The Research on the Architectural Design and Construction Path of Rural Low-Tech Residential Buildings

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Abstract. At present, such problems as excessive destruction of rural natural environment, excessive consumption of construction resources, excessive construction cost of residential houses, unsustainable development mode, and gradual loss and extinction of traditional construction experience and technology need to be studied and solved urgently. This paper proposes to save the current rural residential buildings with the concept of low-tech, starting from the perspective of space, forms, materials, and technologies, etc., in order to explore the main categories and practical paths suitable for the current rural low-tech residential building design and construction.

1. Introduction
Rural dwellings are the place of "home", which is the most primitive and sustainable type of architecture. Due to the constraints of natural environment, climate, technology, resources and other factors, rural residential buildings are often built with natural and original materials, rooted in the local region, culture, workmanship, technology and soil properties, adapting to reduce the pressure of resources and economic burden. This kind of objective appearance not only coincides with the construction concept of low-tech residential buildings, but also responds to the objective requirements of current ecological development and the strategic practice of rural revitalization.

2. Low-tech in the design and construction of rural residential buildings

| Low-tech | High Technology | Traditional Technology | Local Technology | Modern Technology | Ecological Technology |
|----------|----------------|------------------------|------------------|------------------|----------------------|
| Range of application | Traditional architecture (majority) | Modern architecture (minority) | Traditional architecture | Traditional architecture (majority) | Modern architecture |
| Economic cost | Low | High | Low | Low | Both high and low |
| Regional characteristics | Obvious | Not obvious | Obvious | Obvious | Not obvious |
| Material selection | Mainly raw soil materials | High-end modern materials | Mainly local materials | Mainly local materials | More extensive |
| Degree of difficulty | Easy | Difficult | Both easy and difficult | Easy | Both easy and difficult |

Figure 1. Comparison of low-tech and related technology concepts
With the rapid development of the world economy after the industrial revolution, "high technology" emerges at the historic moment, which is manifested in the pursuit of new technologies, new materials, new processes and new methods that keep pace with the times. Corresponding to the concept of "high technology", "low-tech" refers to the traditional methods, skills and experience, which is relative to the existence of high technology, coming from people's daily life behaviors and habits. It is a kind of technological skill formed in the process of people's understanding, transformation and utilization of nature, which is also the intelligent achievement of architects as direct participants. (As shown in Fig. 1)

At present, the rural low-tech residential architecture mainly refers to the residential architecture form built with local materials, folk techniques and rural technologies, ranging from site selections, designs, constructions, technologies to decoration styles, solving local problems through natural and simple local methods, which also aims at the whole design and construction process of rural residential buildings. On the basis of fully respecting the local natural resources, human feelings and historical environment, combining with the existing materials and technical conditions, reasonably selecting the local materials and technological means, optimizing the rural construction techniques, scientifically respecting and retaining the construction methods and craftsman methods of traditional residential buildings, cultivating the aesthetic value of low-technology development according to local conditions, solving the problems faced by the architectural design of the rural residential buildings, and achieving the aesthetic values and expected goals with lower technical cost.

3. The category of low-tech in rural residential building design

3.1. As a low-tech with material representation

In the construction practice of rural residential buildings, the application of practical materiality and low-tech is common. According to the local materials used in the construction of residential buildings, they can be divided into log technology, bamboo technology, brick and tile technology, rammed earth technology, etc; According to the building structure types of residential buildings, it can be divided into wood mortise and tenon technology, bamboo and wood arrangement structure technology, brick and wood structure technology, brick and tile structure technology, etc; According to the types of folk architecture construction craftsmen, they can be divided into bricklayers, carpenters, bamboo weavers, color painters, stone carvers, etc; In addition to the classification of these obvious features, the local construction technology, indigenous craftsman methods, local materials reprocessing technology, special traditional technology involved in the construction process of residential buildings can all be included in the category of low-tech rural architecture. Through the integration of these low technologies with material representations, the original shape and style of rural residential architecture is finally formed.

3.2. Low-tech as construction process and concept

In the construction of rural residential buildings, the methods and types of native building technology are combined with the adaptability of residential building functions. The construction procedure of the indigenous artisan method is adapted to the level of construction in rural areas. The local material reprocessing technology adapts to the construction ability of rural residents' production or life style, and the special traditional craft adapts to the historical and cultural environment of the countryside. In a word, the construction technology suitable for rural natural ecology also includes the technology of site selection, layout and combination, management and decoration, etc. Compared with the low technology of actual material representation, these are more abstract, which are a kind of Taoist natural indigenous design concept, reflecting the overall technical level of low technology construction of rural residential buildings.
3.3. Low-tech as traditional experience and habit
The development of most rural residential buildings has gone through thousands of years, and has accumulated traditional experience and ideas under the specific production and life style. For example, the experience of folk culture, oral or recorded crafts, regional customs and habits, unique technology, etc. passing down from generation to generation. Compared with the former two categories, it is more natural, original and local, and has more specific regional consciousness and local emotion. The rural builders play the mission of inheriting low-tech in the development of residential buildings.

4. The design and construction path of the current rural low-tech residential buildings
At present, the design and construction of rural low-tech residential buildings have the factors of relevance, naturalness, aboriginality, regionalism and development, which can be realized in three aspects: spatial form, local materials and exclusive technology. The details are as follows:

4.1. Low-tech in the spatial form
Traditional residential buildings stress the integration of Taoism, nature and human beings, emphasizing leaning against mountains and rivers, and following the rules of nature, containing the profound low technology and green design concept at the same time. The low technology in the form of residential space is actually to keep the integration of natural resources and traditional culture consistent, and the spatial environment pattern of residential buildings is used for construction to form the spatial effect of ecological energy conservation, making rational use of the natural energy endowed by the nature, and valuing the natural attributes of the nature in order to achieve the comprehensive goal of improving human comfort and reducing energy consumption.

For example, the inner patio of residential buildings in southern Anhui has dual functions of lighting and ventilation; Beijing quadrangle courtyard is also a model of low technology and energy conservation in the traditional residential construction. Its unique spatial form allows residents to protect themselves from wind in spring and receive cool southeast wind in summer. The sky is high and cool in autumn, and you can enjoy plenty of sunshine in winter (as shown in Fig. 2).

![Figure 2. Beijing quadrangle courtyard](image1)

![Figure 3. Recycled bricks in earthquake stricken areas of Sichuan Province](image2)

4.2. Low-tech in material selection
In the current design and construction practice of rural low-tech residential buildings, the complementary relationship between economic efficiency and ecological environment should be fully considered, not only emphasizing the energy conservation of buildings, but also paying attention to the selection of building materials. High-tech building materials in batches are not conducive to the inheritance of rural style. However, the creative use of local raw materials and recyclable materials, focusing on the use of basic materials such as adobe, natural stone, bamboo, log and so on, is not only conducive to the realization of rural raw soil construction, but also conducive to the development of low technology construction of residential buildings. Through the selective use of low-tech building materials, it can not only make the residential buildings and the rural environments live harmoniously,
but also has important significance for ecological protection, low-carbon economy and sustainable development of the rural environment.

The scientific rural ecological construction concept is to reduce production resources and improve the quality of rural residents' living environment through low-tech construction. At present, most architects have such a concept, thinking about innovation while trying to use low-tech way to promote and apply. For example, a large amount of debris left by the Wenchuan earthquake could not be disposed of, and new construction materials were expensive and difficult to transport, and Liu Jiakun, an expert in design practice, proposed "recycled brick": The construction waste in the ruins was used as the aggregate, and the cut wheat straw was used as the fibrous tissue, then cement and fine sand were added for the mixed production, and finally produced low-tech materials for the reconstruction of the disaster area(as shown in Fig.3).

4.3. Low-tech of exclusive technology for rural residential buildings

The rural residential buildings usually contain various forms of low-tech construction technology wisdom. The key of the low-tech is the traditional craft, which is also an important part of the cultural heritage protection. The rural residential buildings have their different regional characteristics and cultural symbols. It is a necessary means for the low-tech construction to protect and inherit these traditional crafts. From the perspective of architecture, the original architecture is the integration of rural regional culture and natural environment, so as to form the exclusive characteristics of residential buildings, which is not only the heritage of different cultural carriers, but also the carrier of particularity and heterogeneity among the villages.

The unique technology of rural residential buildings can not only highlight the appearance of the village, but also provide some practical design ideas for the designers. Therefore, the designer should use the historical perspective to enhance the low-tech aesthetic of the local technology, so as to explore the design value of the low-tech rural residential buildings, revising the one-sided technical concept in the current rural residential buildings, following the essence of traditional construction technology, and discarding the rough and extract the fine, and being able to continuously promote the optimization and improvement of low-tech technology, so that the traditional low-tech technology can keep pace with the times and shine brilliantly.

5. Conclusion

With the help of the concept of low-tech design and construction, this paper combines the construction path of rural residential buildings for the integrated thinking. At present, it is urgent to inherit and protect the low-tech construction technology of rural residential buildings, and to practice, utilize and innovate it. We should realize that the appropriate low-tech orientation is the basic way to realize the current rural residential architectural design and create the "poetic dwelling". It is urgent to carry out the inheritance and application of the traditional construction technology on the premise of economic efficiency, following the ecological mechanism and the green concept.

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