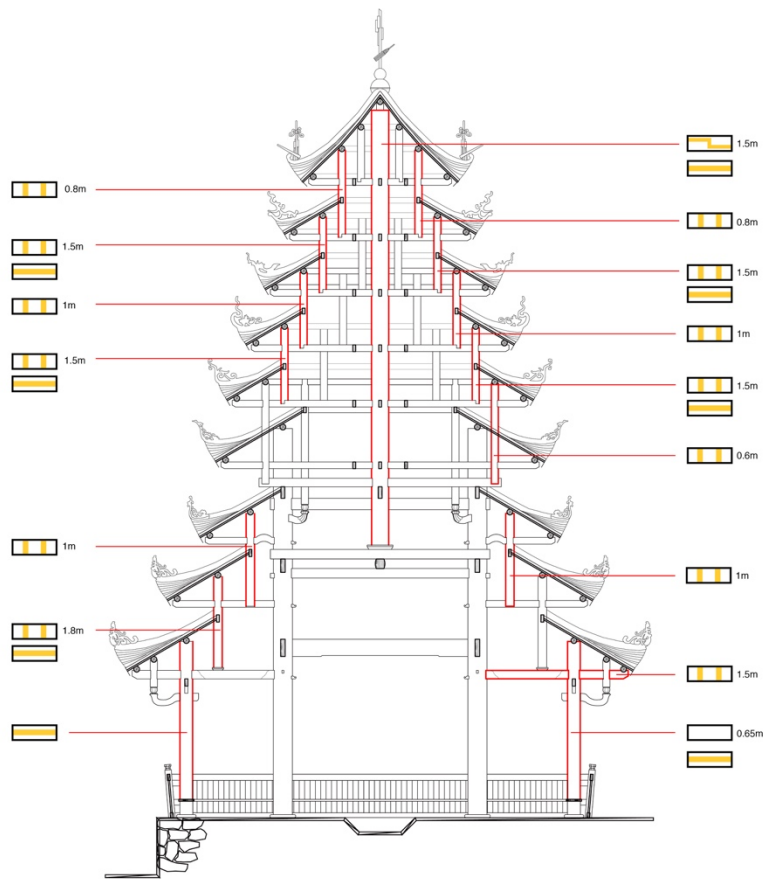
Date: 08/2018

Content: 1-1 section (re-edited by Shiruo Wang)

LEGEND

- | | | |
|--|--|---|
|  preservative treatment |  clean |  No intervention |
|  metal ring strengthening |  splicing | |
|  wood patching(repair) |  wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc



SCALE: 1:100

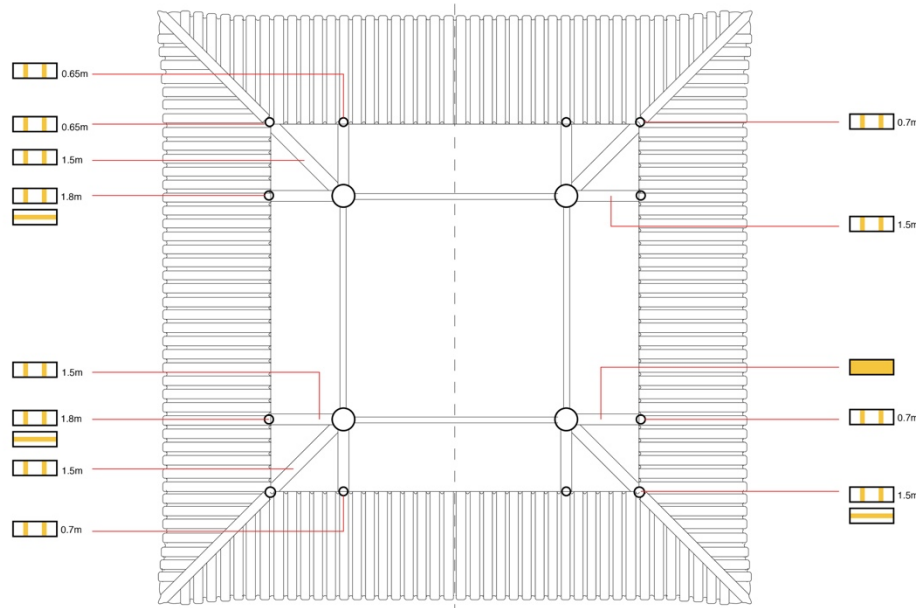
Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 08/2018

Content: 1st storey (re-edited by Shiruo Wang)



The plan of 1st storey

LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

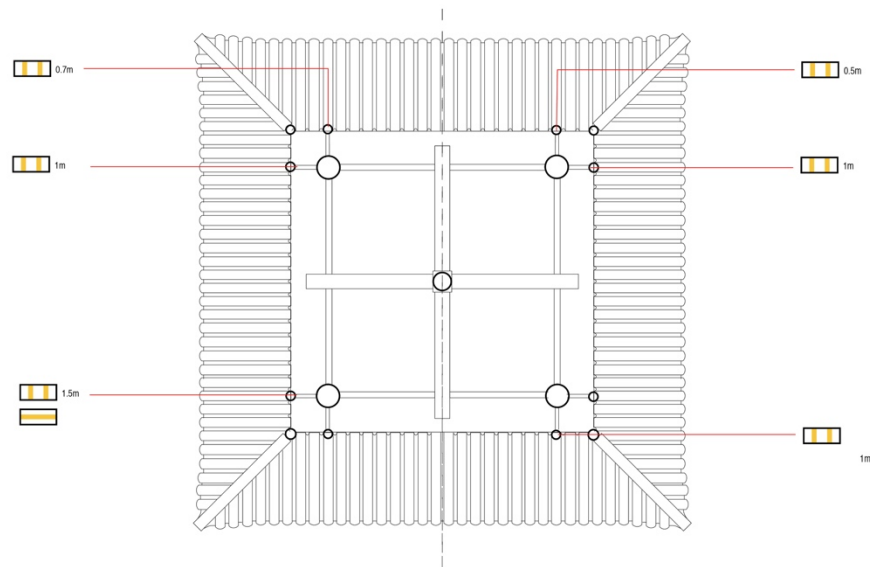
SCALE: 1:100

Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang **Date:** 08/2018

Content: 2nd storey (re-edited by Shiruo Wang)



The plan of 2nd storey

LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

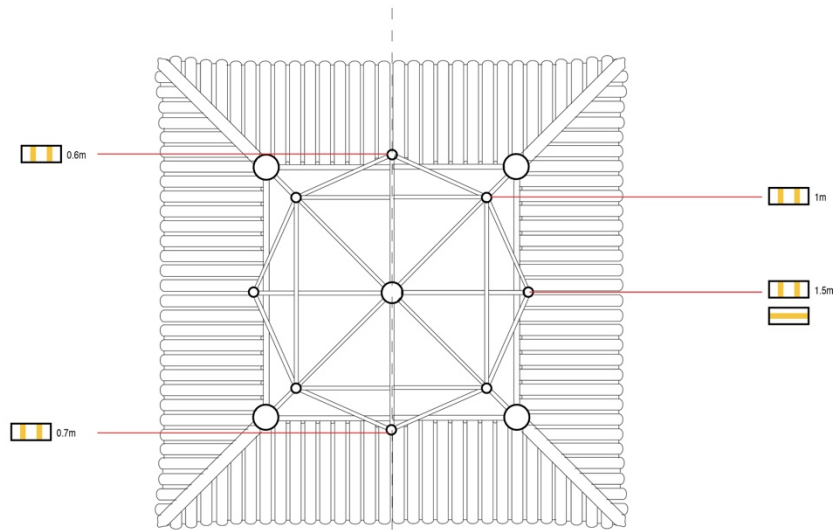
SCALE: 1:100

Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang **Date:** 08/2018

Content: 3rd storey (re-edited by Shiruo Wang)



The plan of 3rd storey

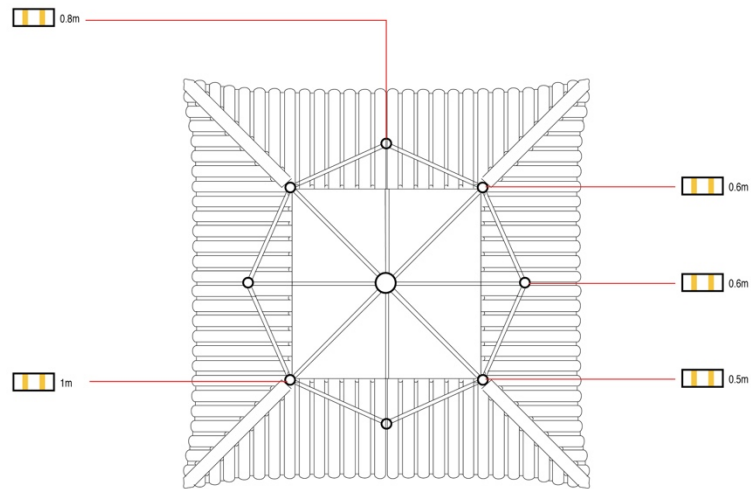
LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

SCALE: 1:100

Name:	Lusheng Drum Tower		
Items:	Intervention analysis		
Author:	Shiruo Wang	Date:	08/2018
Content:	4th storey (re-edited by Shiruo Wang)		



The plan of 4th storey

LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

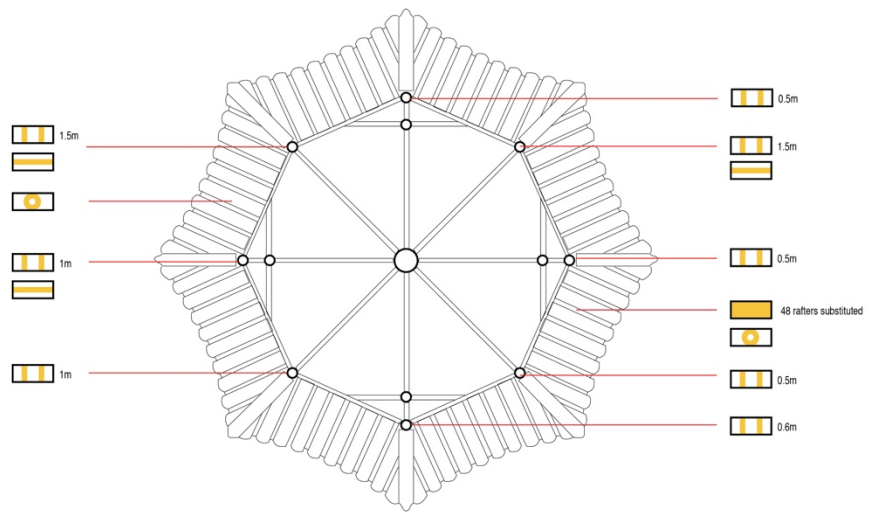
SCALE: 1:100

Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang **Date:** 08/2018

Content: 5th storey (re-edited by Shiruo Wang)



The plan of 5th storey

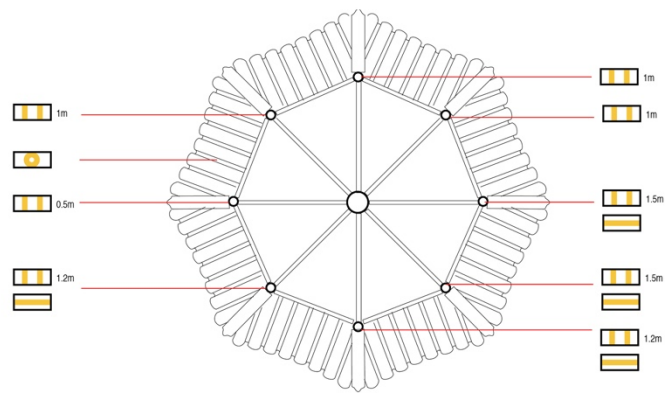
LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

SCALE: 1:100

Name:	Lusheng Drum Tower		
Items:	Intervention analysis		
Author:	Shiruo Wang	Date:	08/2018
Content:	6th storey (re-edited by Shiruo Wang)		



The plan of 6th storey

LEGEND

- | | | |
|--------------------------|------------------|-----------------|
| preservative treatment | clean | No intervention |
| metal ring strengthening | splicing | |
| wood patching(repair) | wood replacement | |

NOTE: The attached number is the length in total of the corresponding intervention.
Preservative treatment includes epoxy resin, etc

SCALE: 1:100

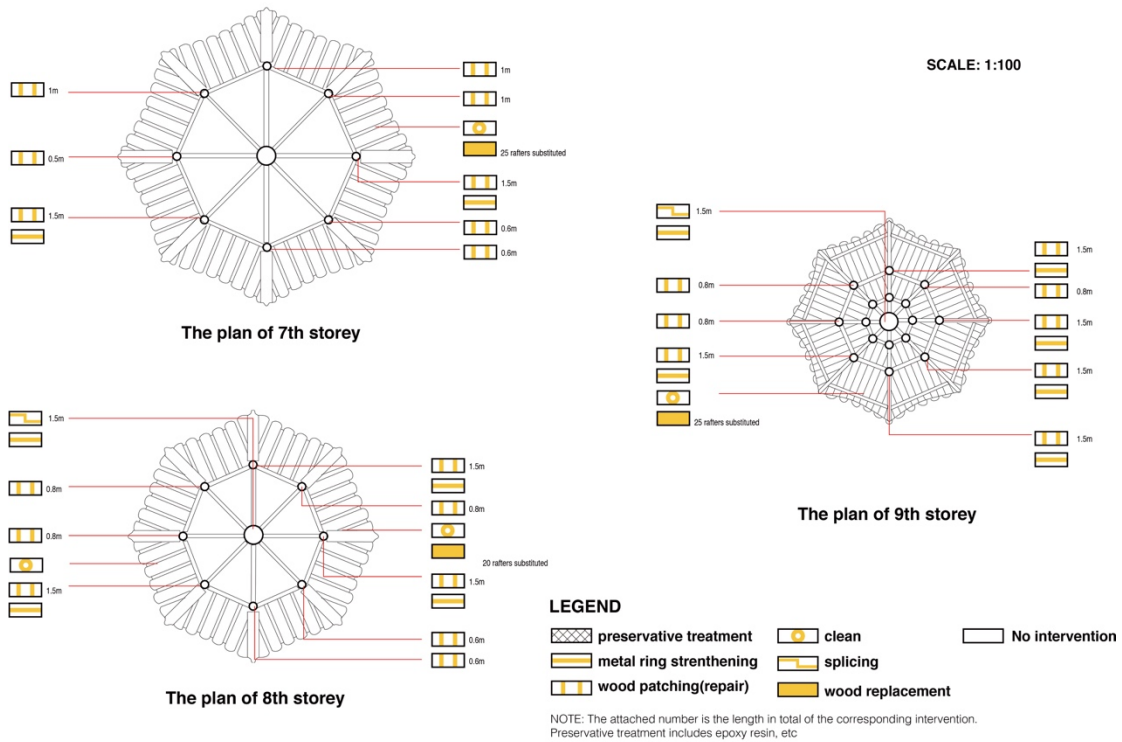
Name: Lusheng Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 08/2018

Content: 7th, 8th, 9th storey (re-edited by Shiruo Wang)



Name: Mapang Drum Tower

location: Mapang village, Baijiang town,
Sanjiang county, Guangxi province



Protected level of the building:

National level
 Provincial level
 Prefectural level

Protected level of the village:

Historical & Cultural Famous Villages
 Traditional Villages
 UNESCO Tentative lists



Original built in: Qing Dynasty _____ Republic of China 1928
 People's Republic of China _____

Historic Change: Restoration 1938, 2005, 2012 Rebuild _____

In charge: Local villagers Local authority

Government document: Collected restoration project in 2005 and 2012
 Uncollected _____

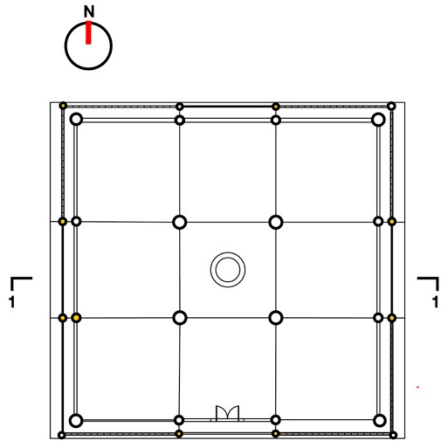
Structural Type: Chuan-dou Tai-liang Tai-Chuan complex

Roof morphology: Pyramid Hip-and-gable Overhanging-gable

Special crafts: Clay sculpture Decorative painting
 Wood carving Dou-gong

Historic settings: Plaza Pond
 Alley Village gate
 Drama stage River

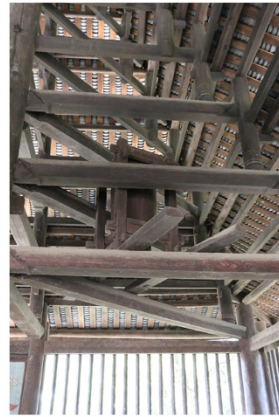
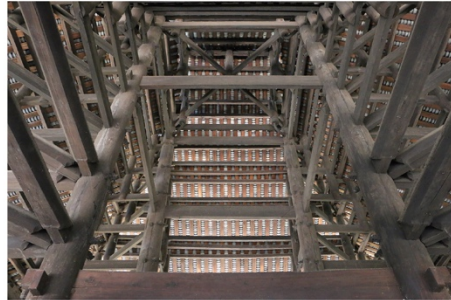
Name: Mapang Drum Tower
Items: Geometric drawings
Author: Shiruo Wang **Date:** 07/2018
Content: Plan, section1-1



Name Mapang Drum Tower
Items: Photography
Author: Shiruo Wang **Date:** 07/2018
Content: General view



Name: Mapang Drum Tower
Items: Photography
Author: Shiruo Wang **Date:** 07/2018
Content: The view of frame-structure



Name: Lusheng Drum Tower
Items: Photography
Author: Shiruo Wang **Date:** 08/2018
Content: The view of some distinct crafts or details



Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018


Content: Ground floor


Abbreviation

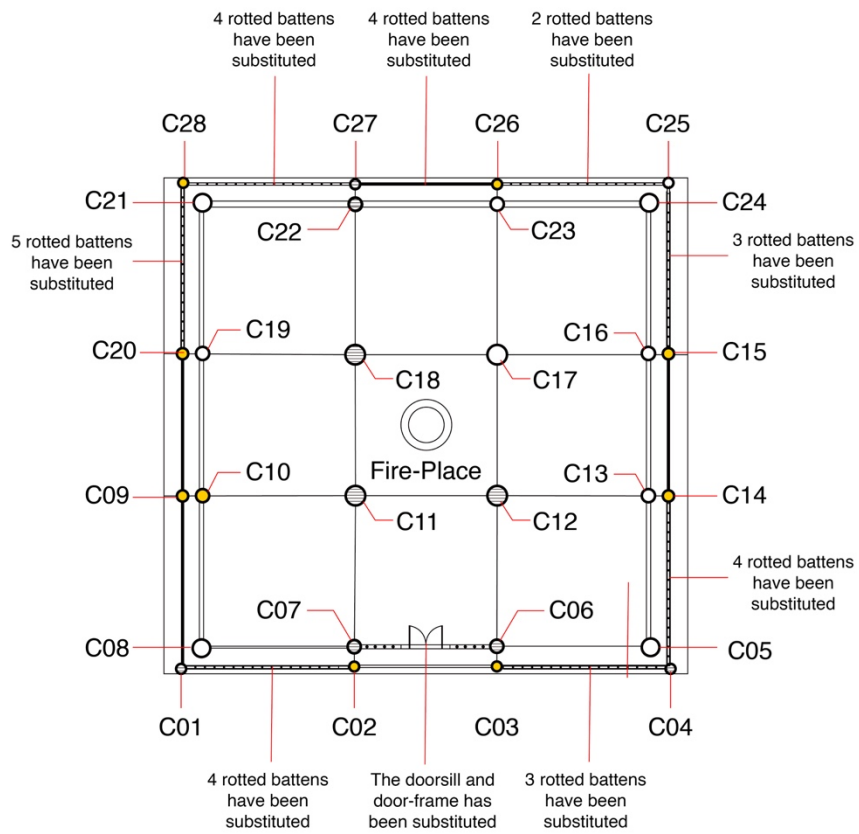
C: Column

*The unmarked elements are in good condition

 replaced elements

 wood patching(repair)

 No intervention



SCALE: 1:100

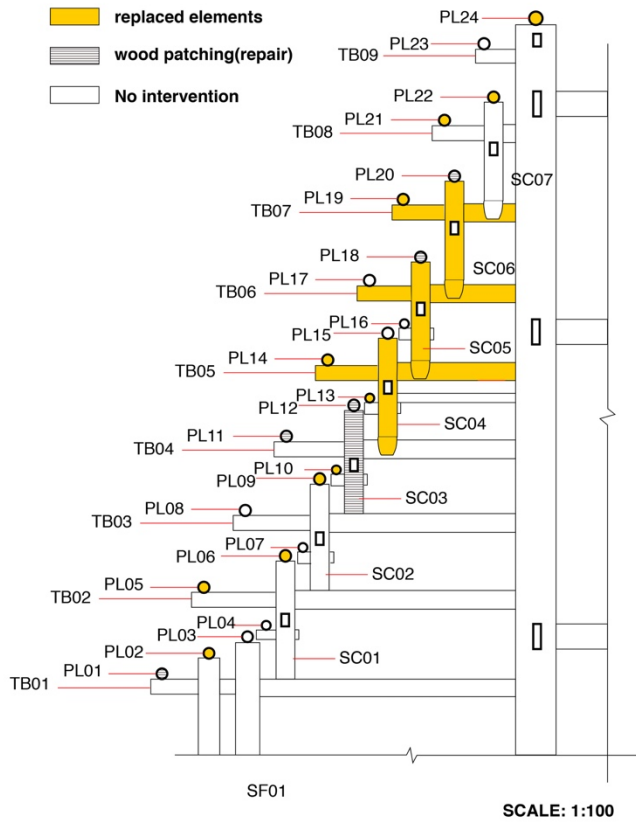
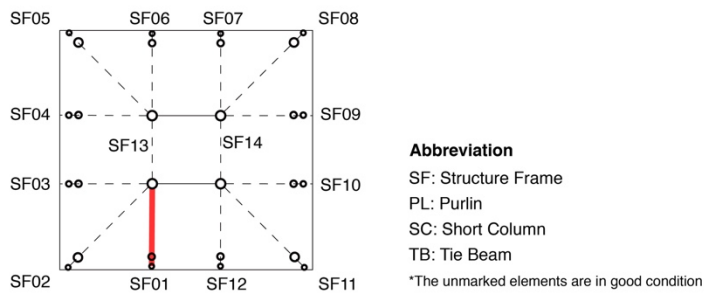
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 01



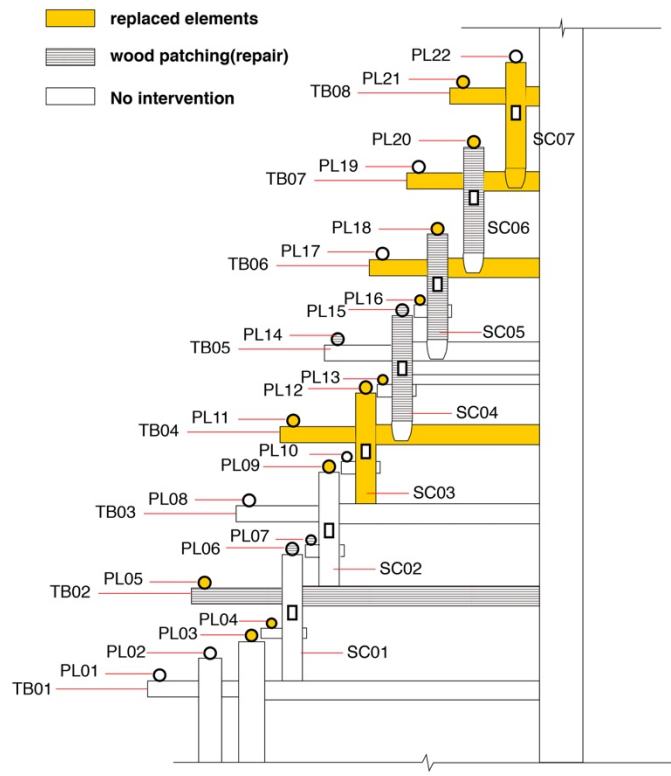
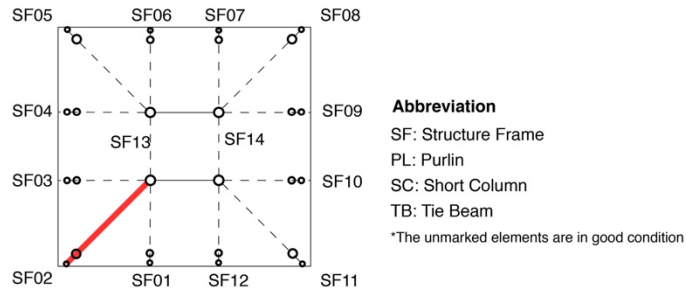
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 02



SCALE: 1:100

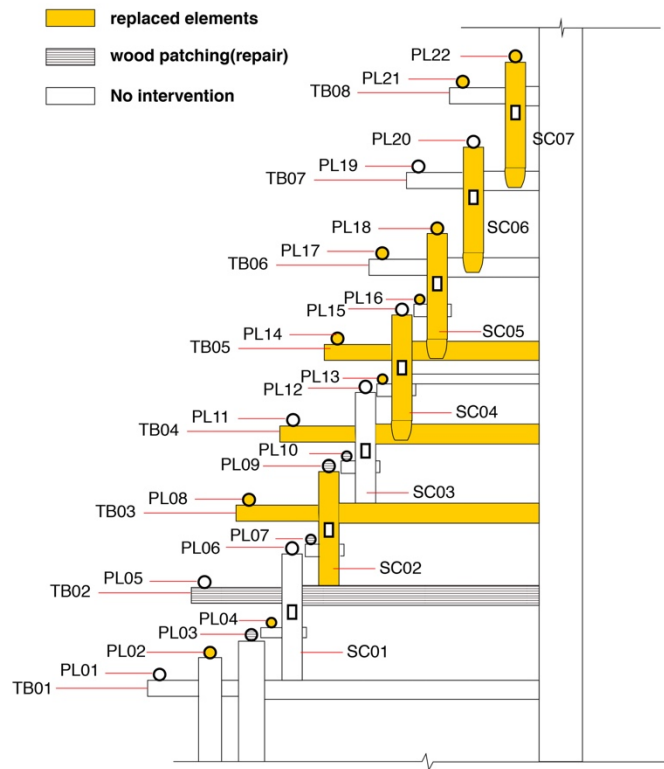
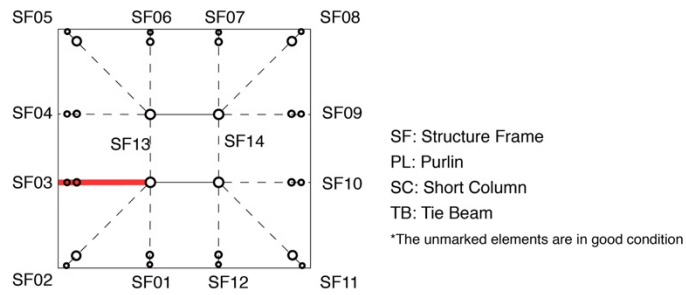
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 03



SCALE: 1:100

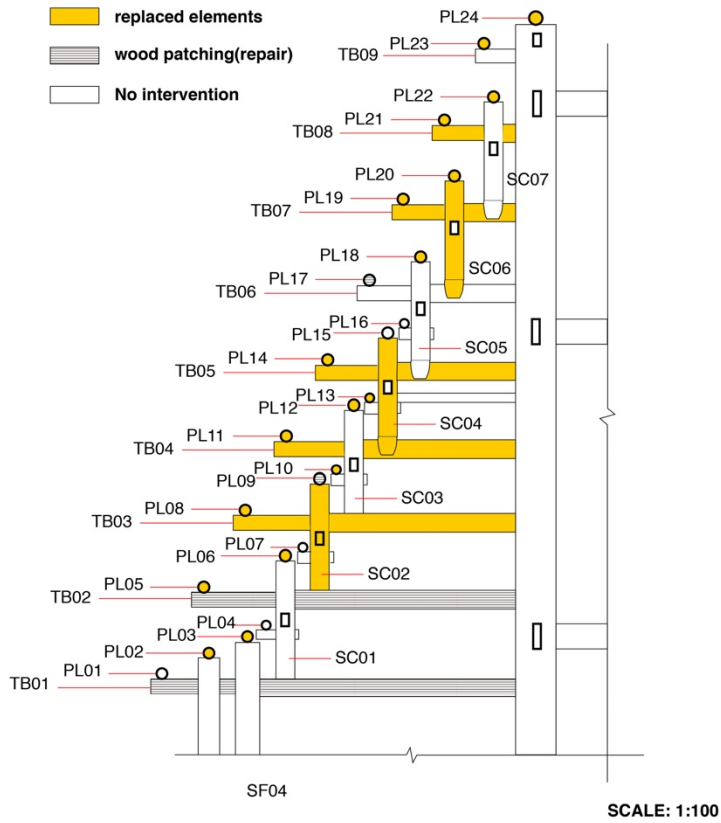
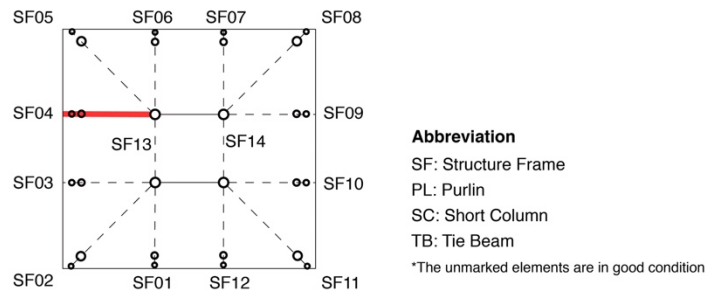
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 04



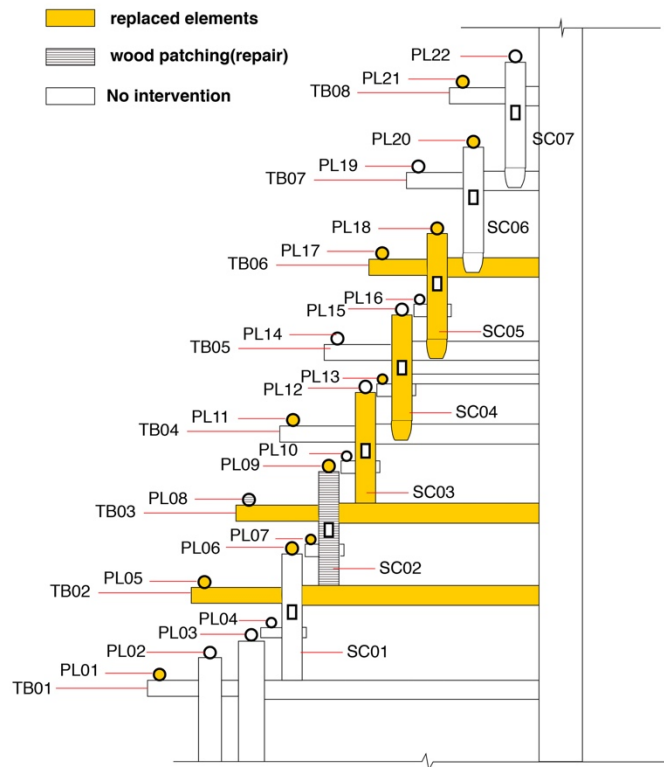
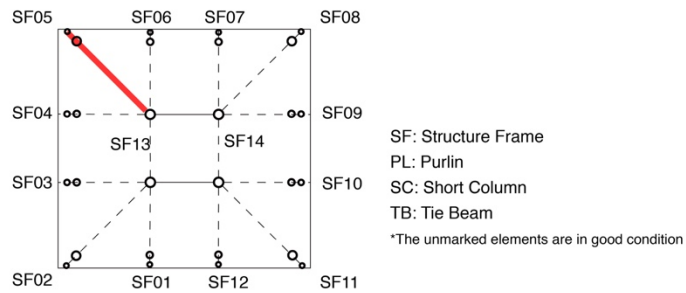
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 05



SCALE: 1:100

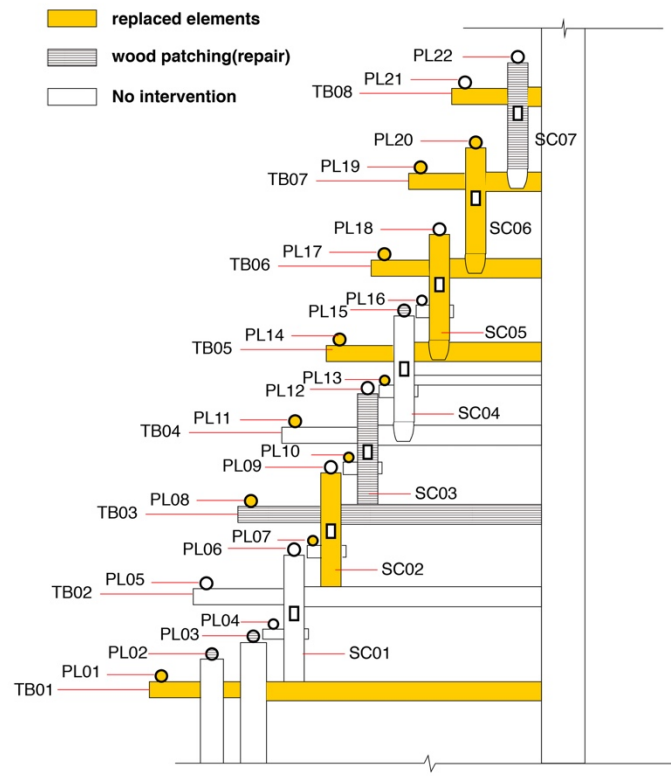
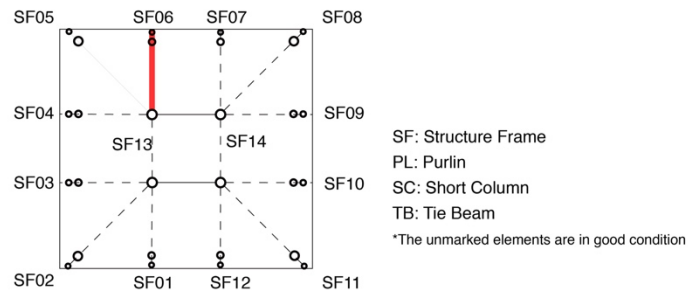
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 06



SCALE: 1:100

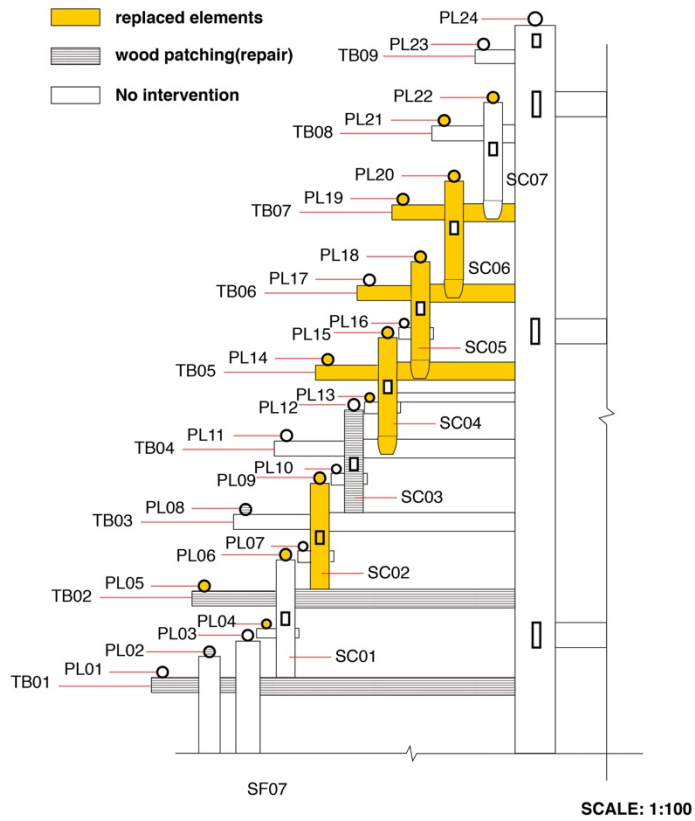
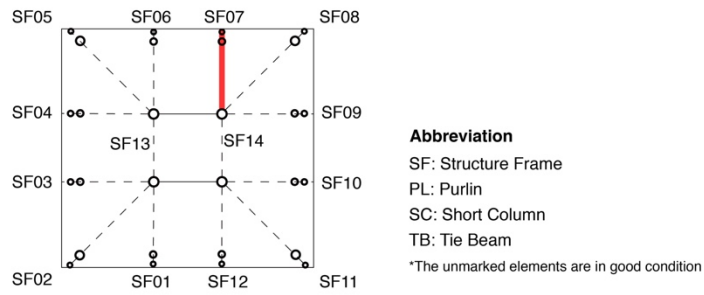
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 07



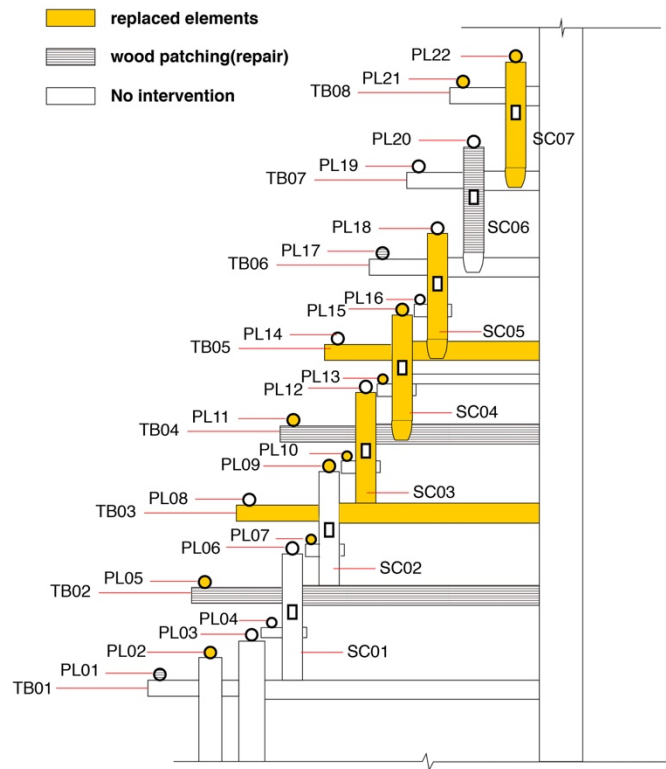
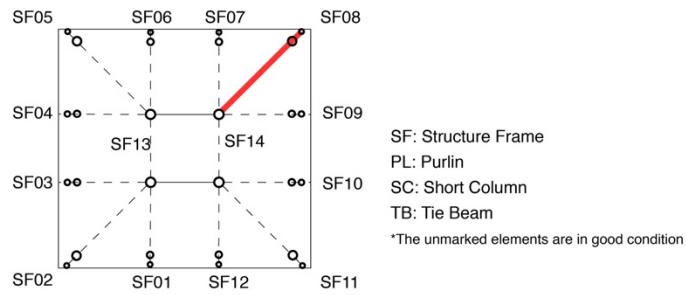
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 08



SCALE: 1:100

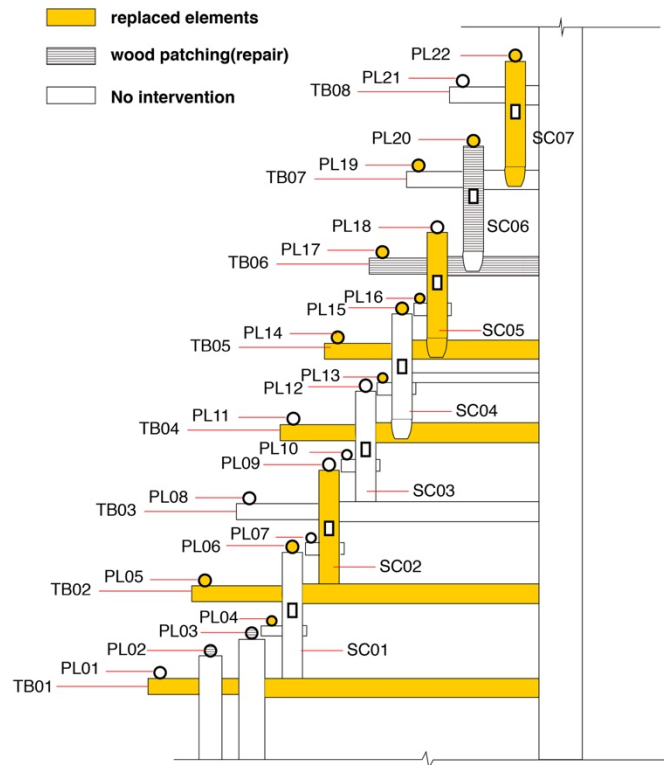
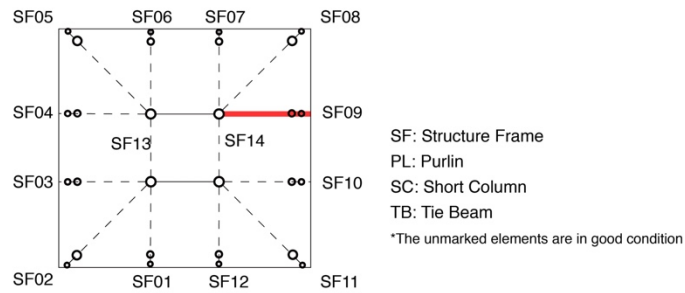
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 09



SCALE: 1:100

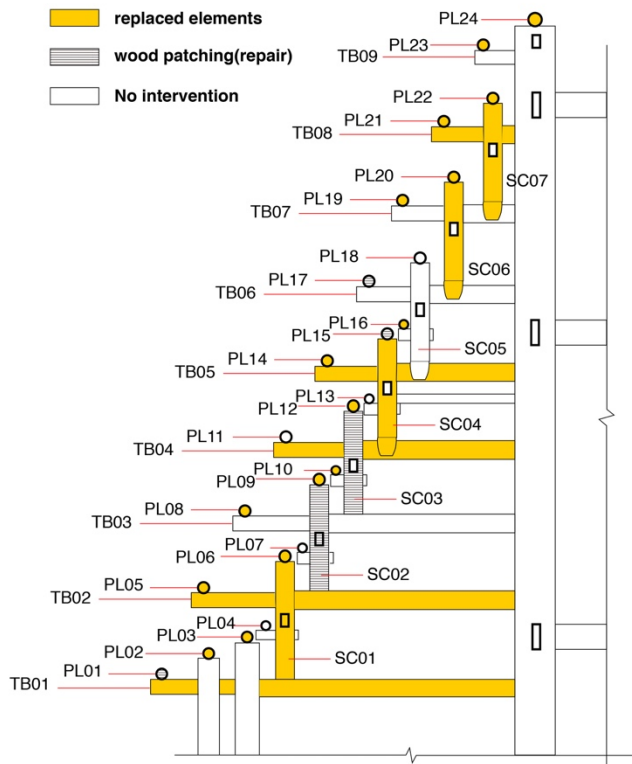
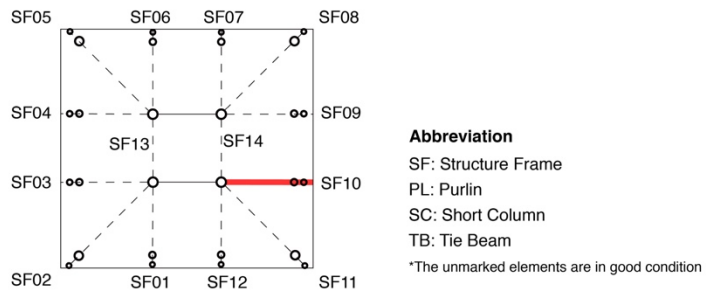
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 10



SCALE: 1:100

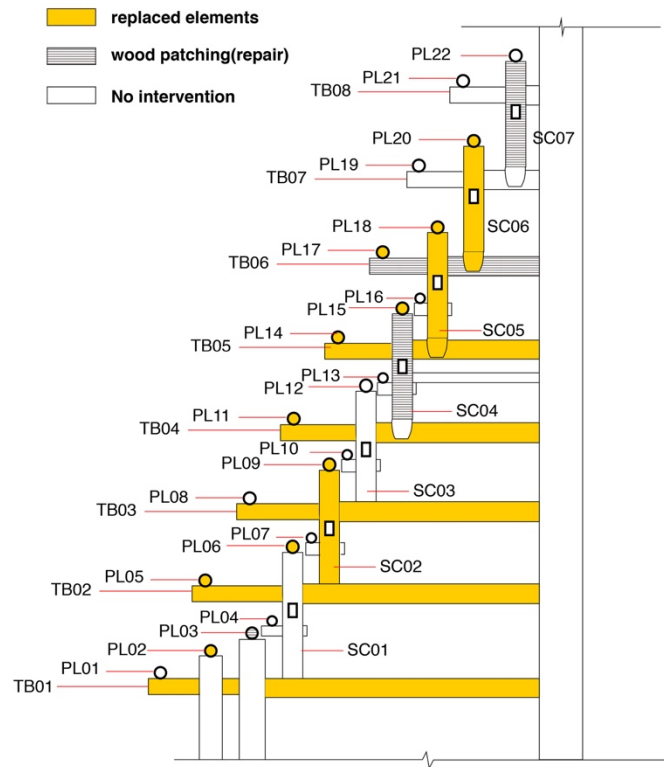
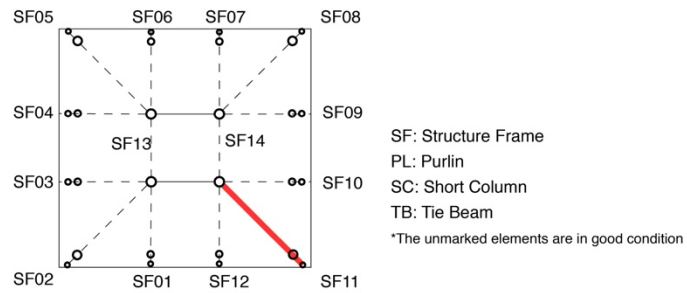
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 11



SCALE: 1:100

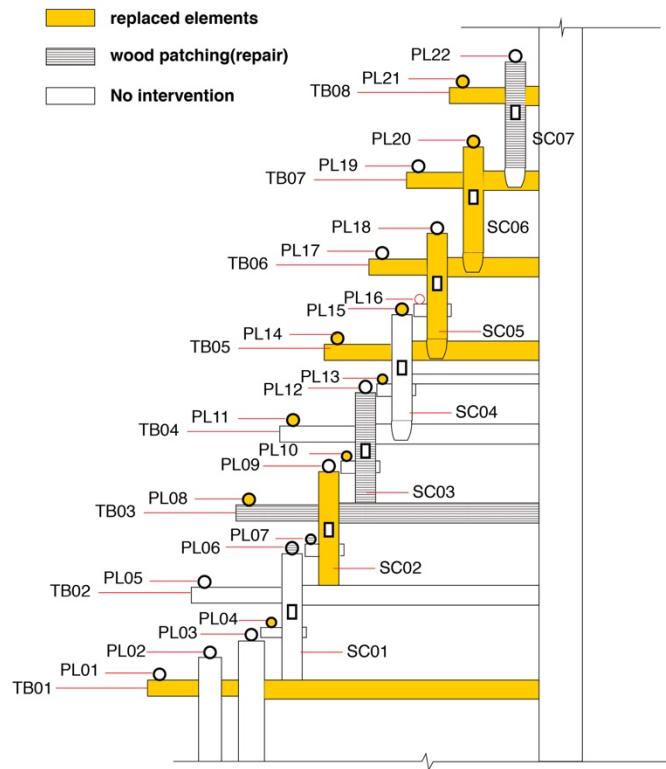
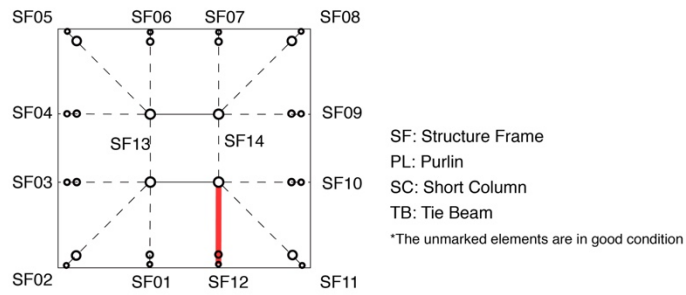
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 12



SCALE: 1:100

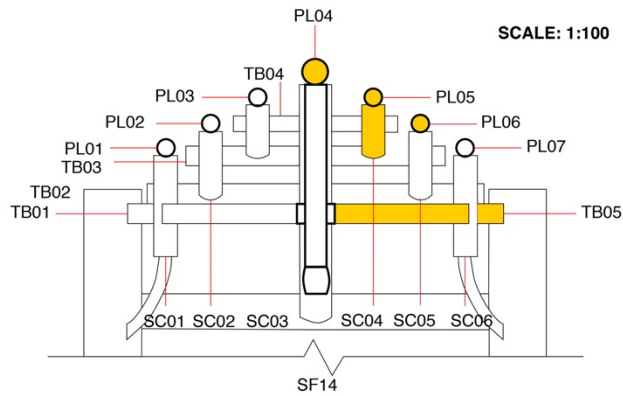
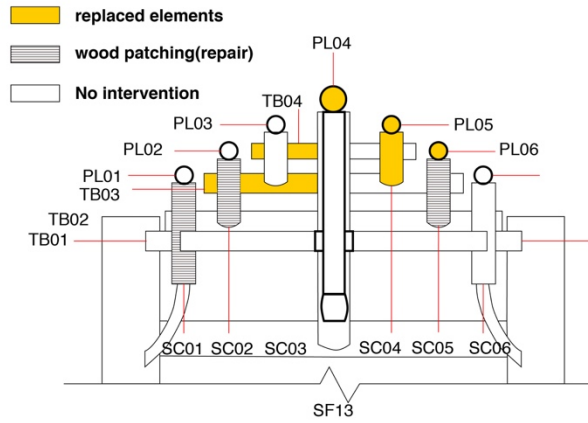
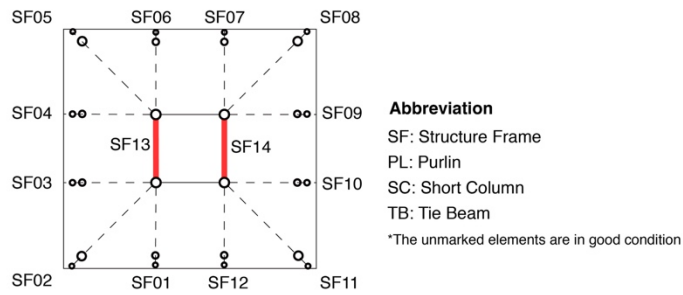
Name: Mapang Drum Tower

Items: Intervention analysis

Author: Shiruo Wang

Date: 07/2018

Content: Structure Frame 13, 14



Bibliography

Literature Review

Fu T., *A Study of the "Collected Tales of the Barbarians of the Southwest*. Guiyang:

Guizhou Nationalities Press. 2003.

Zhou Q., *A Categorical Narration of the Region Beyond the Passes*. 1178.

Tian W., *Book of Guizhou*. 1690.

Tan C., *A Hanbook of Guizhou*. 1700s.

Li Z., *Recording of Guizhou*. 1813.

Hosie, *Three Years in Western China: A Narrative of Three Journeys in Ssu-Chuan,*

Kuei-Chow and Yun-Nan. 1897.

Samuel R. Clarke, *Among the Tribes in South-West China*. 1900.

Chen G., *Dong Drum Towers*, Taipei: The Orient Cultural Service. 1973.

Li C., *Folk Architecture in Northern Guangxi*. Beijing: China Architecture & Building

Press. 1990.

Du Q., *The Characteristics of the Drum Tower, Cultural Connotation*. Journal of Minzu

University of China. 1996.

Irwin, J. Kirk, *Historic preservation handbook*, McGraw-Hill, New York, USA. 2003

Hiroshi H., *Revelation of 100 Worldwide Settlements*. Beijing: China Architecture &

Building Press. 2003.

Curien A., *Littératures enchantées des Dong*. Bleu de Chine. 2000.

Zwerger K., *Vanishing Tradition: Architecture and Carpentry of the Dong Minority of*

China. Orchid Press. 2006.

Zwenger K., *Wood and wood joints: Building Traditions in Europe, Japan and China.*

Birkhäuser, 3rd edition. 2015.

Previous contributions on Drum Tower

Kong D., *The Dong Oral Architecture: Carpentry, Architecture and Phenomena among the Dong People in Southwest of China.* Doctoral dissertation of The Sheffield University(U.K.). 2016.

Hu B., *Hunan Drum Tower Construction Technology.* Master dissertation of Hunan University. 2012.

Shi G., *Toward Zaoxing Village.* China Federation of Literary and Art Circles Publishing. 2002.

Hao R., *A Technical-Anthropology Research on the Architecture of the San Jiang Dong Race.* Master Dissertation of Guangxi University. 2006.

Cai L., Wu H., *Architectural Typology of Dong Village Gate and its Pai-lou (Dou-gong) in Tongdao, Hunan During Ming & Qing Dynasty.* Academic Symposium on Cultural Heritage for Wooden Architecture in Ningbo, China. 2018.

Wu H., *Chinese Dong Ethnic Minority Village Culture.* Beijing. Publishing House of Minority Nationalities. 2004.

Wu H., *Chinese Dong Ethnic Minority Village Culture.* Beijing. Publishing House of Minority Nationalities. 2004.

Ou H., *Dong- Chinese Dictionary.* Beijing. Publishing House of Minority Nationalities.

2004.

Zhang B., *Dong Minority Architectural Art*. Changsha. Hunan Arts Publishing House.

2004.

Wu S., *The Exploration Study on Drum Tower*. *Guangxi Cultural Relics*. 1990(4).

Zhao X., *Research on the Cultural Expressions of Architectural Space in Rural Settlements of Dong Villages in Six Dong Area in Southeast of Guizhou*. Doctoral Dissertation of Tsinghua University. 2012.

Tian Z., *Study on the Inheritance Ways and Influence Factors of Dong Drum Tower's Building Technology in the Southeast of Guizhou Province*. Master dissertation of Southeast University. 2014.

Feng Y., Hai yan, *The buildings beyond the endless mountain: Dong architectures in Guizhou*, Hunan and Guangxi. Nanning: Guizhou Science Press. 2011.

Yang Y., Wu K., *Chinese Dong minority's Drum Tower*. Nanning. Guangxi Publishing House of Minority Nationalities. 2008.

Yang Y., Huang X., *The Dong Folks treasure: Dong Wooden Construction Skills*. Guangxi Nationalities Publishing House. 2012.

Yang X., *Exploration to Dong Drum Tower's Aesthetics*. Guizhou Ethnic Studies.

Zhang B., *Architectural Arts of Dong Minority*. Changsha: Hunan Art Press. 2004.

Wang S., *Research on Dong Minority's Traditional Villages and Drum-towers in Pingtan River Basin, Tongdao County of Hunan Province*. Master dissertation of Guangzhou University. 2016.

Chapter 1

Cai L., *Traditional Villages and Architecture of Dong Nationality's Habitation Region*.

China Architecture & Building Press. 2007.

Kuang L., *Chiya: A dictionary of the Southern China*. Ming dynasty (1368-1644).

Sui N., *Chang-min-ce-shi*. 1575.

Guangxi Zhuang Autonomous Region Local Chronicle Compilation Committee Office edited, *Guangxi Local Annual*. 2017

Yuping County Local Chronicle Compilation Committee Office edited, *Yuping county Annual*. 1757.

Li Z., *Guizhou Local Annual*. 1796-1820.

Ruan X., *Allegorical architecture: living myth and architectonics in southern China*. Honolulu University of Hawai'i Press, 2006.

Yu D., *Analysis of Dong "Drum Tower Culture"*. Guizhou Ethnic Studies. 1989(3).

Chen Y., *Ethic Dictionary*. Shanghai Lexicographical Publishing House. 1987.

Feng Z., *Study of Dong Culture*. Guiyang. Guizhou People's Publishing House. 1999.

Deng M., *The First Analysis of "Sa" Goddess*. Guizhou Ethnic Publishing House. 1990(2).

Arnheim B., *The Power of the Center: a Study of Composition in the Visual Arts*. University of California Press: first edition. 2009.

Lin P., *Guizhou Miscellanies*. 1795-1820.

Shi K., *Dong Drum Tower*. Hua-xia Culture & Art Publishing House. 2001.

Dong Brief History Editors. *The Brief History of Dong Minority*. Guizhou Ethnic

Publishing House. 1985.

Zhang F., *Yuanzhou Ting Annual*, 1903.

Jiang Z., *Wood Properties of the Global Important Tree Species*. Science Press. Beijing. 2013.

Jiang Z., *Wood Properties of the Global Important Tree Species*. Science Press. Beijing. 2013.

Luo D., *Folk Dwellings in Guizhou*. China Architecture & Building Press. 2008.

Jiang Yu., *Sanjiang County Annual*. Volume 3. 1946.

Chapter 2

Fei X., *From the Soil*. Shanghai People Press. 2006.

Eulenburg F. A., *Ansichten aus Japan China und Siam: die preussische Expedition nach Ost-Asien*. Berlin: Verl. der Königlichen Geheimen Ober-Hofbuchdr. 1864.

Morrison G. E., , *An Australian in China: Being the narrative of a quiet journey across China to Burma*. 1895.

Liu D., *A general study of traditional architecture in Southwest of China*. China Building Industry Press. 1942.

Liu D., *A general study of Chinese dwellings*. China Building Industry Press. 1957.

Zhang Z., *Huizhou dwellings in Ming Dynasty*. China Building Industry Press. 1957.

School of Architecture, Tongji University, *Suzhou traditional dwellings referred catalogue. Textbook of Tongji University*. 1958.

Wu I., *The modernization of vernacular architecture and regionalization of modern*

architecture, Huazhong Architecture, Wuhan, 1998.

Feng J., *Thoughts on the Overall Preservation of Traditional Villages*. Civilization. 2013.

Standing Committee of the National People's Congress. *The Cultural Relics Protection Law of the People's Republic of China*. 2013.

State Council. *Notice of the Ministry of Housing and Urban-Rural Development as well as the Ministry of Culture on the application for the publication of the second batch of reports on the list of national famous historical and cultural cities (Guofa [1986] No.104)*. 1986

Ministry of Housing and Urban-Rural Development. *Notice on the Application for the Appraisal and Selection of Famous Historical and Cultural Towns / Villages (Jiancun [2002] No.233)*. 2002.

Ministry of Housing and Urban-Rural Development. *Measures for the Selection of Famous Historical and Cultural Towns/ village in China (Jiancun [2003] No. 199)*.2003

Ministry of Housing and Urban-Rural Development. *Evaluation Index System for Famous Historical and Cultural Towns/ village in China (Jiancun [2007] No.360)*.2007.

State Council. *Notice on Promulgating the First Batch of National Intangible Cultural Heritages (Guofa [2006] No. 18)*. 2006.

State Administration of Cultural Heritage. *Law of the People's Republic of China on Urban and Rural Planning*. 2007.

State Council. *Regulations on the Protection of Famous Historical and Cultural Cities and Famous Towns (Guofa [2008] No. 524)*. 2008.

Ministry of Housing and Urban-Rural Development. *Notice on Carrying out the Exemplary Work of National Characteristic Tourism Sites in Famous Towns and Villages (Jiancun [2009] No. 3)*. 2009.

State Council. *Law of Intangible Cultural Heritage (Chairman's Decree [2011] No. 42)*. 2011.

Ministry of Housing and Urban-Rural Development. *Requirements for the Planning of the Protection of Historical and Cultural Cities and Famous Towns and Villages (Jiangui [2012] No.195)*. 2012.

Ministry of Housing and Urban-Rural Development. *Notice on Conducting the Traditional Villages Survey (Jiancun [2012] No. 58)*. 2012.

Ministry of Finance. *Evaluation and Identification Index System of Traditional Villages (Trial) (Jiancun [2012] No.125)*. 2012.

Central Committee. *Several Opinions on Comprehensively Deepening Rural Reform and Accelerating Agricultural Modernization*. 2014.

Ministry of Housing and Urban-Rural Development. *Guiding Opinions on Effectively Strengthening the Protection of Traditional Chinese Villages (Jiancun [2014] No. 61)*. 2014.

Ministry of Housing and Urban-Rural Development. *Notice of conducting the practice in Protecting Chinese Traditional Villages in 2015 (Jiancun [2015] No. 91)*. 2015.

State Administration of Cultural Relics. *Guidelines for Accreditation of Unmovable Cultural Relics(Trial)*. 2018.

Chen W., *The Study on the Conservation Theory and Method of Heritage*. Doctoral

dissertation of Chongqing University. 2006.

National Standard of P.R.C, *Method for field test of natural durability of wood* (GB/T 13942. 2-92) .1992.

Chapter 3

Gastelli A., *On Western and Chinese conception of time: A comparative study.*

Philosophical Papers and Reviews. Vol. 6(4). 2015.

Wang S., *Knowledge and Practice of Preservation of Cultural Heritage.* China Architecture & Building Press. 2015.

Du F., Building Improvement Responses to Multi-hazard risk in the Historic Dali Dong Village, Guizhou, China. *International Journal of Disaster Risk Reduction* 19.2016.

UNI Ente Nazionale Italiano di Unificazione, *UNI 11119: 2004- Beni Culturali, Manufatti lignei, Strutture portanti degli edifici- Ispezione in situ per la diagnosi degli elementi in opera.* 2004

ICOMOS China, *Principles for the Conservation of Heritage sites in China.* 2015.

ICOMOS, *Principle for The Conservation of Wooden Built Heritage.* 2017.

ICOMOS, *The Nara Document on Authenticity.* 1994.

ICOMOS, *Charter on the Built Vernacular Architecture.* 1999.

Guizhou Provincial Research Center of Cultural Heritage Protection, *Zai'e Drum Tower in situ inspection and restoration project.* 2014.

Guizhou Provincial Research Center of Cultural Heritage Protection, *Zengchong Drum Tower and surrounding buildings' restoration project for salvage.* 2008.

Beijing Jiagong Architectural Design and Research Institute. *Restoration project of historical buildings complex in Yutou village, Hunan*. 2009.

Beijing Jiagong Architectural Design and Research Institute, *Restoration project of Matian Drum Tower in Tongdao, Hunan*. 2014.

Guangxi Provincial Research Center of Cultural Heritage Protection. *Restoration Project of Mapang Drum Tower*. 2005.

Guangxi Provincial Research Center of Cultural Heritage Protection. *Restoration Project of Mapang Drum Tower*. 2012.

Zhang S., *Selected domestic laws and regulations of the International Charters on preservation of urban cultural heritages*. Tongji University Press, Shanghai, China. 2007.

Li Xi., Zhu G., *Strategy of Architectural Preservation in China*, New architecture. 2003(4).

Chang Q., *The Surviving Strategy of Architectural Heritage: Preservation and Re-use Testing*, Tongji University Press, Shanghai, China. 2003.

Chapter 4

Bakken K., *Preserving the Stave Churches: Craftsmanship and Research*. The Norwegian Directorate for Cultural Heritage, Oslo, Norway. 2016.

Jensen G., *Minimum Invasive Fire Detection for Protection of Heritage*. Riksantikvaren the Norwegian Directorate for Cultural Heritage, Oslo, Norway. 2006.

Xian G., *Overview of Dong Minority*. Guangxi People's Publishing House, Nanning,

China. 1995.

Smith O., *What is the Disaster: Anthropological Perspectives on a Persistent Question*. In Anthony Oliver Smith and Susanna M. Hoffman, eds., *The Angry Earth: Disaster in Anthropological Perspectives*, Routledge, London, UK. 1999.

George C., Mc Gavin. *Insetti Ragni e Altri Artropodi Terrestri, Guida Fotografica a Oltre 300 Specie di Tutto Il Mondo*. Dorling Kindersley Handbooks, London, UK. 2000.

Brian R., *Timber Decay in Buildings: The conservation approach to treatment*. Routledge, London, UK. 2000.

CIB commission, *Guide for the Structural Rehabilitation of Heritage Buildings*. CIB publication 335, Rotterdam, Netherlands. 2010.

Carl A., *The Shrinking and Swelling of Wood and Its Effect on Furniture*, Purdue University, West Lafayette, US. 2010.

Onuegbu T.U., Umoh E.T., *Flame Retardant Effects on Flexible Polyurethane Foam Treated with Potassium Aluminum Sulphate*, ARPN Journal of Science and Technology, Vol. 2, No. 11. 2012.

Pingyao County Government and UNESCO, *Conservation Management Guidelines for Traditional Courtyard Houses and Environment in the Ancient City of Pingyao*. Tongji University, Shanghai. 2014.

Du, F.; Okazaki, K. Building Improvement Responses to Multi-hazard risk in the Historic Dali Dong Village, Guizhou, China. *Int. J. Disaster Risk Reduct.* 2016, 19, 64–74.

Pinniger, D. *Pest Management in Museums, Archives and Historic Houses*, 1st ed.;

Archetype Publications: London, UK, 2001.

Ridout, B. *Timber Decay in Buildings: The Conservation Approach to Treatment*, 1st ed.; Routledge: London, UK, 2000.

Jamala, G.Y.; Olubunmi, S.O. Physical and Mechanical Properties of Selected Wood Species in Tropical Rainforest Ecosystem, Ondo State, Nigeria. *IOSR J. Agric. Vet. Sci.* 2013.

Onuegbu, T.U.; Umoh, E.T. Flame Retardant Effects on Flexible Polyurethane Foam Treated with Potassium Aluminum Sulphate. *ARPJ. Sci. Technol.* 2012.