

The Design Study about Using of Natural Resources and Dealing with Environment of the Traditional Settlements

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Abstract: Through field investigations on Yifukou village and Gaojiatai village in North slate area, the paper probes into the residential construction site layout, construction materials and the spatial organization on the environment and use of natural resources to deal with the mode and method of villages in this area. It sums up the characteristics of residential construction, which are of comprehensive utilization of natural resources and initiative confrontation with the environment, with a view on the level of the utilization of resources and environmental confrontation to explore the point.

Keywords: Shibanyan Residents; Traditional Settlements; Nature resources; Deal with environment

1. Introduction

Environment from the narrow sense refers to a certain area the surface morphology, climate, hydrology, vegetation and animal community integration of specific material elements such as system, and the architectural design is attached to this environment system resources integration and active coping process. Attaches great importance to the regional resource utilization and environment coped in the process of design will greatly enhance the value of buildings and influence. Shibanyan residences or named stone room, which are famous for the wall and roof named by the local rich red Shibanyan building, is a unique building type of north China. They are mainly distributed in Linzhou city that is famous for digging artificial Tianhe -- the red flag canal throughout all the country, and Shibanyan settlements are basically a namesake kin with primitive simplicity and amorous feelings. After years of accumulation of experience, Shibanyan area people create the comfortable life environment based on the specific geographic resources and local climate conditions and without artificial temperature control equipment, particularly obvious effects in the use of natural resources and dealing with environment and rich in experience. Gaojiatai and Yifukou are two typical villages of those.

2. Gaojiatai and Yifukou Village

2.1. Gaojiatai Village

Gaojiatai village is located in Shibanyan township town 9 km to the south, backed by Linhu mountain and faced to dew river, and the village is small scale with about 30 families, but its residential morphology and internal and external space is very rich. Village is built up to the

mountain and divided three mesa back layer upon layer, each type according to terrain arrange their house. Although the topography narrow zone, fold rock strewn at random. Each compound can absorb enough sunshine, with flowers and vegetables planted behind the house, and making full use of the courtyard space, which form the local residential distinct characteristics.



Figure 1. The plane layout and aerial view of the Gaojiatai village

2.2. Yifukou Village

Yifukou village is located in Shibanyan township town 2 km to the north, which has castle peak green water and beautiful natural environment. The Shibanyan is larger villages in this area with about more than 50 stone house. The Village, which leans on steep the hills in the north and with the open fields in front, is bounded by CangXi in the south and its water flow into the Dew river. Similar to Gaojiatai village, Yifukou village layout is also depending on the cascade mountains and along the hillside is divided into four levels. Some line and some synthetic courtyard, around the courtyard are mainly concentrated in the second and third level. Although Arrangement of intensive seems to be crowded, due to large elevation difference in before and after, and strewn at random have send, so the each other families are not keep out sunshine and ventilates well.



Figure 2. The plane layout and aerial view of the Yifukou village

3. Deal with the Natural Environment

Shibanyan is located in the warm continental monsoon climate zone with sufficient sunlight and four seasons has clear distinction. There is less windy more rain in spring, heat in summer and rainfall concentrated, uneven drought and flood in autumn, dry and cold in winter. Annual average temperature is of 13°C and annual average rainfall is of 670 mm with frost-free period is 180 days. This unique mountain climate is not only affecting the local people’s livelihood and customs, but also directly reflects in the local residential village site selection, plane layout, space organization and materials of construction.

3.1. Village Location

Shibanyan local-style dwelling houses village location, which is based on the mountain, faces to water and back to mountain and hides the wind to get together gas. Taking Yifukou village for example, it can “Vigorous, Sodium gas, Hidden gas” and blocks the cold north wind in winter for residents fundamentally. With facing to water and toward the south, it can not only embrace the sun, but also can quickly “bound water and check”, which can solve the orientation and water problems of all residents families fundamentally, thus the big living environment with warm in winter and cool in summer is forming naturally (figure 3). Largely it’s in line with the traditional Geomantic theory to the requirement of villages in the external environment, namely “back to main dragon vein living main mountain, and sand hills lie in left and right side” (figure 4)^①. They pay attention to the location of the village environment and gestate with vitality for the whole village environment. Therefore, no matter Yifukou or Gaojiatai village around all is vegetation prosperity with clean water and good ecology.



Figure 3. The schematic diagram of village ecological environment

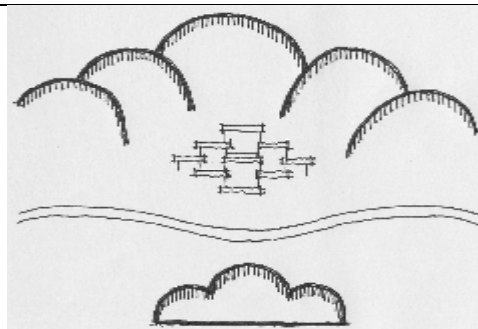


Figure 4. The best location chart of village

3.2. The Plane Layout

The plane layout has three mainly types including “one light two dark one room”, “one vertical two horizontal three-section compound”, and “two vertical two horizontal four-section compound” (figure 5). “One vertical two horizontal three-section compound” is more reserved among all the plane layout types and its form is compact. The basic form mainly are introverted square, and the elements such as the main rooms, the secondary rooms, the doors and walls form the closed inner court around the square. The main rooms are more three or five studio with the size in 8~12 m length and 4~5.5 m deep. the hall of surrounding the inner court and the secondary rooms are more two layers high in commonly 7 to 8 m, and the former is slightly higher than the later. The combination between unit and unit is formed by the terrain elevation difference.

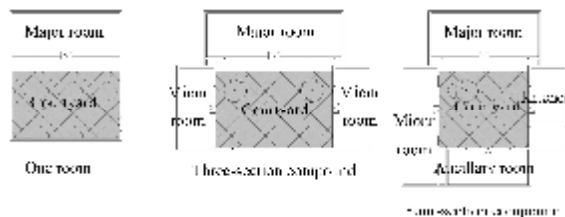


Figure 5. The schematic diagram of three plane layout

Shibanyan dwellings on the plane to deal with the environment is the key to has a courtyard, and the value of the courtyard is green. The “warm in winter and cool in summer” effect of the local-style dwelling houses building is closely connected with the courtyard greening trees. The sun was blocked out by branches and leaves of the trees in summer, which makes the house and courtyard within dancing shadows. The leaves fall in Autumn and winter, and warmed sunshine in winter exposures to the rooms through the clearance of the branches (figure 6). The courtyard as the center of the building forms small environment in building internal to make the transition of indoor space and outdoor space. The ecological system in harmonious coexistence constituted by courtyard and trees is the most crucial. The ecological complex of local

people and approaches to dealing with the environment provide us a new perspective in the problem of protection and renovation of old residences.



Figure 6. The courtyard in four seasons

3.3. Spatial Organization

Shibanyan township local-style dwelling houses village usually have square space and street space, resident's door side space and courtyard space into the village. They are different from the primary and secondary and have distinct levels. As the public space of the village, entrance square space is used for the weddings and funerals and other things of the whole village. However, the courtyard space for individual owned is a private internal space. The door side space with "flexible boundary" belongs to the fuzzy space, which can tend to be more attractive to the activities of the village people. Jan Gehl, the Danish scholar, has explained the concept of "flexible boundary" in the book "exchanges and space", namely "The area that setting up a transitional interface between the private internal space and the public external space is neither a completely private nor completely public transition region. They often can have the effect of handing down connection, which make the residents and activities feel more easy on physical and psychological in the private and public space"②. Such as a household door side space of Gaojiatai village space is accord with the properties of the flexible boundary with a semi-public fuzziness. Therefore, the spontaneous activity in the village are mainly concentrated in here (figure 7).



Figure 7. The plane entrance by the stream

In addition, these different sizes of space are also natural ventilation channels of the organization of villages and residential interior besides their respective functions. In summer, the temperature of the village is slightly higher than the surrounding environment due to the heat storage effect of the building house, and then the temperature in

the evening of the desert is cold quickly so that the temperature is lower, and the hot air in the village because of the light proportion will rise rapidly at the same time, the cold air of mountain villages and fields and rivers around timely supplemented forms a good street corner wind with very cool and wet though large and small distinct space. Therefore, walking in the village make people feel cool wind blow gently and relaxing in the summer night. The heat waves brought by the mountain spring water of the villages radiate to the surrounding slowly in winter, merging and cycling with the temperature of the village, as to rise the temperature (figure 8). The good effect of this natural air conditioning using the principle of climate formation is the result that Shibanyan residential space deals with the local specific environment.

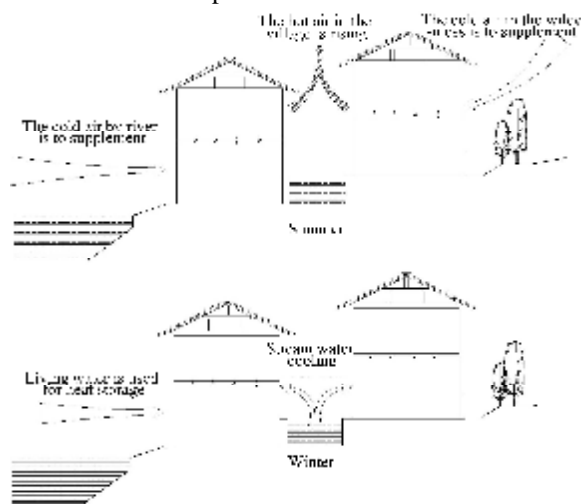


Figure 8. The schematic diagram of air circulation

3.4. Material Structure

Local people participate in building with neighbors in person. Traditional and modern ways of constructing are broadly similar and slightly different. Traditional way is that the external wall is made with 500 mm thick limestone and clay masonry, and roof slope is relatively slow with slab break covered, which is used to dry grain and corn. Wooden beams bearing interior between the rafters and tablets is a combination layer which is called "target" by the local people, it is formed by woven valley and mud mixture to prevent rainwater infiltration as well as the role of fixed roof slabs (figure 9). Modern building external brick in the wall with stone mixed cement mortar masonry is three house high and three of the house is half layer with the top 2 m or so. Although roof slope is also relatively slow with slab break covered, the slope is bigger. The practice of traditional and modern commonness is choose by the local rich in stone as the main material, and the material thermal resistance and thermal inertia is big, which increases the palisade structure damping used as the role of heat and reduces the inner

surface temperature of the retaining structure, it is good for heat preservation and heat insulation. Especially with SLATE tile, they are still widely used in the situation that the tile is convenient to delivery and the cost is lower than the SLATE in the recent. In addition to people's psychological habits and aesthetic temperament and interest, there is another important reason that the wind is very serious, easily blown away, and less stability than tablets. The change of the roof slope is the primary difference between ancient and modern building, which is due to the improvement of productivity, and cereal grain dries can be solved easily in the ground. Top half layer as a warehouse is used to hold the increasing food production, and set the vents on both sides of the gable as a heat insulation layer. Using the principle of wind pressure and hot pressing to make the thermal insulation layer inside air flow is in order to take away most of the radiant heat and reduce the incoming indoor quantity of heat.

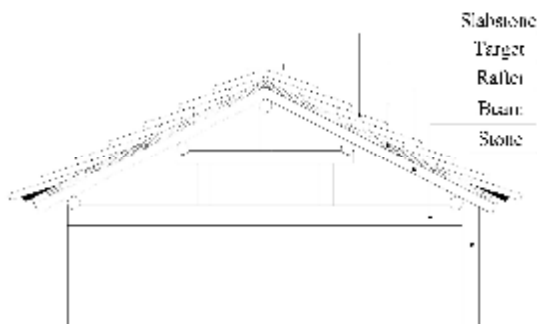


Figure 9. The practice of roof construction

4. Use of Natural Resources

The existence and continuing of the Shibanyan local-style dwelling houses is inseparable with its specific natural environment. We can see some methods and characteristics on the use of natural resources from the stone rooms of Gaojiatai and Yifukou village.

4.1. The Efficient use of Land Resources

The village is built along the mountain and monomer is placed with hill potential that all keep the thought of "heavy soil light house", using the terrain and doing the best of its condition. Such as the local building named Shiweilai in Yifukou village (figure 10), founded in 1983, belongs to the newly-built houses in the village. It is before the main roads in the village with east-west arrangement and facing the south, which take advantage of base and road elevation difference and the underlying as shops is to serve the growing tourism industry. The door is put on the top of the shops through ramps and steps, and the middle blank forms compound, and then the main room is turned back to the mountain. Thus it has solved three types of functional requirements including take-out,

the leisure and living within the very hasty land originally, and the process is very simple and practical.

In addition, the surface runoff of the mountain is truncated by the wall of stone house, which reinforces the mountain to avoid the water loss and soil erosion and increases the possibility of grass and tree seeds stayed. Such as a house beside the Gaojiatai village is still intact although after years, and forms a specific landscape resources in the village (figure 11).



Figure 10. The plane and rendering of Shiweilai



Figure 11. The old house beside the Gaojiatai village

That the man-made surface patterns changing promotes the benign development of the ecological environment, and it is a win-win strategy for land resources and human development.

4.2. For the Comprehensive Utilization of Water Resources

Water as a basic element of human survival has always been priority factors in the traditional architecture environment. Water is also put in a very high position in Geomantic theory in our country. Gaojiatai village especially pays attention to the water with back to Linlv mountain and Dew river to the south, and there are two mountain spring flowing in the village with the image of "The running water across from the village, and people are living by the water" presented in the whole village. Two streams of water is for village residents to drink, and no matter the rain or the sewage in the village can be taken away by dew river, which is a very good ways to solve the problem about the feed water and drainage in the village. And local water system mainly comes from the mountain spring and groundwater, the water temperature is warm in winter and cool in summer. The flowing river takes plenty of hot and dry because of evaporation to absorb heat surroundings in the hot summer. Dew river before the village is located in summer air inlet and go by the warm and cool breeze of the water in the river, which

makes the cooling effect more apparent. The two channels with the natural season changed is also one of the key factors of warm in winter and cool in summer of Gaojiatai village.

4.3. The Reasonable use of Regional Materials

Shibanyan local-style dwelling houses are doing in stone as wall, slab as tile, wood beam bearing, and “target” made up with valley and soil as the combination layer of slabs and beams. The mainly materials used in building that are taken straightly in the local is slab, valley and wood, which can be respectively divided into natural material, renewable materials and recycled materials according to their attributes. The local stone is used widely because of it’s material is uniform with high intensity physical properties and structural stability and the source is adequate. “Target” with the main components named Valley is woven with seasonal planting millet harvest after dried via air in the local and it is renewable, which has also been a moderate amount of applications in building. And although the wood in the local does not lack, it is less that can meet the requirements of building bearing, so the wooden beams taken down from old house are also used to a new home construction after renovation when building, and this is a kind of the recycle use of scarce materials. Therefore, it is fully embodied the wisdom of their choice on the using of residence materials among the people in Shibanyan.

5. Conclusion

Although Shibanyan residences have a variety of forms in the use of natural resources and dealing with environment, we have found that they follow some common rules by the typical analysis of Gaojiatai and Yifukou village, which can be summed up in the two following points:

5.1. The Integration of Resources Utilization

For example, Gaojiatai village has also absorbed the most abundant mineral resources called the red SLATE in the process of maximizing the use of site, and makes it into the main material of the local dwellings. At the same time, the organic integration of the villages surrounding mountain, water, terrain, plants and water system eventually forms “intelligent buildings” with the unique style and the use of local material ingeniously, which extremely has local characteristics. From the perspective of resources utilization, the process of the local village construction is that the village resources are excavated, integrated, regrouped and make the value maximizing in their village area scope. Integration refers to a village or site having a variety of natural resources, and each of these resources have different effect on the development of the village, but it doesn't mean that every resource plays the guide role on the development of the

village and it is several resources through the integration to guide the development of the village frequently. The integrating design of natural resources elements is not only the basic requirements in adhering sustainable development, but also gives the architecture and groups more stronger expression.

5.2. Active Response to Natural Environment

The each factor of Shibanyan residences in the process of development is not only a passive and negative improvement, but also is the creative process with positive and initiative. This kind of its response to environment are all reflected on the location, orientation, plane layout, space combination and in either Gaojiatai or Yifukou village. For example, the location using the concept of Geomantic theory pays attention to the relationship of the elements between natural environment and artificial environment, and the place with “the mountains and water around, full of vitality” is ideal. The courtyard effect is attached great importance in the plane layout to improve the small living environment. The effect of group optimization is focus in space combination to form good advantage of ventilation roadway. The material chosen selection has the heat preservation and heat insulation, which is full of local characteristics, and the SLATE on-site exploited makes into contact between the buildings and the base with the growing imagery. Consequently, it is a process of responding to the environment, learning from the strong points to offset the weakness and constantly creating when people in Shibanyan build their own living patterns.

The comprehensive resources utilization and responding to the local environment of Shibanyan residences reach to high unification of production, life and ecology, which has formed the good ecological system. Some of them may be usual practice experience, and we all have been accustomed to. But by careful analysis, the methods that organically bring the resources and the environment into in the planning and design are worthy of us to reflect and study seriously. Design combined with resources and dealing with environment can help us get out of the wrong region in the residential “inheritance and development”, and no longer tangle in “technique and principle”. In terms of design, it is improve to find a more effective place to start. We need to realize the architectural design is not only a design of physical form, but it is also for the integration of resources and dealing with environment and the return of the ontology of architecture.

6. Acknowledgement

Fund program:the key research project of the Education Department in Henan province in 2014 year(2014-ZD-031)

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