Public Participation and Social Life:
A Green Building Practice in Rural Northwest China

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ABSTRACT: With the rapid urbanization process in china currently, there are more and more opportunities for the rural population to get jobs in the cities. A huge number of people from the rural areas are now working in the cities instead of simply farming in the rural for the most time of the year. Consequently, there have been much more connections between urban and rural life because of this group of people. Social communication and social activities (reading, lecture, recreation, physical exercise and health care, for instance) in the rural societies have become desirable in their daily life. Since the traditional public spaces based on natural environment in rural areas could no longer supply the increasing demand, variety of new public buildings are urgently needed. On the other hand, however, extensively following and imitating the urban model is quite unpractical, and would probably destroy the ecological environment. With these understanding, the Wu Zhi Qiao (Bridge to China) Charitable Foundation organized a green building practice in a selected rural community (Datan village, Tianshui city, Gansu province), in terms of helping the inhabitants to design and build their own community centre by themselves in an ecological and sustainable way. A high level of public participation was emphasized and implemented as an essential part of this practice during each period. Thanks to the inhabitants' experience of participating in the project, their sense of community had been strengthened and their social life had been well developed and improved. Meanwhile, as a supplementary, education about environmental protection and basic ecological principles had been carried out in the process.

Keywords: public participation, rural China, green building

INTRODUCTION

With the gradual improvement of agricultural productivity in rural China, more and more labour has been released from farming in the past few decades. Meanwhile, the high-speed urban development happens to provide an opportunity for the rural surplus labour transfer. This particular group of people in China is, so called, migrant rural worker. As of 2012, the migrant rural workers, who find their jobs both in and out of towns, have grown to 262.61 million, representing for 40.89% of the total rural population [1]. This large group of people works and lives in the cities for most time of the year, fighting for the improvement of their rural families' living quality, and in the meantime, has started to influence the rural society in the wake of getting familiar with the urban culture. In the positive perspective, the migrant rural workers are acting a strong connection between urban and rural areas, helping to eliminate cultural differences. On the other hand, their life style has changed the structure of rural population, that the left-at-home children and aged people may cause negatively social problems. Just for reasons as above, the needs of social life in current rural China would definitely be changed, social communication and social activities (reading, lecture, recreation, physical exercise and health care, for instance) in the rural societies have become essential and desirable in their daily life.

Since the traditional public spaces, which based on natural environment, could no longer be able to satisfy the changing and increasing demand for social communication and social activities in rural areas, variety of new public spaces are urgently needed. However, currently New Rural Construction is quite unbefitting that extensively following and imitating the urban model is not only unpractical, but would probably destroy the ecological environment.

With the above understandings, the Wu Zhi Qiao (Bridge to China) Charitable Foundation [2] organized a green building practice in a selected rural community in 2011 (Datan village, Tianshui city, Gansu province), in terms of helping the inhabitants to design and build their own community centre by themselves in an ecological and sustainable way. An earth building with a design strategy of "High science, low tech" has been completed and a high level of public participation among local villagers, teachers and students and other social volunteers was pursued and implemented as an essential part of this practice during each period. Conversations between the urban and rural society were also achieved in order to get a better understanding of each other. Meanwhile, as a supplementary, education about environmental protection and basic ecological principles for all the participants has been carried out in the process.

LOCAL CONDITION

Figure 1: Tianshui city and China's Loess Plateau region.

Datan (Tianshui city, Gansu province, China) is a Muslim-Han mixed village which located in the China's Loess Plateau region, at an altitude of 1.9 km, with underdeveloped transportation and economy (Fig. 1, 3). This region has an extremely cold winter and a relatively moderate summer, with large temperature swings not only seasonal but daily, and distinctively seasonal precipitation (Fig. 2). Meanwhile, due to the poor conditions of natural resources and agricultural technique, farming could only basically meet their own needs, which leading to an annual net income below 194 USD per capita in 2007. That was far behind the national average value, 700 USD per capita in 2007 of rural residents [3]. Accordingly, vernacular buildings in this region were usually built by adobe bricks with timber structure, deriving from the cave dwelling. Responding to the local conditions, it was a widely used building technique which could achieve a high indoor thermal performance with a very low cost, traditional but wise.

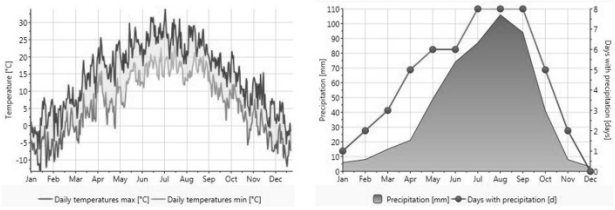

Figure 2: Daily temperature and annual precipitation in Tianshui city (Source: MeteoNorm 7).

The village used to be cut off by a river during the flood season, since the local habitants could not afford for a solid bridge. In the summer of 2008, a WZQ bridge has been built by the student volunteers from HK and China mainland, which has also built the connection between this village and the outside world. Along with the bridge, social requirements for living improvement of the local habitants have gradually raised the participants' attention so that some of other problems, which the local villages are still facing, have been discovered, as below:

Housing
Most of the houses in the village were broken and out of renovation for long years. Even worse, these buildings have suffered different degrees of damage during the earthquake in 2008, and some of which became dangerous. In spite of the willingness to improve their living environment, the local villagers could hardly afford the conventional brick-concrete approach, which would cost more than 162 USD /m2. Therefore, taking this opportunity, an adaptive, regional, scientific and low cost building demonstration was urgently needed, leading them to find a feasible way for developing building environment.

Health care and popularization
There was at least half an hour's walk from the village to the nearest medical facilities, so that inhabitants could not receive timely treatment once they had emergency. Additionally, lacking of elementary knowledge of hygiene and public health was universal in this region, especially among women people. Consequently, a local clinic was appropriately required for health care and popularization.

Craving for knowledge
By realizing the importance and necessity of knowledge for their life and future, local inhabitants had begun to raise their desire for learning, in addition to the guarantee of their children's education. In view of the absence of books and reading environment, a library became desirable and meaningful.

Public space
Majority of the local inhabitants was Muslim, whose daily social communication was mostly based on religious activities in the mosque. However, as a mixed village, there was still lack of a common public space for ordinary gathering, especially for modern entertainment and physical exercise.

From the above condition analyses, a feasible building type had been outlined to meet the local requirements, with the proposal that building a rural community centre with the function of clinic, library and public playground. Furthermore, it was expected to be more than just a green building construction under environmental and sustainable principles, but also a chance for comprehensively social improvement along with the practice.

Figure 3: Overview of the village and building site.

REVIEW

The "High science, Low tech" strategy employed in this green building practice was in line with a previous ecological design prototype of a group of primary school buildings leading by prof. Edward Ng and Dr. Jun Mu, located in Maosi village (Xifeng city, Gansu province), which was also a representative region of Loess Plateau not far from Datan village [4, 5]. By condition analysis and computational simulation experiment, local earth-based technology had been considered to be worth involving in the study of ecological building. Accordingly, the objective of the school project is to explore a feasible approach to ecological buildings specific to the local conditions, in which alternative building techniques and feasible thermal design strategies for this region had been carried out and verified. Thermal mass, insulation, passive solar system and natural ventilation system, which mostly supported by traditional building techniques, had been applied to get the minimum energy consumption and environmental impact, in the meantime, a better indoor thermal performance. In addition, local materials and labour had been utilized during the construction to achieve the maximum cost efficiency and self-sufficiency, contributing to the local economy as well. The hypothesis had been validated to be practical and feasible, that local earth-based buildings could achieve optimal thermal performance with minimum energy consumption and environmental impacts by utilizing local materials and alternative techniques. It was a terrific prototype as a combination of scientific research in ecological theory and locally traditional techniques, which had been subsequently summarized as the concept of "High science, low tech". Being wildly accepted by the world, this prototype provided us the fundamental principles of localized green building and essential experience of rural construction, due to the similar conditions.

Another in-line green building practice organized by WZQ (Bridge to China) Charitable Foundation was conducted in Ma'anqiao village of Sichuan province (MoHURD No.1 Site) [6], as a demonstration for the post-disaster reconstruction after the Wenchuan earthquake in 2008. Aiming at the rural reconstruction, the practice timely accomplished a sample of earthquake proof construction, with a high level of building performance and cost efficiency by employing local rammed-earth technique. Utilizing existing recycle materials from the on-site ruins has been proven to be an efficient approach to reduce construction cost and to recover the living environment, which making it possible for the villagers to rebuild right in their former addresses with a very low cost of 24 USD/m2, comparing to the conventional brick-concrete approach (162 USD/m2). It was worth noting that training section was involved during the prototype construction for all the villagers, so as to be capable of rebuilding their own houses. A DIY manual of rammed earth building for post-earthquake reconstruction has been published based on this building practice [7], in purpose of popularizing this practical strategy. 33 local families (about 140 villagers) directly participated in the prototype building practice and rebuilt their own houses subsequently using the trained techniques, which has been realized to play a significant role in settling down as soon as possible after the disaster, and be beneficial for the social stability and re-development. In view of culture heritage conservation for the local minority of Dai and Yi, a public building has also been built as an ethnic cultural exhibition centre. This project offered us a valuable experience of integrating the concept of training and minority cultural maintenance into building practice.

According to the previous studies, we decided to guide the local villagers in Datan to build a community centre by their own hands utilizing local materials and locally alternative techniques, as a demonstration of sustainable development. Accordingly, social aspect has

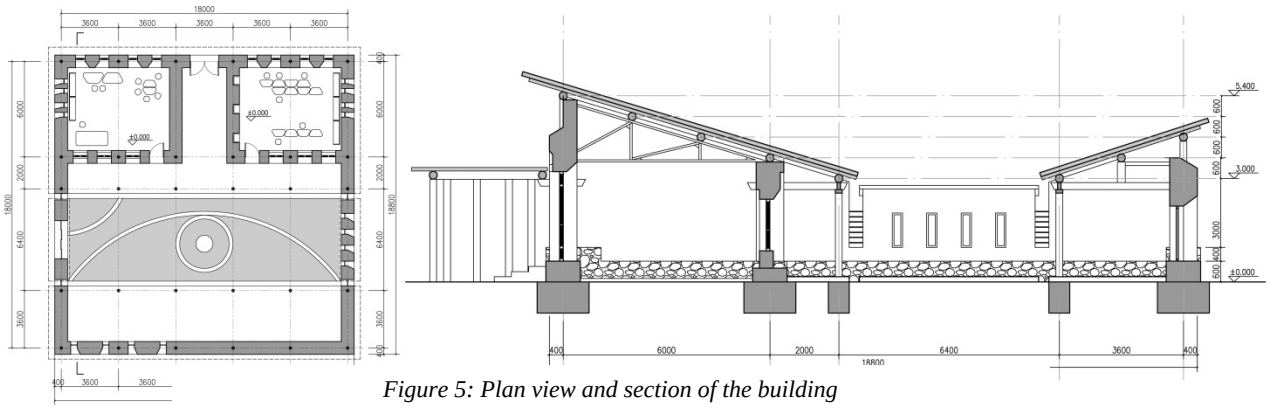

Figure 5: Plan view and section of the building

also decided to be emphasized in terms of encouraging the public to participate the building practice as much as possible. In the meantime, the low cost approach of building skills and the concept of ecological and sustainable building were proposed to be promoted to the villagers, which could be applied to the renovation of their houses. Besides, this community centre was going to be treated as a communicating platform in the remote area, for the long-term concern of rural people's livelihood.

DESIGN PROPOSAL

In order to maximizing cost efficiency and self-sufficiency, local material and traditional techniques are proposed to be employed as much as possible, in terms of earth-based building with adobe bricks, straw mud, timber and stones, etc. Since most of the design issues of the local earth-based building had been studied in the previous project, such as thermal performance, structural stability of adobe walls and material durability, this practice would adequately refer to those technical solutions with adaptation and improvement.

Site plan

Figure 4: Site plan of the building practice.

The integral site is located at a plat land next to the WZQ Bridge, which is the main entry of Datan and other three villages, along with the east bank of the Malu River. The community centre is planned to the south side of the main road, with a north-south orientation for a maximum exposure. Since the bridge is pedestrian only, a pavement has been set to go through the pergola in front of the main building entrance, directing to the bridge. A basketball courtyard for the villagers' physical activities is planned across the road, and a site for the office building of village committee has been reserved for the further development. An eco-toilet is proposed to be built nearby as supporting infrastructure, and landscape is planned surrounding the constructions to provide a pleasing and comfortable building environment (Fig. 4).

Building design

Building form should be designed with green considerations. Two main rooms with the function of clinic and library, respectively, are sited in line on the north side, separated by the main entrance. Both northern and southern windows are installed as a transparent type for natural ventilation. Since the strong solar radiation, a deep corridor is proposed to the south so as to avoid directly exposure in summer and be able to perform the passive solar system in winter. Meanwhile, the northern windows are maximized in size for a better day lighting performance. A large "grey space" is planned on the south side so that a central courtyard with greenery and stone chairs would be formed, providing different types of space for outdoor activities. The traditional single-pitch roof is employed since the light weight and locally skilled technique, with the form of tilting inward which is a conventional culture to collect the rainwater inside the courtyard (Fig. 5).

Materials and techniques

Improving and utilizing local available materials and traditional techniques is the main approach to achieve the maximum cost efficiency, self-sufficiency and environmental friendly in this practice. Building

envelope is made of natural and renewable materials, such as adobe bricks, rubble, straw and timber. According to the former studies, the 800mm-thick adobe walls could play both parts in thermal mass and insulation to keep the indoor air temperature stable by reducing unwanted heat exchange through the walls. Traditional bricklaying of the adobe wall is usually mixed with transverse and longitudinal bricks, in order to speed up the walling work. However, the absence of bonding among the longitudinal bricks would weaken the shearing resistance of the walls (Fig. 6). Thus, considering the building's aseismic reliability, all the adobe bricks are laid transversely in this practice. Besides, some tiles are inlaid into the large-area walls as a further protection against rain. Timber framework is employed as the main structure of the building for its flexibility and anti-seismic property. Besides, additional ring beams is applied to join the timber columns into a cohesive whole, as the seismic reinforcement (Fig. 7). Most of the window openings are designed to be bevelled in the thick wall, in the purpose of maximizing day lighting. Double glazing windows sealed with airtight strips are installed to minimize the heat loss. Meanwhile, to minimize the environmental impact, the stones that used for the pavement are mostly recycled from the leftover material, and concrete is used only on the parapet walls and ring beams.

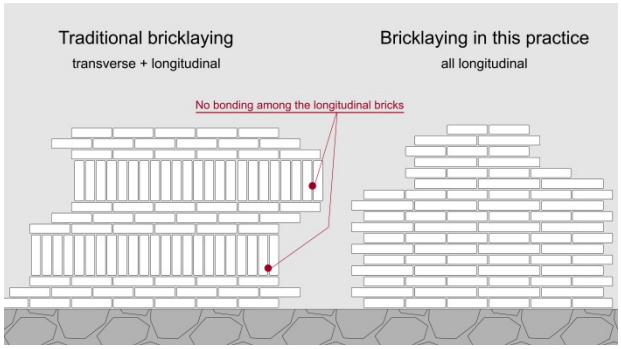

Figure 6: Comparison of bricklaying

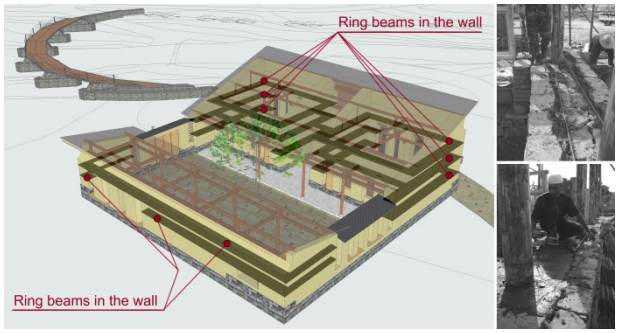

Figure 7: Ring beams for improving anti-seismic performance.

PUBLIC PARTICIPATION AND SOCIAL LIFE IMPROVEMENT

Cooperation and local public participation had been involved in the initial project of WZQ Bridge in 2008, which providing us a good start for understanding the local conditions through our personal experiences. More importantly, mutual respect and trust had been established due to the equality that we insisted all the time in communication and cooperation, through which our idea of doing things was understood and accepted. With such basis, the building practice of community centre was expected to continue the communication with local village, beyond just one construction but an opportunity to pursue rural life improvement. In this project, public participation in decision making has been emphasized and kept coherence from on-site investigation, building design, construction, landscaping, interior design and fitment, to the promotion, and operation proposals.

The strategy of “High science, low tech” makes it easier for the villagers to participate in this practice, since it essentially and fully respect to the local conditions. The maximum utilization of local techniques and materials has not only helped to approach the environmental and economic sustainability, but also the social aspect that enhanced the local inhabitants’ sense of identity and sense of belonging. Local labour has been maximally utilized not only for cost efficiency, but a vast platform for public participation. Adobe bricks were rammed in the tailor-made mold by local families and laid in their threshing ground for drying as early as six months before the start of the construction (Fig. 8). Timbers and stones were selected and transported in local market by local villagers, and straw were from local harvesting. All the timber works were completed by local artisans and other constructional works were open to the public (Fig. 9). Approximately, more than 80 local inhabitants took part in the construction at one time.

Apart from the local labour, student volunteers were also involved into the building practice, during landscaping and interior fitment periods. Two constructional trips have been conducted by student volunteers involving planting trees, paving corridor and courtyard, painting interior walls, paving interior floor and DIY furniture. The idea of “green building” has been inculcated upon the student volunteers, and their practical ability has been toughened. It is worth mentioning that cooperation and communication with local kids have been well carried out by this chance. Working and living together, visiting local schools and families, were good opportunities for the youth to understand each other’s life.

Figure 8: Adobe bricks made by local families.

Figure 9: Building construction.

By the chance of this practice, as expected, several cooperative activities involving public participation have been conducted according to local needs. Considering that majority of the local villagers who older than 40 never went to secondary school, the will and suggestion of locals has been fully respected for the donation of the library books, and their proposal of eliminating illiteracy using library resources has been widely accepted. Two service trips referring to public health and primary care have been conducted by professionals, involving complete survey on public health condition, publicity of appropriate disaster drills and refuse treatment, and group talks for hygiene. The service works were welcome and received positive response from local inhabitants.

Along with the participation in this practice, roles for the further life improvement have been defined respectively from the mature cooperation. In view of local conditions, inhabitants would take charge of problems and requirements finding, and simultaneously, we should be responsible for the scientific support. Both local villagers and external volunteers are suggested to participate in the practical operation, since insisting on the priority of cooperation has been regarded as the most effective way to deal with problems.

Although this building practice would have an end, as a supplementary, education for all the participants were pursued throughout the practice, which has been considered as an imponderable value to both the life of local inhabitants and the growth of youth. For locals, alternative building techniques and environmental considerations have been implanted and fundamental of health care has been popularized. For student volunteers, rural life has been experienced and practical ability has been exercised.

CONCLUSION

This paper has briefly introduced a green building practice in rural northwest China, throughout which public participation was emphasized. Current issues in rural areas about cultural connection and built environment have been studied, and the requirements for social improvement have been investigated. Aiming to explore feasible ways for rural development, prototypes of building practice with environmental and social considerations are extremely needed. By analysing local climate, culture, and living conditions of a selected village, a prototype of green building practice pursuing a high level of public participation among local villagers, teachers and students and other social volunteers has been accomplished by Wu Zhi Qiao (Bridge to China) Charitable Foundation, in terms of building a community centre following the “High science, low tech” strategy. Through these activities, local inhabitants have become positive and optimistic for their future life, and are willing to accept new things from the cultural exchange. Since nearly the whole village was involved into the building practice and other activities, their sense of community has been strengthened based on the cooperation and mutual participation. Furthermore, as an infrastructure with fitted functions, the community centre has started to develop the social life of local inhabitants and would play a key role in further improving.

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