

# On Technology and Ritual of *Chuandou* House Construction in Southwest China: The Case of Dong Minority Area

Congcong Ren<sup>a\*</sup>, Ruchen Bian<sup>b</sup> and Simiao Li<sup>b</sup>

<sup>a</sup> Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China

<sup>b</sup> Architecture Research and Design, University of Chinese Academy of Sciences, Beijing, China

\* Corresponding author: ccrencc@ihns.ac.cn

**ABSTRACT** This study is based on field work conducted in the mountainous countryside of Dong minority area, southwest China, where the custom of *chuandou* house construction has been preserved relatively completely. In this paper, we try to depict the whole construction process of traditional *chuandou* dwellings, from the very beginning of material preparation to the completion of one house, by explaining some details of the various steps of the construction process, including design principles, rituals, characteristic details on engineering, etc. During our research, we followed the work of a group of chief carpenters residing in the Dong minorities area. Ritual and technology are two arms helping them to maintain their professional authority towards other people involved in the construction process. Furthermore, we examine the relationship between ritual and technology, how the two can be combined, how they influence the appearance of houses and how one can master them and pass down their knowledge and know-how to future generations of carpenters.

**KEYWORDS** *chuandou*, technology, ritual, chief carpenter

Received January 15, 2018; accepted February 6, 2017.

## Introduction

The term *chuandou* was initially borrowed from the local carpenter vocabulary in Sichuan Province. The term was noted by Zhiping Liu, who was a part of one of the first groups of Chinese architectural historians of the Society for the Study of Chinese Architecture to investigate vernacular building types in Southwest China (Liu 1990). Later, by the time *Zhongguo jianzhu leixing yu jiegou* (Building types and structures in China) was first published in 1957, *chuandou* had become an important timber structure term (Liu 1957).

*Chuandou* houses are widely distributed in South China, located mainly to the south of the Qinling mountain range and the Huai River. Some are found in the southern areas of Shanxi (Zhang and Peng 2010) and Henan Provinces (Fan et al. 2009).

The construction of *chuandou* structures is still occurring in many places, with the most well-known place being the Dong people's community located at the juncture of Guizhou, Hunan and Guangxi Provinces. This area

has attracted the attention of scholars from both China and abroad. Zwerger (2012, 269) summarised *chuandou* structures as 'vertical elements, posts or columns bearing purlins at their upper ends, play a visually dominant role. In its basic form, each purlin is born by a column standing on the ground. The columns are connected with one another by through-jointed beams to form a truss'. Only the interlocking of several beams with several columns assures that the parallelogram timber frames will be steady in *chuandou* houses.

In this study, we examined *chuandou* houses from the perspective of its construction process. We focused on the engineering technology that was and still is used by local carpenters and rituals they perform aside the construction. According to Pfaffenberger (1988, 236–252), technology is basically a social phenomenon—it is 'humanised nature'. He termed the concept of the 'technology system'. In this paper we tried to depict such '*chuandou* house building technology system' in which technology and ritual is woven together. Also Ruitenbeek (1993) pointed out in his research regarding *Lu Ban Jing* (The Sutra of Carpenter

**Table 1** Field work area and time (Source: Congcong Ren).

Time	Places	Interviewee		
		Name	Age	Profession
07–15/11/2016	Dali Village, Rongjiang County, Guizhou Province	Shenwen Yang	70s	Mark-ink craftsman
		Youguang Chen	40s	
		Xianming Yang	70s	Cooper artisan
		Sheng'an Long	50s	Fengshui master
10–15/08/2016	Tongdao County, Hunan Province and Sanjiang County, Guangxi Zhuang Autonomous Region	Feng'an Li	70s	Mark-ink craftsman
		Yunqing Yang	30s	
12–20/11/2016	Dali Village, Rongjiang County, Guizhou Province			
11–15/12/2016	Junlian County, Sichuan County	Chunze Zhang	70s	Mark-ink craftsman
12–17/04/2017	Xishuangbanna County, Yunnan Province	Maiwen Zhang	70s	Carpenter
14–25/06/2017		Yonghua Wu	70s	Mark-ink craftsman

Lu Ban), 'Yet from all available sources it appears that in the building field, technique, ritual and magic were linked closely from the beginning.'

### Case Study of *Chuandou* Houses' Construction Process

The construction process of a *chuandou* house is recorded in the historical writings related to anthropological methods of ethnographic fieldwork. The time required to construct a *chuandou* house can vary from several months to years. We investigated and combined several field work materials to form an understanding of the construction process of a *chuandou* house, which is completed in four phases.

Our main field work took place in the Dong people settlement of Dali Village in Rongjiang County, Guizhou Province. We visited the settlement twice in July and November, 2016, and during the second visiting we were able to observe two assembly processes. The other field work for this study took place in Hunan, Guangxi and Sichuan Provinces (Table 1). The extent of the *chuandou* technology system covered all the four provinces mentioned above.

We got to know details in phase 1 and phase 2 mainly through interviews. For phase 3 and 4 we were able to witness the process at the construction site. We marked each sources used in the progress' description, one can inquire its reference in Table 1.

#### Phase 1: Material Preparation

As mentioned, it was found through field work that the construction of a *chuandou* house occurred in four phases. Phase 1 comprised log harvesting and preparations. Dali

Village residents harvest trees from their own mountain lands for building purposes. This practice is also prevalent in other mountainous areas where Chinese firs grow in great quantities and people own their land. Logging is usually carried out at the end of spring, when the bark is easy to peel off. Prior to logging, a ritual is usually conducted to pacify the mountain spirits.

When harvested, peeled logs were transported to the village and stored to dry in the air, as shown in Figure 1. It takes at least six months for logs to be ready for use, which is why logging usually occurs in the spring. Thus, construction can begin in the winter.

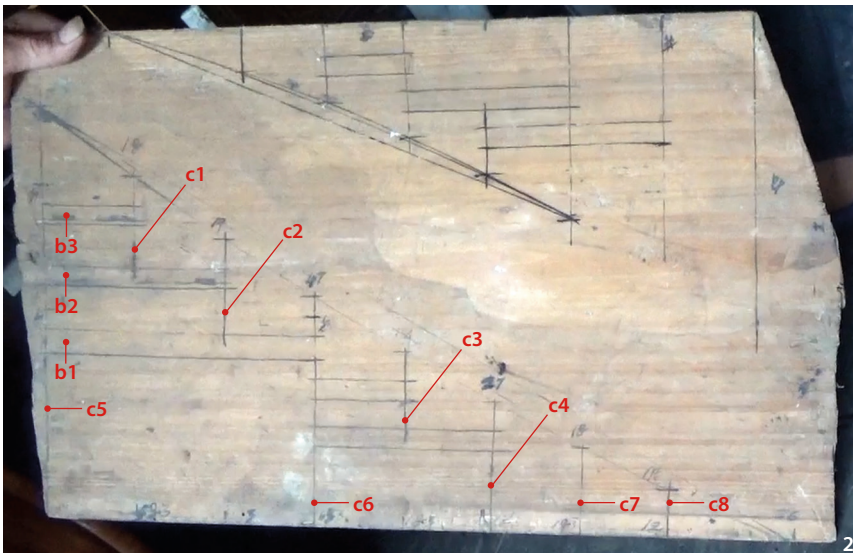
#### Phase 2: Design and Processing of Timbers

According to the wishes of the homeowner and the limits of the site, the chief carpenter designed the timber frame of the home. The layout and façade were designed in Phase 4. One section drawing (shown in Figure 2, which is a 1:10 section) was included. This drawing expresses the chief carpenter's design adequately. Later, all the vertical dimensions from the section drawing were transcribed in a 1:1 ratio on to a long *zhanggan* (dimension pole, shown in Figure 3) made of bamboo or timber. There were usually three bays in the longitudinal direction, and the middle bay was wider than the bays on either side. When all the component dimensions were decided, logs were processed according to the correct measurements.

The design process may seem rather simple, but it embodies the basic methodology of timber structure design. The design and construction process belongs to a profound technological tradition which has a long history and wide applications in China. According to Zhang (2010),



**Figure 1** Logs stored on the ground at a construction site, Dali Village, 2016 (Source: Congcong Ren).



**Figure 2** 1:10 Section drawing, photo taken from chief carpenter Yonghua Wu's home, Guilu village, Rongjiang County, 2017 (Source: Ruchen Bian).

- b1. The first cross through beam
- b2. The second cross through beam
- b3. The third cross through beam
- c1. The upper 'melon' column in the fourth span
- c2. The bottom 'melon' column in the fourth span
- c3. The upper 'melon' column
- c4. The bottom 'melon' column
- c5. The middle column
- c6. The second column
- c7. The eave column
- c8. The 'child' column

its more sophisticated application and achievements are evident in Fujian Province.

After the dimensions were decided, logs were ready to be cut into the necessary components. First, according to each log's size, they were either rough planed for column material or split into planks for beam material. After the rough work had been done by either the home owners or helpers they had employed, the chief carpenter and his disciples processed timbers into their final components. Their professional work included the marking of ink lines on to each column as sketched out on the dimension pole, the cutting of mortise holes to columns and the crafting of tenons on to the ends of the beam planks. The work in this phase always began with a grand ritual called *xinggong famo*, which means to begin the ink work, conducted by the chief carpenter. The research team was unable to witness this ritual, but we did observe a rest-on-beam short column covered with an unusual number of horizontal ink lines, which was evidence that ritual had been performed (Figure 4).

The most difficult and characteristic technology in this phase is to make joints. To cut holes in columns and process tenons on beams, *taoqian-jiaoqian* technology is needed. *Taoqian* is the technique used to survey the form of a mortise hole cut in a column using a stick and mark the dimensions on it, and according to the marked stick, *jiaoqian* is conducted by drawing ink lines on the end of a beam plank, which would cross the same hole later. It is a demanding job. For a typical dwelling, there are hundreds of holes to be surveyed and even more for public buildings, such as towers and bridges. Each stick represents one hole and a notation system was used to number sticks.

Why bother using this one-to-one survey method to make joints? *Chuandou* houses rely on tight joints to maintain their stability, instead of using braces. In addition, the columns are made of natural peeled fir. These cylinder-like trunks are highly asymmetric. To make each tenon perfectly match the mortise to achieve the maximum friction force requires the development of this



Figure 3 Marking ink lines according to the dimension pole, Dali village, 2016 (Source: Congcong Ren).

Figure 4 Short column marked with numerous ink lines, Dali Villiage, 2016 (Source: Congcong Ren).

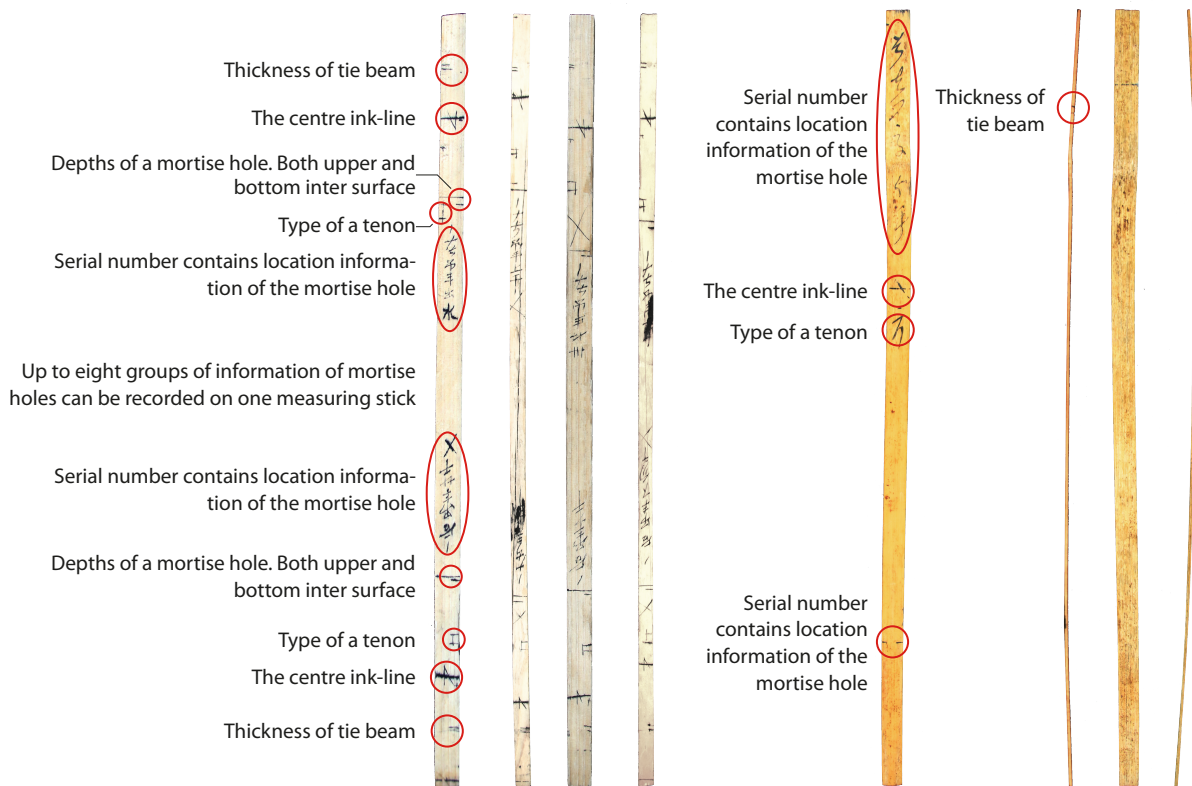


Figure 5 Different kinds of measuring sticks (Source: Congcong Ren).

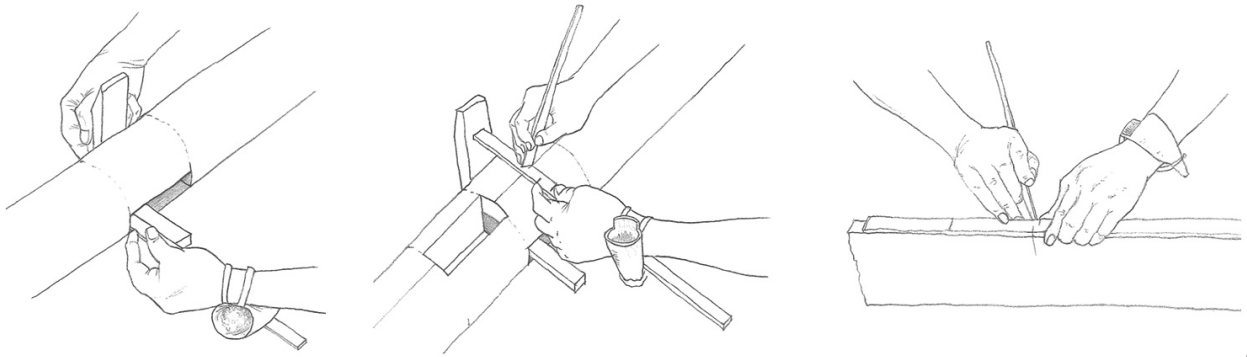
5

*taoqian-jiaoqian* skill. This technology allows people to maximise the use of natural material. The complexity of the technology makes chief carpenters' work become crucial and irreplaceable, which reinforce the differentiation in profession in turn. We will get a better understanding of this characteristic of *chuandou* system if we compared it with other building system. For example, in South-east Asia (some district in Yunnan Province included) and Japan, there are folk houses using square columns. The standardisation of columns lead to the column-beam joints making also standardised. Thus no such

complicated *taoqian-jiaoqian* technology is needed.

On the construction site, the chief carpenter is the only one who masters this skill. Disciples follow his ink lines and process the timbers. Apart from his ritual skills the mastery of this skill becomes the watershed moment that defines a chief carpenter from an ordinary carpenter.

The techniques used to master the skill are usually kept secret in each family line of carpenters. The chief carpenters we interviewed in our field work informed us that they each have their own way to number the sticks (Figure 5). Carpenters from other family lines would find the



6

Figure 6 The Taoqian-Jiaoqian technology. (Source: Congcong Ren).



7a



7b

Figure 7a Tools used for the mark-ink work (Source: Congcong Ren).

Figure 7b *Douchi* (Source: Congcong Ren).

writings of others hard to recognise.

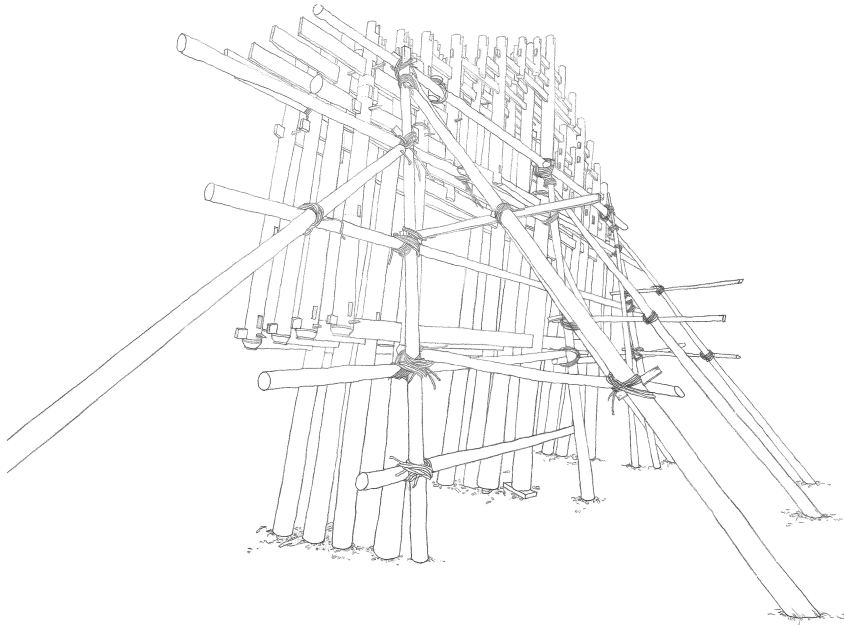
The taoqian-jiaoqian technology requires both mental ability and physical skill. Figure 6 illustrates the decomposition movements of the mark-ink man's hand. In reality, the whole process was done in just seconds. The chief carpenter placed a *douchi* and a stick across the column (Figure 7a, Figure 7b). Then, he used his finger nail to mark the position for the depths of the hole (both the higher and lower edges, so he must use both his thumb and his index finger). He then pulled the stick out, with the position of both fingers maintained and drew the marks with ink. The chief carpenter's speed was directly related to the number of disciples and helpers he could work with at once. Only after he marked the ink lines on to the beams could wood processing begin. Chief carpenter Feng'an Li we interviewed told us proudly that he could work with 11 helpers at one time.

### Phase 3: Assembling and Erecting the Structure

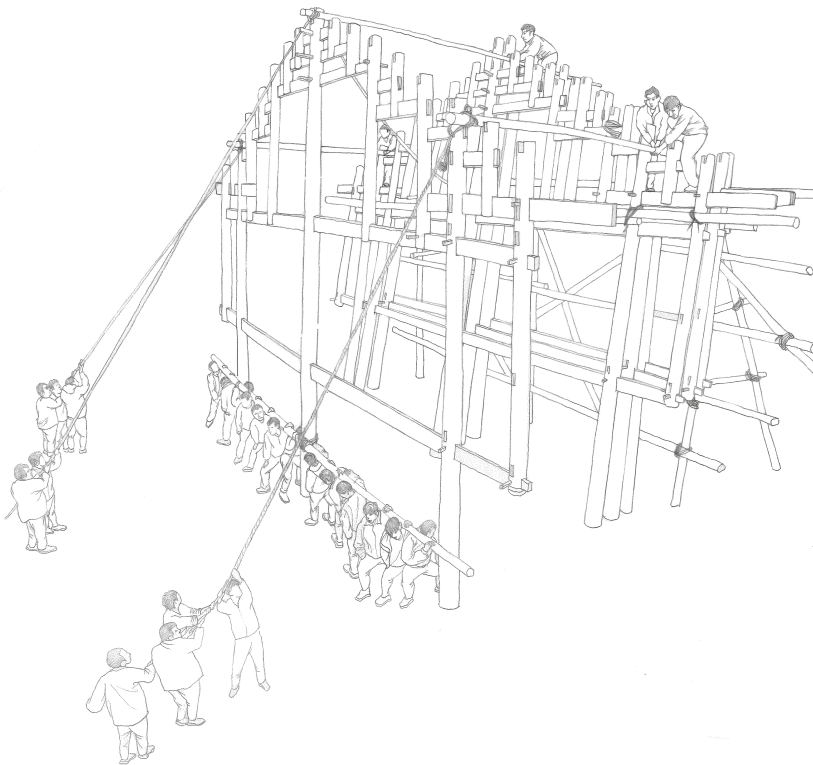
The rituals performed that are associated with the erection

of the timber structure and the placement of the upper beam are crucial to the homeowner's happiness. The time these rituals are conducted were carefully chosen by a fengshui master. He calculated the best time for these rituals down to the hour of day. The two rituals were usually separated by 12 hours. For example, if the erection time was 2 am, then the beam would be placed at 2 pm in the same day.

Prior to the selected day, the chief carpenter arrived with his disciples. They assembled the components of the trusses and leaned them on temporary supports, waiting for the appropriate assembly time (Figure 8). During the proper ritual time, people gathered from the village and relatives came from other villages and stayed for at least three days to finish the work as helpers. In the four Southwest provinces we investigated, the erection time occurred between midnight and dawn. The erection work for a two-story building usually required about 30 men, working simultaneously. When people were ready, the chief carpenter performed the *fachui-shuzhu* ritual, which



**Figure 8** Trusses leaning on the supports, Dali Village (Source: Congcong Ren).



**Figure 9** Erecting the structure, Dali Village (Source: Congcong Ren).

means the erection of columns, which consisted of a series of activities, including a dedication tribute to the gods, the chanting of spells while simultaneously writing them in the air and the cutting of a rooster's throat and pouring its blood over the roots of each column. After the ritual was completed, people began to work together under the chief carpenter's instructions (Figure 9).

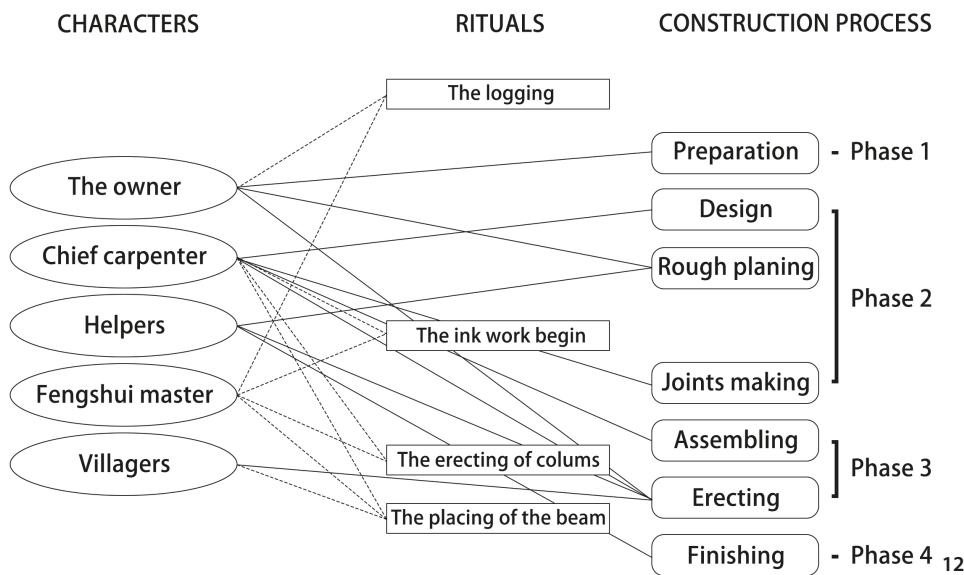
With 30 labourers, the work of erecting the trusses, connecting them with the beams and placing them in the right places was completed in a few hours. This work usually

finished by the morning so that people still had time to go home and rest a bit before attending the *shangliang* ritual (the erection of beams) in the afternoon. It is noteworthy that the 'beam' (In some areas it is called *baoliang*, the precious beam) used in the *shangliang* ritual is not the ridge beam which connected the middle two trusses in the end. The real structural ridge beam will be put upon the 'precious beam' (Figure 10). In Dong people's region the precious beam must be made of *Ailanthus* wood. When the right time came, the chief carpenter began to perform the ritual. He first



**Figure 10** 'The precious beam' is under a ridge beam. Zaidang Village, 2017 (Source: Congcong Ren).

**Figure 11** 'The precious beam' had been raised up to the ridge. Dali Village, 2016 (Source: Congcong Ren).



**Figure 12** Social network in the *Chuandou* technology system (Source: Congcong Ren).

dedicated some tributes to the gods and blessed the 'precious beam' which was laid on two brackets on the ground. It was regarded as the tree of heaven and its selection and felling had to follow a certain rule. After the blessing, the chief carpenter took a pair of new shoes from the owner of the house and began to climb the structure using his bare hands while chanting spells. When he reached the top, two men needed to be waiting there. One had to be a cousin from the owner's father's family and the other a cousin from his mother's family. These men pulled the 'precious beam' up while the chief carpenter threw candies to the crowd below (Figure 11). This was the climax of the ritual.

### Phase 4: Completion

On the next day of the shangliang ritual and the third day of the whole event, after a feast at noon, people went to their own mountain land to cut a Chinese fir as a gift for the home owner. It was quite an experience to hear the logging sounds emanating from all directions at once during that time.

The completion of the *chuandou* house included the work necessary to make all the walls, roofs and floors. Thus, a large quantity of wood was needed. Gifts of wood helped the home owner a great deal. The final carpentry required for the completion of the construction is an



Figure 13 The beginning of *shangliang* ritual. Dali Village, 2016 (Source: Congcong Ren).

expertise different from that of the chief carpenter. There was no ritual or magic involved in the finish work. Usually, local carpenters are hired for this work because they do not need to be paid for their accommodation. Finishing work usually takes more than three months, depending on how many carpenters the home owner hires.

### Chief Carpenter in the Community

In this section, we attempt to interpret the role of the chief carpenters as the leader of carpenters and their relationship with other people involved in the construction activities to show how their professions are established.

Figure 12 shows the different groups of people involved in the construction, the rituals they perform and the steps in the construction process. The solid lines link the people with their jobs, whereas the broken lines link the people who are the ritual executors. As seen in Figure 12, each ritual is acted before the skilled work begins. The purpose of the rituals differs depending on the occasion, but they include conciliating spirits, praying for safety and blessing the residents, among others. An important purpose appears to be what could be called a *séance*, which is used to invite the patron saint of carpenters, Lu Ban, to infuse the divine power to the chief carpenter. And this enhances their authority at the construction sites.

In a majority of these relatively isolated country villages, people tended to hire a chief carpenter from any other villages that their acquaintances may have recommended. If they did hire a local chief carpenter, fee negotiations could prove to be troublesome, especially when it came to commission work.

When a conflict between the owner and the invited chief carpenter did occur, it was usually regarding money. The chief carpenter is also regarded as a Taoist master

and he has the power to curse a home owner if treated unjustly. Li (2016) has reviewed many literature records regarding the existence of carpenters' exorcism.

The competition between chief carpenters can be intense. There exists anecdotal evidence relating instances on how chief carpenters sabotage their competitors' work. Through our field work we heard some stories. For example, on some occasions, two chief carpenters were purposely invited to the same project. Each of them was in charge of half of a house. They then started to work at the same time from both sides of the house to see who was better and faster. Sometimes, they even hung a piece of cloth in the middle of the house so that their competitor could not see their work (told by Shengwen Yang in Dali village). Another story says that there was a chief carpenter got jealous on another carpenter. He stole some sticks which marked with dimensions (their usage is going to be talked right later in this paper) and hoped that his competitor carpenter would feel anxious when he need to use them and make a fool of himself in front of other people (told by Yonghua Wu in Sanjiang county).

### Chief Carpenter as Descendants of Lu Ban

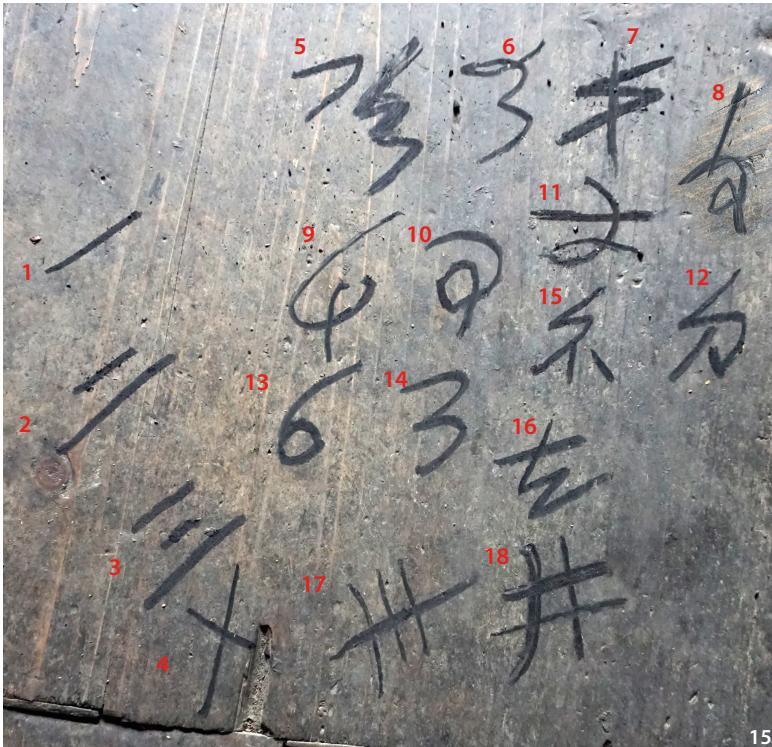
There is a sharp distinction between the chief carpenter and ordinary carpenters. We can find this inherent hierarchy vividly described in a piece of ancient Chinese prose called *Ziren Zhuan* (A Biography of a Chief Carpenter) by Zongyuan Liu, a famous Tang Dynasty writer. It tells the story of a chief carpenter by the name Ziren who had excellent organisational skills on a construction site but lacked the skill to fix his own bed's legs. What we saw in the Dong minority countryside was more or less the same occupational characteristics. Chief carpenters are in charge of work including designing, organising, supervising and so on, but they rarely involve themselves in any of the physical work.

Through our research we discovered that the number of chief carpenters is low, demographically speaking. Normally there is one chief carpenter per village. To become a chief carpenter, one must receive formal career training. This education is often kept in one family, normally but not necessarily transmitted from father to son. A chief carpenter qualified as a mentor can accept non-family disciples, but in those circumstances, the relationship between tutor and pupil remain in many aspects similar to a father-son relationship. To begin one's learning, there is a ritual called *baishi*, in which the disciple must worship his mentor as well as the saint Lu Ban on his bended knees. Saint Lu Ban is considered the founder of the occupation of carpenters.





Figure 14 Lu Ban ruler, last used in the 1950s. Tongdao County, 2016 (Source: Congcong Ren).



- |           |                   |
|-----------|-------------------|
| 1. One    | 10. Right         |
| 2. Two    | 11. Big           |
| 3. Three  | 12. Lacking       |
| 4. Four   | 13. Top           |
| 5. Front  | 14. Bottom        |
| 6. Back   | 15. Melon         |
| 7. Middle | 16. Earth         |
| 8. Eave   | 17. Cross through |
| 9. Left   | 18. Child         |

Figure 15 Lu Ban characters, Rongjiang County, 2017 (Source: Congcong Ren).

In this particular ritual the position of saint Lu Ban is represented by some wood-working tools, usually an axe and a frame saw (Liu 2017, 4–5). In a sense, all chief carpenters see themselves as descendants of saint Lu Ban.

During the research, we found that the belief in saint Lu Ban permeated many aspects of chief carpenters' profession. Saint Lu Ban is credited to having invented almost every important wood working tool there is. He is always represented by tools at the site of rituals (like in the Shangliang ritual, where wood working tools were placed beside the table with a pig's head on top, showing that sacrifice has been offered to saint Lu Ban (Figure 13). We also found a ruler called Lu Ban ruler in chief carpenter Fengan Li's home (Figure 14). He told us it was used in order to decide the width of doors and windows in the past. In chief Yonghua Wu's home, we were shown the writing style of Lu Ban characters, each character uniquely representing the shape, direction, numbers and names of building components. These are exactly the words written on measuring sticks (Figure 5). Wu told us that each lineage of chief carpenters has their own way of writing Lu Ban characters (Figure 15). One can't read others'

writings. It's a way to keep a trade secret.

It is noteworthy that what we observed of the house construction trade in the Dong minority countryside is merely a blurry shadow of a past and distant magnificent tradition. The belief in saint Lu Ban and more profound design principles, rituals and taboos can be traced back to the famous carpenter manual *Lu Ban Jing*. The earliest edition preserved was published in Ming Dynasty (Guo 2016, 944). It is believed the original manuscript could be finished in the Yuan Dynasty (Chen 2010, 97–98). The practise might be even earlier.

## Conclusion

The fact that the trade of constructing *chuandou* houses still survives, although more and more obscure, makes the Dong minority countryside an appropriate subject of further studies. Dong people are actually generally more known for their unique public buildings, such as towers and bridges. However, the building technology in the region doesn't differ very much from the one in Han areas in south China, for they do also put great importance to

saint Lu Ban and the construction of *chuandou* houses.

We observed a complete building system specified by both ritual and technology, and kept the same routine almost as the same as described in *Lu Ban Jing* (Guo 2016, 946–947). Yet we found more details. In the name of Lu Ban, ritual and technology are unified in building practise. Chief carpenter has become an avatar of saint Lu Ban. He uses tools invented by Lu Ban, writes in Lu Ban characters, designs houses by following principles set by Lu Ban, etc. When he conducts rituals he sometimes even plays the role of saint Lu Ban. In a sense, every *chuandou* house in man's world is built under saint Lu Ban's power. According to some folk beliefs, Lu Ban is consider a god. Through our field research on the construction technology, we discovered a more deep-going relationship between the belief in saint Lu Ban and building practise. Such a technology system has been well adapted to traditional society for hundreds of years, because it has several advantages that are summarised below.

Firstly, the chief carpenter's professional character being overlapped with religious figures would give him some authority on the construction site, which he needs to negotiate with clients or hold a leading position in the job site, etc. Secondly, following the principles that are said to be set by saint Lu Ban and that are passed down by generations would decrease a lot the workload. It is practical to make the construction process and the houses themselves stylised and fixed. Finally, the confidentiality of technology makes it hard to copy and learn. Thereby it could be inherited in its original way to the utmost. However, this conservatism of technology has limited its development and innovation.

Although it is not the focus of this paper, it is still instructive to clarify the scope and duration of the *chuandou* system, which suits quite well with a traditional society that in a way still lives on in southern China. Furthermore, if we compare this building system with others around the world, we get a better understanding of its characteristics. And knowing the differences between building systems will help us to get a better understanding of both the history as well as the future of *chuandou* houses.

## References

- Chen, Yaodong. 2010. *Lubanjing jiangjiajing yanjiu* [The investigation of Jiang Jia Jing]. Beijing: China Architecture & Building Press.
- Fan, Yin, Hongyi Lv and Yan Shi. 2009. "Nanyuanbeizhe- Yunan shandi chuantong minju muzuo jishu ji yingxiang yinsu yanjiu [Study on the Timber Structure Techniques and Its Influencing Factors of the Vernacular House of the Mountain Area in Southern Henan]." *Architecture Journal* 2009 (z2): 63–67.
- Guo, Husheng. 2016. *Zhongguo gudai jianzhu jishushi* [History and Development of Ancient Chinese Architecture]. Beijing: China Architecture & Building Press.
- Li, Fengan. 2015. *Dongzu chuantong jianzhu jian* [Research on Traditional Architecture of Dongzu]. Beijing: Wenshi Press.
- Li, Shiwu. 2016. *Zhongguo gongjiang jianfang minsu kaolun* [The Study of Handicraftsman in the Construction of Buildings in China]. Beijing: China Social Sciences Press.
- Liu, Yong. 2017. *Beijing chuantongminzhai yu mugongjiangzuo* [The Traditional House in Beijing and Wood Construction]. Beijing: Science Press.
- Liu, Zhiping. 1990. *Zhongguo juzhu jianzhu jianshi: chengshi, zhuzhai, yuanlin* [A Brief History of Chinese Resident: Urban, House, Landscape]. Beijing: China Architecture & Building Press.
- Liu, Zhiping. 1957. *Zhongguo jianzhu leixing ji jiegou* [The Type and Structure of Chinese Architecture]. Beijing: China Architecture & Building Press.
- Pfaffenberger, Bryan. 1988. "Fetishised Objects and Humanised Nature, Towards an Anthropology of Technology". *Man*, New Series 23(2): 236–252.
- Qiao, Xunxiang. 2014. "Shilun chuandoujia yanjiu quxiang [Research on the Tendency of Column and Tie Construction]." *Huazhong Architecture* 2014 (3): 168–171.
- Ruitenbeek, K. 1993. *Carpentry and Building in Late Imperial China, A Study of the Fifteenth-Century Carpenter's Manual Lu Ban Jing*.
- Yang, Hongxun. 1999. "Ribei liedao de huangdishu mingtang [The Imperial Ceremonial in Japan]." *World of Antiquity* 1999 (4): 78.
- Zhang, Yuyu. 2010. *Fujian chuantong damu jiangshi jiyi yanjiu* [Studies on the Craftsmanship of Traditional Chinese Carpentry in Fujian Region]. Nanjing: Southeast University Press.
- Zhang, Qiang, and Peng Yong. 2010. "Shannan chuantong minju jianzao jishu yanjiu [The Study on Structural Techniques of the Traditional Dwellings in Southern Shanxi]." *Sichuan Building Science* 2010 (3): 263–265.
- Zwenger, Klaus. 2012. *Wood and Wood Joints*. 2nd ed. Basel: Birkhäuser Architecture.