Research on Wall Masonry Technologies of Traditional Residences in Tukeng Village, Quangang

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Abstract. The wall construction and masonry techniques employed in traditional residences in the southern Fujian region are unique due to environmental, historical and cultural influences. However, with the development of modern architectural materials and construction techniques, it's difficult to protect and repair the walls of traditional residences. The ancient buildings in Tukeng village 土坑村, Quangang District 泉港区 are designated as 'Fujian provincial cultural relic protected sites'. This paper results from a detailed research conducted on wall types and masonry technology of some representative cases of architecture, through a long-term follow-up and recording of construction processes, as well as interviews with relevant craftsmen who had the opportunity to conduct repairs in Tukeng Village. In addition, this paper also explores the measures taken by local craftsmen to cope with the natural climate and human environment when building the walls of traditional houses in Tukeng Village, so as to provide references for future research, heritage conservation and repair work.

Keywords: Traditional architecture · Southern Fujian · Heritage protection · Wall type · Masonry technology · Construction wisdom

1 Introduction

The function, materials and masonry of walls in traditional residences in the southern Fujian region differ from other parts of China due to the particular influence of its environment, history and culture. At present, regarding the study of construction techniques of traditional architecture in southern Fujian, the number of systematic research results on wall masonry is still low, and these have not achieved the proper levels of depth and detail. With the passage of time and technological progress, the traditional technology of wall masonry has practically ceased to be applied, and is currently facing a gradual demise. The lack of research on this topic makes it challenging to provide effective guidance for the design, construction and repair of ancient buildings. Therefore, it is urgent to carry out special research on the wall masonry technology of traditional buildings in southern Fujian.

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The traditional residences of Tukeng Village,[1] in Quangang District, Quanzhou City (Fujian Province) are located at the junction of Quanzhou 泉州 and Putian 莆田. The village is part of the 'Red-Brick' cultural area in southern Fujian, but at the same time there are some differences in terms of wall materials and construction between Tukeng Village and other parts of Quanzhou.

Having obtained the opportunity to accompany a number of protective repair works of traditional houses in Tukeng (Fig. 1),[2,3] the authors investigated the traditional architecture of the village, tracked the construction process *in situ*, studied the materials, types and masonry technology of the walls, and analyzed the strategies adopted for dealing with the natural environment and architectural functions, so as to provide basic information for the study of traditional architecture in southern Fujian.

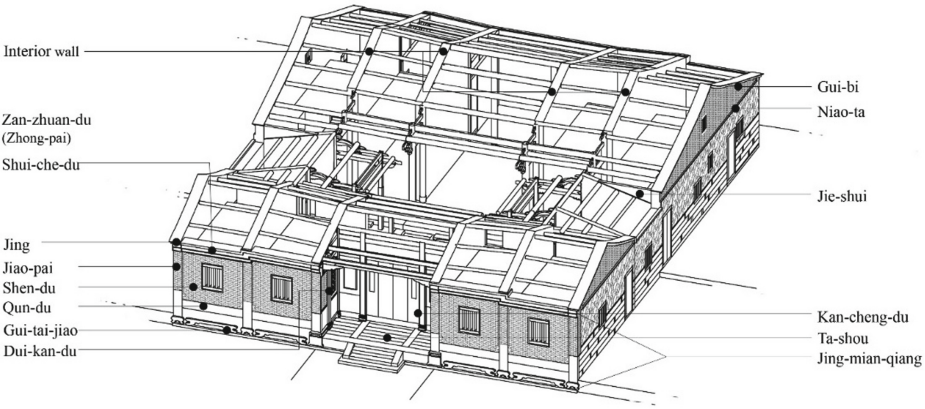

Fig. 1. Sketch of Bohe Fudi residence (shown without roof).

2 Wall Materials

2.1 Wall Construction: Bricks and Blocks

Red Bricks. The use of red bricks in traditional residences in southern Fujian has a long history. There are many kinds of red brick materials used for wall construction, and

[1] The group of ancient buildings in Tukeng Village is one of the sites designated in the 'Eighth batch of provincial-level cultural relic protection units' in Fujian Province, as well as the 'Eighth batch of national key cultural relic protection units'. The Chinese terms used for these buildings and their transliteration into Western characters can be found in Appendix 2. Most of them were built in the middle of the Qing dynasty, but their exact date of constructions has not been verified. In this paper, the expression "Tukeng Village traditional architecture" includes both 'provincial cultural relic protection units' and other historical buildings existing outside of this designation.

[2] Except when otherwise stated in the figure captions, all of the images, photographs and tables in this paper were drawn, photographed and recorded by the authors.

[3] The traditional architectural terms used in the text are written according to the southern Fujian dialect, which correspond with previous research studies and the opinions of local craftsmen. For a complete list of terms, see Appendix 1.

several scholars have done research on this topic.[4] Compared to previous studies, the bricks of Tukeng Village show a greater variety of sizes and forms (see Fig. 2, Fig. 3 and Appendix 2).

Fig. 2. Examples of red bricks found in Tukeng Village.

Fig. 3. Example of an ordinary red brick used in Quanzhou. This picture was taken in Tangdong Village 塘东村 Jinjiang 晋江.

The red brick in southern Fujian has very strong regional characteristics. It is famous for the *Yan-zhi* Brick, which means that one side of the red brick has red and black-spaced stripes. Besides, the brick laid on flat in the wall has an uneven surface created by digging some mud and forming some grooves before firing. According to the local craftsmen, the main purpose of this is to facilitate the laying of bricks, so that they remain more stable after laying. Secondly, it can reduce the dead weight of the brick and save materials, but the effect is limited. Usually this kind of brick in Tukeng is about 190–230 mm in length, 100–120 mm in width, and about 40–60 mm in height. The brick-on-end is 200–210 mm in length, 140–155 mm in width and 20–40 mm in height, and has no grooves in any sides.

Granite. Southern Fujian is rich in high-quality granite. The most commonly-employed stones in southern Fujian are the cyan-stone and white-stone (based on color classification), and it is the same for this village. The exposed surface of the stone that is used for *Qun-du* and *Gui-tai-jiao* is smooth while the other side is rough, which can help to cement stones and other materials better (Fig. 4). There are also some rough stones. In the division of labor of traditional constructions in southern Fujian, the processing of stone for *Gui-tai-jiao*, *Qun-du* and columns is completed by professional stonemasons, and the processing of rough stone and all stone masonry is done by bricklayers.

[4] The most representative studies come from Cao Chunping, Lai Shixian and Zhang Qianqiu. For more information, cf. the "References" section.

a. Cyan-stone *Gui-tai-jiao* (Baiwan Dacuo)

b. White-stone *Qun-du* and *Gui-tai-jiao* (Zhongcuo Budian)

c. *Shen-du* of *Kan-cheng-du* (Jianzhen Dacuo)

d. Inner part of a *Qun-du* Stone (Jiaju Liangpu)

Fig. 4. Examples of granite stone used in traditional buildings.

Tu-que. This material is also formally referred to as adobe bricks. *Tu-que* is mainly made of soil, with some straw and small stone mixed, which are then used to fill in the wood template and firmly pressed down to make it compact. After drying in the sun or shade, the bricks can be formed. The specifications of *Tu-que* are not fixed. The common size used in Tukeng Village is approximately 340 × 230 × 160 mm. No matter whether it contains small amounts of lime or not, its hardness can turn out to be significantly lower than cement mortar and concrete, and thus more susceptible to rain. Therefore, to avoid water penetration, *Tu-que* can only be used for building interior walls or the interior side of the exterior wall, and should be laid only from a certain height upwards (commonly about 600 mm) on top of rough stone. During the masonry, the common arrangement forms of *Tu-que* are 'laid-on-flat' and *Yi-zhou-yi-wo* (Fig. 5).

a. *Tu-que* (Kaitai Jinshidi)

b. Red brick and *Tu-que* Wall (Kaitai Jinshidi)

c. *Tu-que-qi*, *Yi-zhou-yi-wo* (Baiwan Dacuo)

Fig. 5. Examples of the use of *Tu-que* in traditional architecture.

Broken Brick. Many walls of residences in the village are made of broken brick fragments mixed with loam. This structure has higher strength than the loam alone. According to our field investigation and interview with the local craftsmen, there is no lime in the broken brick wall, so its strength is still low and has bad water resistance. The advantage of using broken bricks is that the width of the wall will not be limited by the size of the building blocks. This reflects the fact that traditional communities made full use of waste and old materials, which is both economic and environment-friendly (Fig. 6).

Fig. 6. Wall containing broken bricks (Shunyu Dacuo).

2.2 Cement Materials

Main Components. In the masonry of bricks, stones and other materials, mortar and other cementing materials play a very important role. In the traditional construction process in southern Fujian, the craftsmen made different kinds of mortar through the combination of lime, sand, soil and other materials. Oyster shell is a common material used in coastal areas of southern Fujian, and it is easier to obtain than limestone, so traditional builders used shell to make lime, which is called shell-lime.[5] Other materials include laterite, sand and so on. Laterite is abundant in southern Fujian, and its viscosity is higher than that of ordinary soil. In addition, the Quanzhou area is rich in sea sand, but its high salinity will cause efflorescence, therefore river sand is more ideal.

Ratio of Ingredients in Mortar. During the repair of a traditional house in Tukeng, according to different purposes, the local plasterers mainly use the following methods for proportioning the ingredients in mortar:

1. For stone, brick masonry and the bottom plastering of walls, the ratios of lime, laterite, sand = 1:1:3 (volume ratio).
2. For the surface plastering of the inner wall: lime, sand = 1:3 (volume ratio).
3. For using with the red-brick in the *Jing-mian* wall, it needs to be prepared one week in advance so that there is enough time for the chemical reactions to complete: lime, water = 5:4 (weight ratio).

[5] At the present time, due to various reasons, only a small amount of shell lime is produced. The craftsmen used ordinary lime instead of shell lime in this restoration.

3 Types of Wall

3.1 Architectural Façades

The façade of traditional residences in Tukeng Village is composed of *Jing-mian* wall, *Dui-kan-du* and *Kan-cheng-du*.[6] This composition is the same as that of other places in Quanzhou (Fig. 7).[7]

Fig. 7. Photo of a typical *Jing-mian* wall (Kaitai Jinshidi).

The surface of the *Jing-mian* wall is divided into several parts: from bottom to top these are the *Gui-tai-jiao*, *Qun-du*,[8] *Yao-du*, *Shen-du* and *Shui-che-du* (see Fig. 1). The *Gui-tai-jiao* and *Qun-du* are made of granite, while the *Yao-du* and *Shen-du* are usually made of red-brick. There is a brick frame on the surface of the *Shen-du*, which is called *Xiang-xian-kuang* in the local dialect. The masonry form used in the frame is *Feng-zhuan-bi*, which means that the surface of the wall is sealed by red bricks. The *Shui-che-du* is also made of brick and covered by lime mortar. Compared to red-brick houses in other regions of Quanzhou, the brick masonry method of the *Jing-mian* wall of Tukeng is simpler. The *Gui-bi* in front of the *Hu-cuo* is also part of the front of the building, which is basically the same as that of the *Jing-mian* wall.

The *Dui-kan-du* and *Kan-cheng-du*, located in the residential entrance, are similar to the *Jing-mian* wall: the *Shen-du* portion of them commonly uses brick-carving or a pattern made by some special bricks, the patterns being called *Hu-lu-ao* and *Wan-zi-wen*. Traditional houses in southern Fujian usually have stone-mullioned windows in the central part of *Shen-du* on the *Jing-mian* wall. Moreover, Tukeng Village used to have some commercial activities, and some residential houses along the streets also acted as shops, so they have doors and windows for business on the *Jing-mian* wall which were distinctive compared to ordinary houses (Fig. 8).

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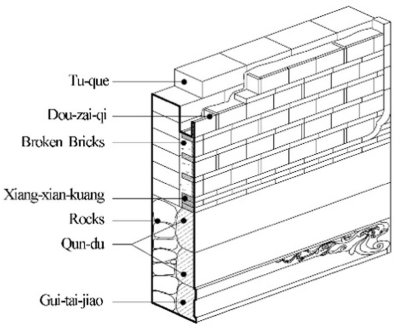
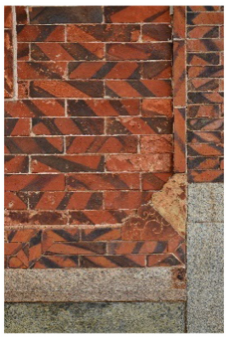
[6] The word *kan-cheng-du* comes from the craftsman Liu Qizhi 刘其志 This part of the wall is also called *Pai-lou-mian* 牌楼面by the scholar Cao Chunping 曹春平.

[7] Due to the limitations of the site area and the small wide angle of the camera, it was impossible to capture the whole building in a single photo. The panorama is composed of four photos.

[8] In the dialect of southern Fujian, a part of the wall is called *du* 堵.



a. Typical construction of a *Jing-mian* wall in Tukeng Village



b. The *Xiang-xian-kuang* in *Shen-du* (Shibu Dangpu)

c. The *Shui-che-du* after the plaster comes off (Jiaju Liangpu)

d. The front wall of *Hucuo* 护厝 (Baiwan Dacuo)

e. Red-brick wall with door and window for business (Wanjie Shisanhang)

Fig. 8. *Jing-mian* Wall.

3.2 *Gui-bi* and Other Exterior Walls

There is always a *Niao-ta* in the cornice height of the *Gui-bi* of *Xia-luo*, *Ding-luo* and *Hou-luo*. It separates the *Gui-bi* into two main parts: the upper one is built by brick, the lower one is composed of *Chu-zhuan-ru-shi*, strips of stones and rammed earth; some also have *Yao-xian* bricks to separate the *Qun-du* and *Shen-du*. The *Hou-yan* wall is similar to the *Jing-mian* wall, but their workmanship and decoration are usually less exquisite than the facade. The outer walls of the *Hu-cuo* (except for the front *Gui-bi*) are similar to those below the *Niao-ta* (Fig. 9).

3.3 Interior Walls

There are many examples of *Ge-lin-zao* in Tukeng, which is a common construction method used in traditional residences of southern Fujian. In this construction, the purlins are placed directly above the wall. The interior wall is usually made of rammed earth or *Tu-que*; the lower part of the wall is built with stones which can be used as a moisture barrier. The thickness of the interior wall is generally 360 mm.

a. Chuanshengju b. Bohe Fudi c. Jianjie Haihuoshang-hang d. Ligong Shuyuan

Fig. 9. Different types of *Gui-bi.*

There is also the construction method of *Gan-zhen* wall[9] within the timber frame. Bamboo is used as an internal frame, and the outside part is covered with mortar. Sometimes it is also necessary to add straw plaster to the mortar to prevent cracking. The surface of the *Gan-zhen* wall is lime mortar, just like the other interior walls (Fig. 10).

a. *Tu-que* (Jiaju Liangpu) b. Rammed-earth wall (Kaitai Jinshidi) c. Lower stone portion of a rammed-earth wall (Kaitai Jinshidi) d. *Gan-zhen* wall (Duanyu Dacuo)

Fig. 10. Details of interior walls.

4 Masonry Process

4.1 Preparation

The preliminary work mainly includes site cleaning, material depositing, level determination, etc. During the restoration work, to determine the level, the most commonly-used tool is a tubular level or a laser-marking instrument. With the help of these equipments, the craftsmen can mark an ink line on the walls by flicking the ink, so that the height of other locations can be determined.

[9] The term '*Gan-zhen* wall' 杆真墙 comes from page 388 of the book *Traditional architecture in Southern Fujian.*

4.2 Masonry Employed at the Wall Base

Because the walls built in Tukeng need to bear the weight of the roof in the manner of *Ge-lin-zao*, the treatment of the wall base is very important. Because a part of the wall was modified after collapsing, the original wall base no longer exists, so it is necessary to do a re-digging and re-apply the masonry. The purpose of digging is to remove the upper layer of softer soil and reach the hard one. The depth will depend on the situation, usually not less than 500 mm. The common depth is about 600–700 mm in Tukeng. The width is about three times as thick as the wall. After the ditch is done, by using small stones, lime, sand and soil to fill its bottom, the lime soil is watered, and then the workers begin to build a foundation with large stones, which are cemented together with ordinary mortar. The width of this layer is about 1.5 times that of the wall's thickness (Fig. 11).

a. Digging (Jiaju Liangpu) b. Backfill with small stones (Jiaju Liangpu) c. Foundation with large stones (Baiwan Dacuo)

Fig. 11. Composition of the masonry at the base of the wall.

4.3 Stone Masonry

When preparing the rough stone masonry, craftsmen will further adjust the size and shape of the stones according to the need. The walls in Tukeng should be built on top of a certain height of stone wall in order to keep the water off. No matter what kind of stone is used, its size and weight are much bigger and heavier than those of the red-brick and adobe brick. Therefore, the masonry technique is more difficult, especially when the length of the stone is close to the width of the room. The craftsmen adjust the position of stones with small stone chips or coins, and then use mortar to cement them. The small stone used for adjustment is mainly placed in the inside, so as to minimize the gaps outside. In the exterior surface of *Qun-du*, the gap is difficult to insert, even a blade is used (Fig. 12).

The common masonry methods of Tukeng are *Ren-zi-qi* and *Luan-shi-qi*.[10] There are mainly two kinds of stone arrangement patterns employed in the masonry: *Ping-feng* and *Gu-feng*. Among them, the *Gu-feng* is a traditional form. The contemporary plasterer uses *Ping-feng*, and sometimes lines are drawn in the middle of stones (Fig. 13).

[10] The terms *Ren-zi-qi* 人字砌 and *Luan-shi-qi* 乱石砌 come from page 243 of *Traditional Architecture in Southern Fujian.*

a. Stone adjustment (Duanyu Dacuo)

b. Stone masonry (Duanyu Dacuo)

c. Masonry of *Qun-du* (Shibu Dangpu)

Fig. 12. Composition of stone masonry.

a. *Ren-zi-qi*, *Ping-feng*

b. *Luan-shi-qi*, *Gu-feng*

Fig. 13. Photos of wall patterns made with stones.

4.4 Red-Brick Masonry

Construction Type. The red-brick walls in Tukeng's traditional architecture are usually made of a combination of rammed earth, broken brick or stone fragments inside, and red brick outside. Red-brick not only plays a very good role in decoration, but also protects the walls as its main function. There are four main forms of red-brick masonry in this village: *Dou-zai-qi*, brick laid on flat, *Chu-zhuan-ru-shi* and *Ping-hua-zhuan*. The brick joints are usually small and recessed, the pointing width being 2–3 mm. A special example is Zhaoyuan Jinshi House, whose pointing width in *Jiao-pai* reaches 8 mm.

Dou-zai-qi is similar to the rowlock cavity wall in its formal look. This method of construction does not form a complete box in Tukeng, just half of it. It is mainly used for the *Shen-du* of the exterior wall, or the upper part of *Niao-ta* on the *Gui-bi* (Fig. 14). The method of the brick laid on flat is used for the outside of the wall as well. The joint is in the manner of *Gong-zi-feng*. It is mainly used in the *Shen-du* or *Yao-du* portion of the *Jing-mian* wall, *Zan-zhuan-du*,[11] *Kan-cheng-du* and *Dui-kan-du*; it is also used in the upper part of *Niao-ta* on the *Gui-bi*.

Chu-zhuan-ru-shi is a distinctive structure in southern Fujian, especially in Quanzhou, mainly used for the part between the *Niao-ta* and *Yao-xian-zhuan* on the *Gui-bi*, which is characterized by a mixture of stone and brick masonry, and the surface of the stone is lower than that of the brick by about 10 mm (Fig. 15).

Ping-hua-zhuan is also used on the outside of the wall, serving both a protective and decorative role. The pattern of *Ping-hua-zhuan* is not as delicate as that found in the area of Jinjiang 晋江.

[11] The term *Zan-zhuan-du* 錾砖堵 comes from page 186 of *Traditional Architecture in Southern Fujian.*


a. *Dou-zai-qi* in *Gui-bi*


b. *Dou-zai-qi* in *Jing-mian* wall

Fig. 14. *Dou-zai-qi* in Tukeng Village. (This kind of masonry method is similar to the effect of *chu-zhuan-ru-shi* 出砖入石).


a. *Gui-bi* (Zhaoyuan Jinshidi)

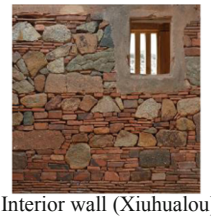

b. Interior wall (Xiuhualou)

Fig. 15. *Chu-zhuan-ru-shi.*

Key Points of the Masonry Process. Before the start of the brick masonry, the plasterer needs to put the brick in the water for more than two hours; this process can enhance the adhesion between brick and mortar. The craftsmen also carefully select and try out the brick material, using their tools to adjust the size if necessary, in order to ensure that the surface of each brick[12] is the same, avoiding uneven brick joints.

By using lime as a cementing material, it is only necessary to plaster at the edge of the bricks, which is similar to the official practice of "*Dai-dao-hui*". After the masonry, the extruded mortar cannot be removed immediately. It needs to be scraped carefully after semi-drying it, otherwise it will cause the wall to become stained. The tool used for pointing is a sharpened bamboo piece (Fig. 16). In the laying of the *Niao-ta* of *Gui-bi*, it is necessary to tilt the brick outward up to a certain angle for drainage (Fig. 17).


a. Masonry of *Feng-zhuan-bi*


b. Plaster placed at the edges of bricks


c. Pointing


d. Bamboo tool used for pointing

Fig. 16. Process used for brick masonry.

[12] This kind of brick surface is formally called by the term *Kan-mian* 看面.

Fig. 17. Photo of masonry used for *Niao-ta* (Duanyu Dacuo).

4.5 Common Issues

The exterior wall typical of Tukeng's traditional buildings, such as the *Jing-mian* wall, is composed of two layers, namely the inner side of the rammed earth layer and the outer brick or stone layer. Because of the difference in hardness and water resistance between the two layers, it is easy for them to separate from each other due to foundation settlement or earthquakes, and subsequently, additional problems such as inclination and convexity of the wall may occur. The probability of occurrence of this problem for external walls is higher than in the case of interior walls (Fig. 18). Due to the above characteristics, it cannot be regarded as just an ordinary brick wall during the repair works. The appropriate method is to partially remove the wall surface, clean and reinforce the inner wall, and then rebuild the red-brick or stone layer.

Fig. 18. Photo of a frequently-occurring issue in the wall and its repair (Shunyu Dacuo).

5 Conclusion

By investigating, sorting out and summarizing the materials, structural types and techniques used in traditional residential walls of Tukeng Village, the authors find that:

1. In terms of brick materials, in addition to the relatively diverse specifications (see Table 2), it is worth mentioning that many brick materials are thick, up to 60 mm. This kind of brick has been encountered many times in the villages, such as Baiwan

Dacuo, Zhaoyuan Jinshidi, Kaitai Jinshidi and so on. This kind of brick is rarely seen in the traditional buildings in other areas of Quanzhou, but it is also seen many times in the Putian area, which is also a 'red-brick cultural district' (Fig. 19). As Tukeng Village is close to the junction of Quanzhou Plain 泉州平原 and Xinghua Plain 兴化平原 (Putian Plain 莆田平原), this situation shows that although there are many differences between Tukeng Village and Putian's residential buildings in terms of small details, there are some connections in terms of building materials.

a. Putian Wenfeng Tianhou Palace 莆田文峰天后宫 b. Dazongbodi 大宗伯第 c. Putian Guanghua Temple 莆田广化寺

Fig. 19. Types of red brick used in Putian.

2. Regarding the type of wall structure, it is mainly composed of brick laid on flat and *dou-zai-qi*, with a lesser prevalence of *Ping-hua-zhuan*. Compared with traditional residences in Jinjiang, the *Xiang-xian-kuang* found in Tukeng Village is simple, and with elegant decoration.
3. In terms of repair technologies, the integration of new and old bricks in the outer appearance of the wall has always been a difficult problem. Because the traditional red-brick wall is one of the characteristics of southern Fujian, whether from the perspective of the government or the villagers, it is often required to restore the original appearance as much as possible during the repair. The old materials collected elsewhere also face problems of inconsistent quality and specifications. In addition, the skill level of the craftsmen is also uneven, which also affects the final result of the repair works.

Although since the Ming Dynasty, traditional Chinese architecture began to use a large number of bricks, the walls of the existing traditional houses which were built in the Ming and Qing dynasties are not entirely made of brick. A large number of red-brick and stone *Qun-du* not only decorate the whole building, but also protect the inner part of the wall from wind and rain. By taking this approach, the structure can increase in durability, and it saves costs. From the viewpoint of architectural physics, this double-structure is also beneficial for sound insulation and heat insulation. All of these reflect the wisdom of traditional builders under limited material conditions. However, the downside is that the internal structure of the wall is loose and can't withstand earthquakes. In addition, if there is no timely repair to prevent roof leakage and other issues, the rain will soon erode the inside of the wall, causing considerable danger.

At present, most of the traditional residential buildings in Tukeng Village are still well-preserved, which provides valuable case studies for the investigation of construction

techniques and related repairs of traditional architecture in southern Fujian. There are also some buildings in danger, especially those with collapsed roofs, meaning that the isolated walls are more likely to be destroyed. The study that resulted in this paper not only aims to provide some basic materials for the protection of traditional buildings in southern Fujian, but also hopes that others may be inspired to contribute to this type of research work and engage in the protection of local traditional architecture.

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Appendix 1

(See Table 1).

Table 1. Comparison list of construction terms in Chinese and Western characters.

Western Characters	Southern Fujian Terms 闽南术语	Formal Terms 官式术语	Western Characters	Southern Fujian Terms 闽南术语	Formal Terms 官式术语
Chu-zhuan-ru-shi	出砖入石	-	*Niao-ta*	鸟踏	-
Dai-dao-hui	-	带刀灰	*Ping-feng*	-	平缝
Ding-luo	顶落	-	*Ping-hua-zhuan*	拼花砖	-
Dou-zai-qi	斗仔砌	斗砌	*Qun-du*	裙堵（砌堵）	-
Feng-zhuan-bi	封砖壁	-	*Shen-du*	身堵	-
Gan-zhen wall	杆真墙	编竹夹泥墙	*Shui-che-du*	水车堵	-
Ge-lin-zao	搁檩造	-	*Shui-zhe*	水遮（截水）	-
Gong-zi-feng	工字缝	十字缝	*Ta-shou*	塌寿	-
Gu-feng	鼓缝	圆线	*Tu-que*	土埆	土坯砖
Gui-bi	规壁	山墙	*Tu-que-qi*	土埆起	-
Gui-tai-jiao	柜台脚	-	*Wan-zi-wen*	万字纹	-
Hou-luo	后落	-	*Xia-luo*	下落	-
Hu-cuo	护厝	-	*Xiang-xian-kuang*	香线框	-
Hu-lu-ao	葫芦凹	-	*Yao-du*	腰堵	-
Jiao-pai	角牌	-	*Yao-xian* brick	-	腰线砖
Jing	景	-	*Yan-zhi* brick	烟炙砖	-
Jing-mian wall	镜面墙	-	*Yi-zhou-yi-wo*	-	一凳一卧
Kan-cheng-du	看埕堵	-	*Zhong-pai*	中牌	-

Appendix 2

(See Table 2).

Table 2. Dimensions of red bricks used in walls in Tukeng (units: mm)

Building Name	Parts	Length	Width	Thickness
Baiwan Dacuo (百万大厝)	*Zan-zhuan-du* 錾砖堵	240	120	60
	Jing-mian wall 镜面墙看面	230	-	50
	Jing-mian wall & etc. 其他（镜面墙看面）	240	-	58
Bohe Fudi (博鹤府第)	*Zan-zhuan-du* 錾砖堵	220	110	45
	Zan-zhuan-du 錾砖堵	200	110	50
	Jing-mian wall 镜面墙看面	220	-	45
Changchuntang Yaopu (长春堂药铺)	*Zan-zhuan-du* 錾砖堵	210	110	45
	Jing-mian wall 镜面墙看面	210	-	45
Chuanshengju (传盛居)	*Zan-zhuan-du* 錾砖堵	205	100	45
	Jing-mian wall 镜面墙看面	210	120	-
	Jing-mian wall 镜面墙看面	210	-	47
Duanyu Dacuo (端瑜大厝)	*Zan-zhuan-du* 錾砖堵	230	115	52
	Jing-mian wall 镜面墙看面	230	-	52
	Jing-mian wall 镜面墙看面	225	-	40
Jiaju Liangpu (家驹粮铺)	*Zan-zhuan-du* 錾砖堵	225	110	40
	Jing-mian wall 镜面墙看面	200	-	55
	Jing-mian wall 镜面墙看面	200	140	-
	Jing-mian wall 镜面墙看面	220	130	-
Jianlong Fudi (见龙府第)	*Zan-zhuan-du* 錾砖堵	220	115	45
	Jing-mian wall 镜面墙看面	230	-	40
	Others 其他	210	-	45
Jianzhen Dacuo (建珍大厝)	Zan-zhuan-du 錾砖堵	215	110	45
	Jing-mian wall 镜面墙看面	220	-	45
Kaitai Jinshidi (开泰进士第)	*Zan-zhuan-du* 錾砖堵	205	105	45
	Zan-zhuan-du 錾砖堵	225	110	50
	Jing-mian wall 镜面墙看面	210	-	45
	Jing-mian wall 镜面墙看面	200	-	60
	Jing-mian wall 镜面墙看面	190	-	48
	Hou-yan wall in Huixiang回向后檐墙	185	140	40
	Courtyard wall 院墙	205	140	37
Laipu Dangpu (来铺当铺)	*Zan-zhuan-du* 錾砖堵	215	105	45
	Jing-mian wall 镜面墙看面	210	-	47
Shibu Dangpu (施布当铺)	*Zan-zhuan-du* 錾砖堵	200	120	55
	Jing-mian wall 镜面墙看面	230	55	-
	Jing-mian wall 镜面墙看面	200	35	-
	Gui-Bi in *Hou-luo* 后落规壁	210	155	20
Shunyu Dacuo (顺裕大厝)	*Zan-zhuan-du* 錾砖堵	220	110	60
	Jing-mian wall 镜面墙看面（陡砌）	220	-	48
	Ping-qi in the *Jing-mian* wall 镜面墙看面（平砌）	230	110	48
Wanjie Shisanhang (万捷十三行)	*Zan-zhuan-du* 錾砖堵	210	100	60
	Jing-mian wall 镜面墙看面	210	140	-
	Jing-mian wall 镜面墙看面	210	-	40
Xiuhualou (绣花楼)	*Zan-zhuan-du* 錾砖堵	220	105	45
	Jing-mian wall 镜面墙看面	190	-	45
	Jing-mian wall 镜面墙看面	220	-	45
	Jing-mian wall 镜面墙看面	200	120	-

(*continued*)

Table 2. (*continued*)

Zhaoyuan Jinshidi (肇元进士第)	*Zan-zhuan-du* 錾砖堵	230	110	60
	Jing-mian wall 镜面墙看面	190	-	60
	Jing-mian wall 镜面墙看面	200	140	40
Zhongcuo Budian (中厝布店)	*Zan-zhuan-du* 錾砖堵	200	100	60
	Jing-mian wall 镜面墙看面	205	145	-
	Jing-mian wall 镜面墙看面	200	130	-

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