

## The Engineering Land Reclamation Mode of Row Cave Dwelling in Shaanxi

Lu Zhang<sup>1,2,3,4, a</sup>

<sup>1</sup>Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710075 China;

<sup>2</sup>Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710075 China;

<sup>3</sup>Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources of the People's Republic of China, Xi'an 710075 China;

<sup>4</sup>Shaanxi Provincial Land Consolidation Engineering Technology Research Center, Xi'an 710075 China

<sup>a</sup>luluqiaofeng@126.com

### Abstract

The study about utilization planning of hollow village land reclamation from the row cave dwelling reclamation technology in Yaozhou area, Tongchuan, Shaanxi, which provided the scientific reference improve the land utilization of idle homestead in our country. Through these engineering patterns of excavating the row cave dwelling, land leveling, terrace layout, field roads, irrigation drainage, water withdrawal system construction and cultural relics protection in project area, which were used as utilization planning of row cave dwelling engineering reclamation mode. This unique formation of row cave dwelling remediation technology is significance to strengthen the construction of high-standard farmland, improve the regional ecological environment, and accelerate the adjustment and optimization of rural economic structure.

### Keywords

Hollow village; Row cave dwelling; Land reclamation; Utilization planning.

### 1. Introduction

With the acceleration of social development, the rural population went out to work, the population was "hollowized", the old villages were abandoned and not demolished, and the homestead was "hollowized". A large number of rural areas in China gradually evolved into "hollow villages" or "abandoned villages"<sup>[1-5]</sup>. Therefore, studying the "hollow village" remediation technology is of great significance in effectively solving the problem of idle housing sites in rural areas, alleviating the pressure on land demand in China, improving land utilization and promoting new rural construction. The countries that carried out land consolidation work earlier in the country were France and Germany<sup>[6]</sup>. Since 1705, France has promulgated and revised the Land Consolidation Law. The land use and ecological environment have undergone profound changes and achieved good results. Economic, social and ecological benefits<sup>[7]</sup>. In the early 1970s, South Korea listed rural development as a national development strategy and launched the "New Rural Movement"<sup>[8]</sup>. Japan implemented unified planning for villages and rehabilitated residential land, with remarkable results<sup>[9]</sup>. Germany proposes that "life in rural areas does not mean that it can lower the quality of life" and "the urban and rural equivalence" concept of "different from urban life but equivalent"<sup>[10]</sup>, and has become the direction of EU rural policy since 1990.<sup>[11]</sup> In order to expand reproduction, Russia uses the latest achievements of relevant disciplines to improve land yields – building density and floor area ratio, and reduce land occupation rate<sup>[12-13]</sup>. The successful cases and experiences abroad have provided reference and reference for the rectification of China's "hollow village". The state has repeatedly issued relevant policies to promote the effective rectification of "hollow villages". In October 2004,

the State Council issued the “Strict Land for Deepening Reform”. The Decision on Management (Guo Fa [2004] No. 28) proposes a policy linking urban construction land increase with rural construction land reduction, strictly controlling construction land increment, revitalizing land stock, and strengthening land conservation and utilization. October 2008 The Decision of the Third Plenary Session of the 17th Central Committee on Promoting Some Major Issues in Rural Reform and Development proposes to regulate the reform of rural land management system, carry out the consolidation of rural housing sites and villages, and gradually establish a unified urban and rural construction land market<sup>[14-19]</sup>.

The “hollow village” has various types of remediation. In the case of Shaanxi Province, it is divided into five types of abandoned residential sites: pit kiln, aboveground kiln, kiln, adobe house and mixed type. This article is based on Xiaoqiu Town, Yaozhou District, Tongchuan City. The renovation of the village kiln project is an example to illustrate its remediation technology and planning and utilization issues.

## 2. Hollow village remediation target

For a long time, the construction of rural housing sites in China is basically in a spontaneous state, lacking effective restraint, supervision and management mechanisms. The layout is scattered, the land is chaotic, and the environment is poor. It is a prominent feature of the current rural homestead. With the rapid improvement of the level of urbanization and industrialization, the rural economy has continued to grow, and the number of farmers building houses has increased. Many peasants abandoned the old houses in the village and built new houses on the side of the village or on the roadside. They often built new houses on the periphery of the village. The old houses in the village were idle and ruined, forming a so-called “hollow village”<sup>[20]</sup>, which caused serious Land waste, which affects the living environment of farmers and the development of rural economy and society, has become an important obstacle to building a harmonious society in the construction of a new socialist countryside. In accordance with the four principles of planning, guiding, clearing the direction, adapting to local conditions, classifying guidance, intensive land, optimizing utilization, people-oriented, and perfecting the protection, the elements of remediation of “Hollow Village” are as follows:

First, improve land utilization. The land occupied by abandoned old residential land in rural areas can not be ploughed or lived, resulting in great waste of land resources, which further intensifies the contradiction between people and land. Therefore, improving land utilization rate is the primary goal of the renovation of “hollow village”.

Second, improve the living environment and the personal safety of residents. In some rural old homesteads, the broken kiln rotten houses are on the verge of collapsing, directly threatening the normal life production of the masses, improving this situation, and making the renovation of the “hollow village” a practical significance.

Third, develop rural civilization. Due to uninhabited abandoned houses in rural old residential sites, many villagers used old houses for captive livestock, which caused the sanitation of the village to be “dirty, chaotic and poor”, seriously affecting the living environment and physical and mental health of these residents. The construction of rural civilization is inseparable from the effective rectification of “hollow villages”.

Fourth, regulate rural management. According to the Land Administration Law of the People's Republic of China, rural housing sites must be retired, but in reality, due to the loose and chaotic rural land management, the land occupation of the homestead is extensively planned, and the farmers still occupy the new homestead while occupying the land. The original homestead piles up debris for livestock raising. The rectification of the “hollow village” will help regulate rural management and promote the reform of the management system.

Fifth, build rural infrastructure. The existence of old residential land in rural areas makes the peasants' residences scattered and scattered. The distribution area of rural villages is too large, and the extension

of villages is too long, which makes it more difficult for rural areas to carry out unified construction of water, electricity, roads, communications, public facilities and other infrastructure. It has greatly affected the further development of rural economy and society. The renovation of “Hollow Village” is not only the rectification of land, but also the construction of rural infrastructure, enriching life and improving production.

Sixth, protect assets. At present, the rights of the state and rural collectives after the transfer of rural housing sites are not reflected. The rural housing estate transactions are mostly “black-box” operations and are arbitrarily priced. This illegal collective land transfer needs to be properly rectified in the “hollow village”. The rights and interests of the transferee are guaranteed, and the rural collective or national land assets are effectively protected.

In summary, under the current situation of a large reduction in cultivated land and a high voice in the construction of a conservation-oriented society, it is imperative to save land and use land rationally. The renovation of “Hollow Village” has attracted wide attention.

### 3. Project implementation and design

#### 3.1 Project site selection and kiln characteristics

The project area is located in the village of Xiaoqiu Town, Yaozhou District, Tongchuan City, Shaanxi Province. The abandoned homestead in this area has many kiln kiln. The location of the kiln is special. It is built on the soil of the stepped north Shaanxi Loess Plateau. The excavation of the cave dwelling, built on the mountain, is a unique residential form on the Loess Plateau in northern Shaanxi. According to the unique characteristics of the kiln kiln, the loess layer is thicker. The characteristics of the loess are used. According to the slope, the horizontal hole is drilled in the natural soil wall, and the kiln cave is built by digging the cave. Interphase, several holes are connected, the upper tiles are connected, and the caves are arranged continuously. Because the construction of the kiln is built according to the topography of the local Loess Plateau, the orientation of the kiln is also along with the cliffs. The shape is unique and the style is unique. Figure 1 shows a typical kiln real map.



Fig. 1 Rowing kiln landscape map

The kiln has its unique topography and topography, and the terrain is undulating. The elevation between the design fields is different, and the slope of the channels and roads is large. The waste kiln land will be mainly occupied by residential areas. The surrounding area is intersected with villagers' villages and farmland. The boundary of the project area is irregular. In order to prevent the loss of land and water resources, it is not appropriate to plan the exhaust kiln house site as a sloped farmland when planning. It should be adapted to local conditions, according to its unique geographical location. The field is planned to be terraced in Taitian. The terraced fields should be leveled, and the fields should be laid on the edge of the field to protect the fields.

#### 3.2 Land leveling project

According to the natural conditions and economic and technical conditions of the project area, comprehensively consider irrigation and drainage, field roads, farmland and ecological environment

projects, and formulate land leveling projects. Before leveling the abandoned kiln house site, each field will calculate the amount of excavation work, plan the moving direction of the earthwork, and maintain the balance of earthwork excavation and filling. Then equipped with appropriate construction machinery to assist in the land leveling construction of the abandoned kiln homestead. The bulldozer is layered to pile up the old homestead, the old wall and the kiln back organic loam. The bulldozer and loader are used to dismantle the old Zhuangji in the project area, and the abandoned kiln house site is excavated. In the middle, there will be a large amount of construction waste, and it must be equipped with a dump truck to assist in the construction and clean up the waste such as bricks in the old building. Finally, the bulldozer and the loader are used to evenly spread the available earthwork. The specific construction machinery model is selected according to the construction site conditions and the characteristics of the project area. Leveling the abandoned kiln house site to make the land parcel and easy to cultivate, so as to increase the effective arable land area, increase the land utilization rate and the arable land yield rate. The reclaimed construction of abandoned residential land in Xiaoqiu Town, Yaozhou District is shown in Figure 2.



Fig. 2 Reconstruction construction map of abandoned residential land in Xiaoqiu Town, Yaozhou District

### 3.3 Terrace arrangement

After the abandoned kiln house site is rectified, a flat, usable land is formed. Due to the special form of the original kiln building, when the flattened land is reclaimed, it is necessary to make a layered stepped water platform field, which cannot be sloped from top to bottom to prevent soil erosion. Maintain the water storage capacity in the terraces to facilitate farmers to cultivate crops and improve the utilization rate of the land. Horizontal terraces are stepped farmland built along the contour line on the slope. It is an effective measure to control soil erosion in sloping farmland, and the functions of water storage, soil conservation and yield increase are very significant. The horizontal terraces are built in areas with good soil quality, relatively gentle slope, convenient transportation, low position and close to water source, and are planned to be on slope farmland below  $25^\circ$ . For steep slope farmland above  $25^\circ$ , in principle, the farmland should be returned to the forest. Also grass, develop diversified operations. If there is a small amount of slope above  $25^\circ$  on a mountain or a slope, it is also possible to cultivate terraces in order to make the farmland continuous, continuous, and easy to cultivate.

- 1) Flatness. A stepped field with a level of field level and a uniform ridge on the sloped arable land along the contour line. Terraces change the terrain, slow down surface runoff, and trap water and improve the soil. In the case of irrigation, the field should maintain a ratio of 1/300 to 1/500 that is consistent with the direction of the water flow.
- 2) Leveling unit. Most of the terraces are built on slopes above  $15^\circ$ , and the area of each terraced leveling unit is controlled at 0.10~0.15hm<sup>2</sup>, and at least should not be less than 0.03 hm<sup>2</sup>.
- 3) Terraced Tiankan.

① Width of terraced fields: It should be determined according to the principle of less earthwork, less labor, less land occupation and convenient farming. The Taibei area of the northeast of the farmland with a slope of  $5^\circ$  or less is suitable for 30~50 m, and the hills and hilly slopes above  $15^\circ$  are suitable for 10~15 m. ② The slope of the terraces: 150~300 m terraces in the gentle slope area below  $5^\circ$ , and about 100 m terraces in the steep slope area above  $15^\circ$ . Do not minimize less than 20 m. ③ Height of the ridge: Considering the amount of work and stability of the ridge, the height of the ridge is generally not more than 3 m. ④ The slope of the ridge. Considering the small land occupation and the stability of the ridge, the slope of the general slope of the ridge should be 1:0.36~1:0.26.

4) Terraced rice field. After the land is consolidated into terraces, in order to prevent water and soil loss in the stepped terraces, water storage, sand prevention, and slope damage prevention, and to maintain the ecological benefits of the farmland, it is necessary to do the upper field in the marginal field of Taitian. The field is built along the contour line at an appropriate distance on the farm slope. For the parts that need to be built in the field, the soil should be reserved in advance during the land leveling process, and the construction of the field is carried out after the leveling.

① Water storage: water storage rafts on the terraced fields, 0.3~0.5 m above the surface, 0.3~0.5 m from the top, and 1:1 ratio of the inner and outer slopes. ② Plant Guards: Outside the terraced fields, sometimes you can plant some cash crops on the terraced fields. Some economic crops such as mulberry trees and peppers should be planted according to local conditions. You can also grow daylilies and drought-tolerant species. Crops can also grow grass and so on. This will form a biopery, which can not only store runoff and silt, but also gradually increase the siltation of the slope into a horizontal terrace. The surface of the field is more stable, achieving the purpose of protecting terraces and increasing the economic income of farmers.

The principle to be grasped when doing Tian Hao is: to ensure the safety and stability of the ridge, to occupy as little farmland as possible and to use less work. The shape of the ridge should be adapted to local conditions, depending on the terrain, the slope of the ground, the conditions of the machine, the nature of the soil and the degree of drought. Tiankan must be filled with raw soil, and there should be no gravel, roots, turf and other debris in the soil. When constructing, it should be layered and compacted. Each layer of soft soil is about 20 cm thick and about 15 cm thick after compaction. After each year and after each major heavy rain, it is necessary to inspect the terraced area and find that Tiankan (Tianlu) has damages such as gaps and holes, and repairs in time.

### 3.4 Field road

According to the Land Development and Consolidation Project Construction Standards of the Ministry of Land and Resources, the field road layout requirements for terraced fields are: the terraced area is arranged from the village to the field, and the width of the trunk line should not be less than 4 m, and the ratio should not exceed 15%. Where the slope of the ground exceeds 15 degrees, the road is built with the "S" coiled up, and the field road can be built with the terraced ridge. Intermediate roads are generally used, and advanced roads can be used in economically developed areas.

### 3.5 Irrigation drainage project

In the loess area where rainfall is low, water diversion is mainly used. It can be pumped up from the mountain water source. It can also be built on the top of the mountain. Using the height difference of the mountain stream, the stream is stopped at the height to the ditches that are excavated by the mountain, and the terraces are gradually irrigated. According to the amount of water coming from the slope, a certain amount of water rafts can be arranged on the inner side of the terrace to intercept the road flow and the rainwater discharged from the terraces to develop rainwater harvesting. In the Qinba mountainous area with a lot of rainfall, small storage, drainage and drainage projects should be arranged in the terraced area and outside, and the rainwater and slope runoff that can not be stored in the terraces can be used for farmland irrigation to ensure the safety of terraces.

### 3.6 Water withdrawal system

As an important part of the water circulation system, the water withdrawal system should be specially designed in the process of remediation of abandoned residential sites. It should be designed according to the relevant national standards and in accordance with the relevant design specifications, and combined with the actual conditions of the project site, to move the town of Xiaoqiu in Yaozhou District. The village land improvement project is taken as an example for illustration, and its general plan for water withdrawal is shown in Figure 3.

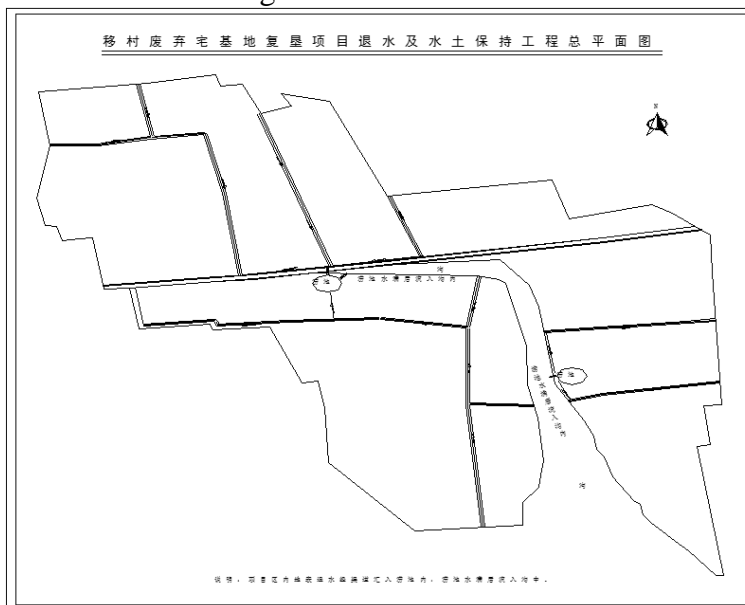


Fig. 3 General plan of the water withdrawal and soil and water conservation project of the abandoned residential land reclamation project in Xiaoqiu Town, Yaozhou

### 3.7 Cultural relic protection

While renovating the abandoned kiln house site, it is also necessary to protect some cultural relics with historical value, scientific value and artistic value. It mainly includes: buildings, ruins, monuments, etc., which are related to major historical events, revolutionary movements and important figures, with commemorative significance and historical value; ancient cultural sites with historical, artistic and scientific values. Although the transformation of the original form of kiln caves and the construction of modern rural residential houses are a development trend in the implementation of new rural construction in China, some valuable kiln buildings still need our inheritance and protection. For example, Yan'an University's kiln building was built in the 1970s. It consists of 6 rows of 200 porous caves. The rows of kiln caves are arranged in an orderly manner along the hillside. The style is unique and the atmosphere is spectacular. It is a patriotic education center. Therefore, similar to this type of building, we should take certain repairs and protection measures for special protection during the remediation process.

## 4. Engineering utilization planning

According to the special topography and geomorphology of the kiln, through the rectification of the abandoned kiln-type homestead, the original abandoned kiln house site or the unused dilapidated kiln will be rebuilt and reusable by mechanical construction. Horizontal terraces. And complete the irrigation and drainage facilities, field roads, farmland shelter forest network. Realize the localization of water, the terraced land in the dry land, the sand and petrochemical in the field, and the production roads are solidified. In this way, the regional ecological environment has been improved and the adjustment and optimization of the regional rural economic structure has been accelerated. We have improved agricultural production conditions and stabilized agricultural production and income. Through the comprehensive improvement of the abandoned kiln house site, the vegetation coverage rate has been improved, the soil erosion has been controlled, and the regional ecological environment

has gradually developed into a benign development. The agricultural production conditions have been fundamentally improved, the cultivated land protection area and effective irrigated area have been expanded, and the drought has been reduced. Natural disasters such as cockroaches and freezing damage occur, land productivity is gradually increased, crop yields are stabilized, and farmers are expected to increase their incomes. The area of cultivated land has been increased, and the dynamic balance of total cultivated land has been implemented, effectively improving land utilization rate and reclamation rate. The expected ecological, social and economic benefits have been achieved. Take the abandoned homestead project in Xiaoqiu Town, Yaozhou District as an example. Figure 4 shows the current status of the land after the reclamation of the abandoned residential land in Xiaoqiu Town, Yaozhou District.



Fig. 4 Land map after the reclamation of abandoned residential land in Xiaoqiu Town, Yaozhou District

## References

- [1] W. Xu, K. C. Tan. Reform and the process of economic restructuring in rural China: A case study of Yuhang, Zhejiang. *Journal of Rural Studies*, (2001) No. 11, p. 165-181.
- [2] X. P. Shen, J. C. Ma Laurence. Privatization of rural industry and de facto urbanization from below in southern Jiangsu, China. *Geoforum*, (2005) No. 36, p. 761-777.
- [3] Y. S. Liu. Rural Transformation and Development of New Countryside in the Coastal Areas of Eastern China. *Journal of Geographical Sciences*, (2007) Vol. 62, No. 6, p. 563-570. (In Chinese)
- [4] F. G. Zhang, Y. S. Liu. China's regional rural development dynamic mechanism and its development model. *Journal of Geographical Sciences*, (2008) Vol. 63, No. 2, p. 115-122. (In Chinese)
- [5] Y. S. Liu, Y. Liu, R. X. Zhai. Geographical Research and Remediation Practice of China's Rural Hollowization. *Journal of Geographical Sciences*, (2009) Vol. 64, No. 10, p. 1193-1202. (In Chinese)
- [6] R. Q. Han. Construction of Rural Land Consolidation Decision Information System and Its Application Research in Pingyin County. Jinan: Shandong Normal University, (2002). (In Chinese)
- [7] J. R. Yang. Theory and practice of land consolidation. Chengdu: Sichuan University Press, (2002). (In Chinese)
- [8] X. H. Yang. The Enlightenment and Reference of Foreign Land Consolidation. *Territorial Economy*, (2002) No. 7. p. 43-44. (In Chinese)
- [9] W. Q. Qu, L. Chen. Japan's Village-making Movement and Its Enlightenment to China's New Countryside Construction. *World Agriculture*, (2006) No. 7, p. 63-64. (In Chinese)
- [10] Erich wei. Rural land consolidation in the Federal Republic of Germany. Beijing: China Agricultural Publishing, (1999). (In Chinese)
- [11] X. Q. Li. The Characteristics and Enlightenment of German Agriculture and Rural Development. *Jilin Agricultural and Rural Economic Information*, (2005) No. 7, p. 26-27. (In Chinese)

- 
- [12] National Land Administration Planning Department, China Land Survey and Planning Institute Intelligence Institute. Land consolidation at home and abroad. Beijing: China Land Publishing House, (1998). (In Chinese)
- [13] L. M. Wang. Land consolidation in Russia in the transformation of land system. Chinese Land Science, (1997) Vol. 11, No. S1, p. 66-68. (In Chinese)
- [14] L. S. Cheng, W. Y. Feng, L. H. Jiang. Mechanism Analysis of Rural Settlement Hollowization in Southeastern Taiyuan Basin. Journal of Geographical Sciences, (2001) Vol. 56, No. 4, p. 437-446. (In Chinese)
- [15] H. L. Wang. Analysis on the Causes of the Formation of Rural "Hollow Villages" and the Countermeasures. Journal of Rural Economic, (2005) No. 9, p. 21-22. (In Chinese)
- [16] Y. H. Chen, H. Sun, Y. S. Liu. Comprehensive improvement model of hollow villages in typical agricultural areas of China. Journal of Geographical Sciences, (2010) Vol. 65, No. 6, p. 727-735. (In Chinese)
- [17] Liu Yansui, Wang Lijuan, Long Hualou. Spatio-temporal analysis of land-use conversion in the eastern coastal China during 1996-2005. Journal of Geographical Sciences, 2008, 18(3):274-282
- [18] Long Hualou, Liu Yansui, Wu Xiuqin et al. Spatio-temporal dynamic patterns of farmland and rural settlements in Su-Xi-Chang region: Implications for building a new countryside in coastal China. Land Use Policy, 2009, 26(2):322-222
- [19] Y. S. Liu. Research progress on innovative ideas and models of China's new rural construction. Geographic Research, (2008) Vol. 27, No. 2, p. 479-480. (In Chinese)
- [20] B. B. Xiao. Investigation and Research on the Potential of Rural Homestead Based on Farmers' Behavior. Chongqing: Southwest Agricultural University, (2007). (In Chinese)