



Chinese Vernacular Architecture

Hakka Earth Building (土楼 Tulou)

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EPSRC, DfID -DECC

Within the framework of the EPSRC-DfID Project, a UNNC academic team consisting of Prof. Ali Cheshmehzangi, Liska Gálvez and Chris Butters (from the University of Warwick) made an academic visit to Fujian Province to get a full overview of its Chinese Hakka Earth Buildings. Named as Tulou, the visit was carried out in Nanjing County, China from April 4th to 5th April 5th in 2015.

This visit is part of an on-going EPSRC-DfID funded research programme, under the “Energy and International Development” scheme. The project is titled “Energy and Low –Income Housing in Tropical Housing”, and it integrates housing evaluation and energy consumption analysis in both rural and urban areas of China. The programme include three academic papers: “Development of rural housing in China: Transitions in housing development patterns”, “China’s urban housing energy consumption: the case of Ningbo” and “China’s Urban Housing: The Review of Three Housing Typologies and Patterns”.

Considering the relevance of Tulou to these academic papers, the visit allowed observing a vernacular architecture building in subtropical monsoon climate looking through rural housing transition pattern, the environmental features of Tulou and the current housing pattern in China.

Tulou are a unique kind of rural buildings with rammed earth and in a wooden framework, often of a circular configuration surrounding a central shrine, located across the southeastern China such as Fujian, Jiangxi and Guangdong provinces. The growing awareness of vernacular building’s potential to positively impact environmental issues pushes Tulou to the forefront in order to understand its sustainable features to architecture. Other reason has been the fact that, even Tulou’s cultural, artistic and environmental values, they are declining in recent years.

1 To evaluate the role that Tulou plays in the current china rural housing transition.

Firstly, many elements are negative affecting the rural housing include population decline, lack of construction control, ageing and stagnant economy. Despite that Tulou has become a touristic destination and younger generation are still living in these rural areas, observation findings reveal that Tulou buildings are strongly affected by these phenomenon mentioned above.

The second finding is about the lack of construction planning regulations. In this aspect, some important issues to consider include: the emergence of self-development houses along with the preservation of some oldest Tulou buildings. This has resulted in a mixed rural housing landscaped in which older Tulou buildings coexist next to new dwellings (Figure 1).



Figure 1 – Mixed Rural housing (Source: Authors’ own 2015)

Despite the Nanjing County authorities has committed to preserve Tulou buildings, as in many other countries, with the modernization of rural areas and its inconvenience to adapt of modern preferences, many Tulou are been abandon (Figure 2).



Figure 2 – Old Tulou buildings abandoned (Source: Authors’ own 2015)

2 To evaluate the role that Tulou plays in the environmental issues.

Built between the 12th and the 20th centuries, Hakka Earth Buildings structures are built of local, natural materials with complex techniques. The main functions of these historic structures were: security, protection from climate, preservation and necessity to use regionally available materials.

The foundation of Hakka Earth Building was built with paved stones on top of compacted earth ground, in two to three tiers. Tulou have a wall thickness of 1.3 m to 1.5 m and height of 40 cm ~50 cm.

From the viewpoint of sustainable buildings, Tulou features have moderating interior climatic functions, with the massive earthen walls to help buffer temperatures and the natural airflow due to circular structures. This is particularly important, given the characteristics of Fujian Province climate zone (hot summer - mild winter).

Other sustainable features of Tulou’s buildings are the use of local materials. The buildings are made of earth, stone, bamboo and wood structures are formed by compacting earth, mixed with stone, bamboo, wood and other readily (Figure 3).



Figure 3 – Typical Old Tulou buildings (Source: Authors’ own 2015)

As a result, Tulou buildings present an effective solution for the sustainable issues because it has significant environmentally features that respond to sustainability such as low-energy techniques to provide for human comfort, approaches that are integral to the form, orientation, and materials that are obtained from local resources. Even in the case of demolition, the materials will not cause environmental issue.

3 To analyse the role that Tulou could play in the current Chinese affordable housing Programs

In the current China's housing and urbanisation, providing adequate and affordable housing for low income families is crucial for the success of China' housing reform.

Despite China has already made considerable progress in housing shortage and overcrowding housing, the capability of the government in providing affordable housing and adequate living conditions is being critically questioned. In this context, Tulou building design could assign urban dwellers an accessible accommodation. Given that the structures of Tulou buildings implies many small units, the design can be used to develop mass housing schemes and provide better housing solution to low- income homebuyers find a home they can afford (Figure 4).



Figure 4 – Tulou buildings design (Source: Authors' own 2015)

Remarks

Nowadays Tulou are under important regional preservation policy, focusses in a significant tourism development (Figure 5). However, during the visit, many Tulou were found with poorly maintained or abandoned conditions (Figure 6).



Figure 5 – Tulou touristic development (Source: Authors' own 2015)



Figure 6 – Tulou abandoned conditions (Source: Authors' own 2015)

The challenge of the authorities strategy implies that while upgrading existing Tulou's to modern living standards, the programs are facing some obstacles such as preserve the vernacular features of the Tulou's origin design and the incorporation of the sustainable features (maximize energy efficiency and environmental sustainability).

Socio-economic considerations should also be taken into account. The decline in Tulou occupancy rates, high cost construction and the preferences of today's generations are playing an important impact in the preservation of Tulou

buildings. Like so many rural villages across China, the region houses are predominantly built of brick or concrete construction. As Mr. Shi mentioned, owner of one Tulou-Hotel: "traditional construction methods are beings lost", he referred that new generation have little acknowledge about Tulou's buildings technique construction.

Another important result was a significant rise for air conditioning use. This growth in air conditioning neglected the Tulou's vernacular sustainable elements and empathize the need to make more efforts to consider Tulou buildings low-energy methods for warm climates in the modern architecture (Figure 7, 8 9). A better understanding in air condition consumption may become a significant contributor for further development of Tulou's suitable thermal comfort standard for hot summer - mild winter.



Figure 7 – Tulou residential air conditioners consumption (Source: Authors' own 2015)



Figure 8 – Tulou residential air conditioners consumption (Source: Authors' own 2015)



Figure 9 – Tulou residential air conditioners consumption (Source: Authors' own 2015)

Accomplishments

Through participating to this visit, the academic team had an opportunity to strengthen knowledge on the Vernacular Earth Buildings and the development and implication of the Tulou buildings approach on the principles of sustainable architecture.

From many years to now, earth-buildings have been growing in USA and all over Europe and Middle East. The visit thus has contributed to the comparison study on earth buildings by the evaluation of Chinese Tulou buildings.

The visit has also contribute to discuss of Tulou building including the role this can play in modern earth buildings in terms of material functionality, climate change and the vernacular architecture.