



## Exploration of application of local materials to traditional houses in South Shaanxi

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### ABSTRACT

*This paper at first analysed basic characteristics of local materials and pointed out their shortcomings and improvements in traditional houses in South Shaanxi. Combined with the present condition of new rural construction in this region, the paper deeply explores the concept of “depending on the flow of Universe” to get a new understanding of rural construction and employed materials. Afterwards it emphasized that it is necessary to make an improvement of local materials based on the analysis of the present situation of application of local materials to building traditional houses. It advocated the functional promotion of local materials and the active exploration of new strategies and approaches adopted in the construction.*

**Key words:** Vernacular architecture; traditional houses; new rural area

### INTRODUCTION

#### 1. In South Shaanxi native materials specific applications

##### 1.1 Roof and roof trusses

In South Shaanxi residential area due to the rainy climate characteristics, mainly in the form of a roof sloping roof based. The laying of the tiles on the roof from the local stone, it is not only cost savings, but also highlighting the regional characteristic. Roof covered with tiles, as well as the roof of the white floral. Between the expanse and the tiles in shades of black and white ash, as if there is no sense of rammed earth construction too heavy, just feel delicate and sophisticated[3][5]. In South Shaanxi forms of residential building construction in general, similar to chuan dou-style wooden frame as a weighing frame, filled with clay walls, playing the role of the envelope and shelter.

##### 1.2 Wall

In South Shaanxi houses mostly wooden structures bearing system, the wall just to play the role and maintain internal and external space separating the role of the wall is generally based on a different position to select the appropriate structure approach. Building below the surface in the mountains above the rammed earth structure for chuan dou structure[1][2], during which bone walls with wood as the maintenance of the structure. Behind all for rammed earth structure, few windows, load beams in part to the load-bearing rammed earth walls.

##### 1.3 Stairs and flooring

In South Shaanxi region rich in stone, so much as to make the best residential buildings. In addition to the steps, street paving, patio yard also with quartzite bedding. Even the base part of the wall is also more pebbles assembled, usually someone front shop law as well as tiled law. And at the corner flat with quartzite puzzle, for one thing, it can make the corner of the flat, for another, it can prevent pebbles to skidding[4] [8].

#### 2. Advantages and disadvantages of native materials and In South Shaanxi Improvement

In South Shaanxi region material variety and easily obtained, with good economic performance. Houses built using local materials not only has good ecological performance, and ease of maintenance. Thus, the local residential

construction material has long been widely used in building materials. Whether it is from the perspective of sustainable building, or from the perspective of economic energy, local materials have good prospects for development.

**2.1 Advantage of local materials**

In South Shaanxi superiority mainly local materials can be recycled in several application areas, ecological, economic, geographical features, ect. (Form1)

**Form1. Advantage of local building materials**

Advantage of local building materials	Specific features
Recyclability	Rammed earth walls can be reused, no special treatment
Ecological	Warm in winter and cool in summer, the stone material, loess is burning
Economy	Material of low cost, simple construction techniques, repair techniques require low
Geographical features	Vernacular architecture can show strong features

**2.2 inadequate and improvements (Form1)**

**2.2.1 Poor structural stability**

Civil structure built on stability fatally flawed, the main reason is weak in tension, shear and flexural capacity aspects. However, in the Wenchuan earthquake, one of the hardest hit in South Shaanxi Shaaxin, there are some buildings can stand the test, we can see that as long as the rational design of civil structures, in terms of stability can be improved [7].

**2.2.2 Poor durability**

Because of vernacular architecture mostly local materials, the most commonly used materials are wood. Most of the building wall structure for rammed earth walls. [3] Civil architecture primarily as a load-bearing wood components (roof trusses, purlins, Columns, rafters), on the one hand, it is lack of anti-corrosion, moisture, insects and other measures of treatment [6], on the other hand, plus roof (tile, quartzite) heavier loads, thereby greatly increased the burden on the structure itself.

**2.2.3 The lack of construction techniques**

A big impact on the traditional architecture of modern architecture from "thousands of village side" form can be seen. Coupled with traditional crafts are in the social status of the master pass apprentice [9]. Such as the spread of vernacular architecture in the cold tile laying way, rammed earth wall compaction technology, as well as traditional timber frame architecture techniques such as overlapping between the fracture appeared on the skills heritage.

Form2 The lack of vernacular architecture improvement measures

Lack of vernacular architecture	Improvements
Structural stability	Reducing roof load (light watt), Window and door openings increased reinforcement measures, using sticky soil or join a strong adhesive (starch, etc)
Durability	Increased wood preservative (anti-corrosion paint), protective measures (fire layer)
Craft heritage issues	Changes in social attitudes, improve the social status and income artisans, advocated the building of regional architecture

**3. "New Applications" In South Shaanxi Local Materials**

**3.1 Reinforced rammed earth walls**

This bamboo walls have a special structure practice: first, set up the column between the wall separating wall segments, in each set within the first horizontal bamboo, then, set the vertical bamboo strips to form a grid-like, and, on the bamboo walls compiled into compacted soil covering, finally, wipe the outer surface of the mud, when wiping the mud and other semi lime (Figure1) [2]. This wall hard, simple structure, fast construction and pollution, good ventilation, especially for in South Shaanxi humid climate.

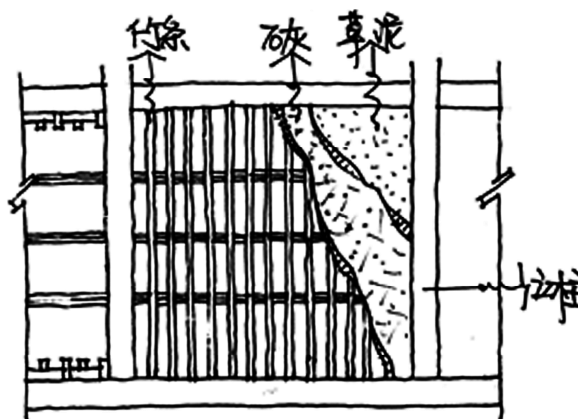


Figure 1 Rammed earth wall

**3.2 The new compound wall**

In South Shaanxi areas of traditional rammed earth walls, adobe walls were systematic improvement and technology optimization, using a new type of ecological composite wall, na

mely concrete ribbed with a combination of new adobe mud wall(Figure2).

This wall significantly improve the seismic performance of the wall,and insulation,insulation and other aspects are better than a brick wall[4].



Figure2. The process of ecological composite wall

### CONCLUSION

Under the new rural construction and relocation of in South Shaanxi background,in order to better the cultural essence of traditional houses of in South Shaanxi heritage and chieve sustainable development of new rural construction,the need for new rural construction proper guidance:ecologically sustainable construction as a basic principle,to encourage the use of renewable energy and energy efficiency technologies in construction[10].At the same time,actively promote the construction of new rural in South Shaanxi appropriate technology,and strive to create a better living environment.In the new rural construction in encouraging the use of low-power local materials,give full play to its advantages,thereby reducing costs.Therefore,in the in South Shaanxi massive relocation and new rural construction,postive selection of native masterials are the most rational choice,should draw traditional residential buildings ecological concepts,follow the principle of appropriate technology,and actively explore and promote the local material in Shaanxi in South Shaanxi rural construction applications.

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